MOBILE APPLICATION SYSTEM INTEGRATED WITH VOICE ASSISTANT TO ENHANCE STUDENT'S LEARNING PROCESS (STUDY CASE: XYZ UNIVERSITY)

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ABSTRACT

Information technology which is growing rapidly nowadays has become one of the main needs in all fields and aspects of life, one of them is in education. Every educational institution continuously strives to make innovations that can provide added value and improve quality, including at XYZ University. XYZ University has presented a mobile-based application that can be used by students to make it easy to access information about lectures using a smartphone. However, the total number of users and the level of frequency of use are always increasing. Continuous innovation is needed. One of the innovations that can be done is to provide voice assistant technology in the system. This study presents the design and analysis on the innovation of the application of voice assistant technology in the university and providing the results of technological innovation designs in applications according to the needs of the stakeholder and XYZ university students. Several proposed voice assistant menu features are classroom location, schedule, exam, finance, forum and attendances. The result of the evaluation shows that the proposed voice assistant system design on the mobile application is accepted by the stakeholder and XYZ university students. The proposed design of the voice assistant system on the mobile application is a supporting innovation of the existing system so that this innovation can create effectiveness and efficiency for the students.

Keywords: *Technology, Innovation, Information, Voice Assistant, Learning*

1. INTRODUCTION

Information Technology, which is increasingly developing today, has become one of the main needs in all fields and aspects of life, in business, economy, and education [1]. This is happened because of the fulfillment of people's needs for information with the role of Information Technology. Educational institutions, especially university, is a place for teaching and learning process. The implementation of the teaching and learning process between educator and student is inseparable from the role in utilizing Information Technology, which is used to search for information on learning materials and also produce the required information accurately and more cost-effectively. Learning media that are well designed will greatly assist students in digesting and understanding the learning material [2].

The fast growth of information technology has an impact on the ease with which information may be obtained rapidly. The advancement of communication technology, particularly cellphones, has increased the speed with which this information may be obtained. The development of smartphones continues to evolve from year to year. This is evidenced by the function of the smartphone itself. Smartphones are not only used to communicate but are used to searching for information. The development of smartphones also has an impact on the intensity of smartphone users in Indonesia. The number of smartphone users in Indonesia is expected to reach 89 percent of the population by 2025, according to a study performed by Databoks.co.id [3].

The rapid growth of the internet in Indonesia has also had an impact on the increasing usage of smartphones in the country. Indonesia has a total population of 264 million people, with 171.17

million (or about 64.8 percent) of the population connected to the internet out of that total [4]. Based on the results of a survey conducted by the Penyelenggara Jasa Internet Indonesia (APJII), it shows that internet usage penetration of people with a bachelor's degree has reached 79.23%, followed by S2 / S3 strata reaching 88.24% [5].

According to the results of these studies, the higher the degree of education, the greater the penetration of internet usage to discover material that would assist students in their learning during lectures. In this digital age, it is impossible to ignore the fact that technology trends are always evolving, developing, and changing. This occurs in a variety of industries across the globe. Our everyday lives, as subjects, are undoubtedly being transformed, and we can definitely feel the effects of these transformations. Technological advancements have progressed at a fast pace, prompting many individuals to look for new items as soon as possible. One such technology, Artificial Intelligence, is now in the early stages of its development. Generally speaking, Artificial Intelligence is used to assist human activities, including those performed on smartphones, which are referred to as features. There are many ways to do this, including via specific capabilities on cellphones and through features in other apps. Artificial Intelligence is being used in a variety of applications, including speech technologies and voice assistants, which use AI in the form of Natural Language Processing. People may only manage the gadget or smartphone according to their wishes if they speak clearly or use their voice clearly in the process. In accordance with the results of the study [6,] Indonesia has shown that it is ready to use Artificial Intelligence technology.

Based on the survey on [7], only 10% of the respondents surveyed are not familiar with Voice Assistant products and devices. And 90% of them have used Voice Assistant (72%). Adoption is driven by younger consumers, households with children, and households with incomes > $100,000. The 2017 Accenture Digital Consumer Survey involved 26,000 people from 26 countries, one of which was Indonesia. The survey found that 46% of consumers use "voice-enabled digital assistants". These figures are even higher in India and China, which can reach 55%. When considered in a breakdown by age group, this indicates more use among younger users. Over 30% of 14 – 17-year-olds use Voice Assistant regularly, with another 20% just starting out and 33% interested. Thus, 84% of teens already use Voice Assistant or plan to use it.

The development of innovation in Voice Assistant technology can properly help many industries, including the education industry, to win the competition in offering greater added value through new and more innovative services by enhancing the user experience. One of the impacts obtained from technological developments in education today is that educators or students can search and find various information and knowledge quickly through the internet network [8]. So, in the development of technology that is developing very rapidly and together with the emergence of equipment or applications that are very easy to learn and use as a learning media.

Every educational institution continuously strives to make innovations that can provide added value and improve quality, such as at XYZ University, which keeps up with the times to facilitate the learning process on campus by presenting a mobile-based Learning Management System application that can be used by students. The mobile application was built in 2018, and the purpose of this application is to make it easy to access information about lectures using a smartphone, as well as improve services.
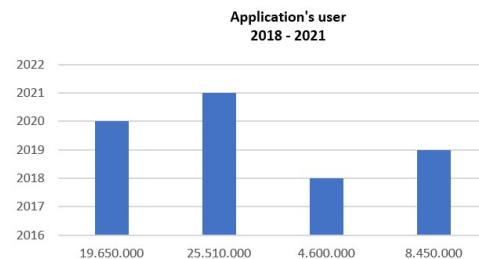

Figure 1: The Number Of Users Using The LMS Application From 2018 – 2021 At XYZ University

The total number of application users from 2018 to 2021 is always increasing (Figure 1), which indicates that every year there are always new students who will use the application to support the learning process during lectures at XYZ University.
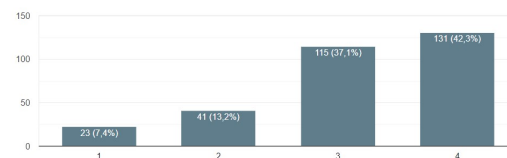

Figure 2: The Results Of The Questionnaire Related To How Often Students Use The Application To Access Lectures Information

As shown in Figure 2, based on the results of preliminary studies from the questionnaires that have been distributed to 327 students (both undergraduate and graduate students), it was found that there are a total of 310 students who use the application to access lectures information, with a total of 131 (42.3%) students who use it very often, 115 (37.1) students who use it frequently, 41 (13.2%) students who rarely use it, and 23 (7.4%) students who very rarely use the application.

As the increasing users every year and the level of frequency of use, continuous innovation is needed. One of the innovations that can be done is to provide additional features to users by integrating Voice Assistant technology.

In this study, we proposed the case study of voice assistant system integration into the LMS of XYZ University. This study followed Design Science Research methodology with the steps that include goal-based solutions, identify problems, define goals for solutions, design and develop solutions, create simulations, discuss, and draw conclusions. Data collection in this study was carried out using three methods, such as interviews, document analysis, and literature review.

In the next section, we reviewed literature related to this study. Section 3 describes the methodology and the current business process in this study. Section 4 shows the proposed voice assistant in XYZ University. Section 5 discusses the challenge, user interest and benefit of the proposed system. Last, the concussion is presented in the last section.

2. LITERATURE REVIEW

2.1 Mobile Learning

When e-learning and mobile computing come together, the result is Mobile Learning (m-learning), which provides a unique potential to improve the learning experience for students in both official and informal education settings. Learning becomes more portable and spontaneous as a result of the flexibility offered by mobile devices, allowing students to experience more customized learning, learning that is situated in a meaningful environment and genuine learning with real-world issues that are relevant to them [9]. Because it has characteristics that are practically carried anywhere, mobile learning has its own interests. With a mobile that is connected to the internet, it is certain that you can explore any world, including looking for teaching materials that

support learning [10]. Students can improve relationships or communication with the other students and also as a medium of practice from the theory that has been obtained from the learning that has been followed.

2.2 Artificial Intelligence

Human-machine interaction technology is one of the most rapid breakthroughs in the development of science and technology in the world today [11]. Artificial Intelligence technology is still very broad in scope, so its use also varies in various fields. Artificial intelligence is a way for computers to be able to perform a series of thinking tests that humans and animals have [12]. The technology is also adopted in the game world. Artificial Intelligence is still very broad in scope, its use also varies in various fields. The world of education is one of the fields that can adopt Artificial Intelligence technology because it makes learning more easier. The notion of Artificial Intelligence is divided into four categories [13]. First, humanly thinking states that Artificial Intelligence technology reflects human thinking in everyday activities such as solving problems, making decisions, and other actions. Second, acting humanly, which means that Artificial Intelligence is a machine that is capable of displaying uses by involving intelligence capabilities when displayed by humans, and is able to do something now that has a better quality than humans. Third, thinking rationally, which means that Artificial Intelligence is able to coordinate mental abilities through a computational model. Fourth, acting rationally shows that Artificial Intelligence is designed to create intelligent agents through creation using sophisticated systems. Artificial Intelligence technology is a technology that creates a system and allows computers or applications as one of the mediums to carry out the interaction process and make it easier for humans to carry out their daily activities.

2.3 Natural Language Processing

Natural Language Processing is a field of artificial intelligence that focuses on the processing of natural language. Natural language is the language that people use to communicate with one another on a regular basis [14] [15]. The computer must first analyze and comprehend the language that it has received in order for the meaning of the user to be correctly comprehended by the computer. In Natural Linguistic Processing, a wide variety of

language strategies for understanding human language are covered, including statistical methods and machine learning, as well as rule-based and algorithmic approaches [15]. Tokenization and parsing, lemmatization/stemming, part-of-speech tagging, language recognition, and the identification of semantic connections are all examples of fundamental natural language processing tasks. The success and popularity of text mining is highly dependent on the development of Natural Language Processing both in the process of generating and understanding human language. Natural Language Processing allows the extraction of various features from unstructured text so that various types of data mining techniques can be used to extract knowledge (new and useful patterns and relationships) from it.

2.4 Chat Bot

Chat Bot is a form of voice-based Artificial Intelligence text that aims to help users get what is requested more quickly and accurately, and can carry out conversations in natural language where users can communicate as they should be as natural as possible [16]. A chat bot powered by Artificial Intelligence technology employs a machine learning technique in order to comprehend human language and respond in the manner requested by the user. These Chat Bots may grow more successful with each discussion; all that is required is that the users train them and utilize them on a regular basis. They not only have the capacity to define and offer suggestions, but they also have the power to make choices, comprehend behavior patterns, and are designed to grasp various languages. They can also save a significant amount of time in the long run [17]. Chat Bot have several different types of consequences for organizations. First, Chat Bot will change the way to provide information, communicate, and transact between user or other external stakeholders. On the other hand, Chat Bot can greatly influence and change organizations in conducting communication, and collaboration in the future.

2.5 Voice Assistant

Voice Assistant is basically a computer program that conducts conversations supported by Artificial Intelligence Natural Language Processing which allows users to speak and get responses in the form of replies from applications in the same way as what happens to other individuals [18]. Voice Assistant will be activated by a combination of a

mobile device with an Application Programming Interface. Voice Assistant systems on applications and computers are not something new. Voice assistants can now do many things, from making calls, write small notes, open applications, to set the alarm. All can be done without needing to touch the smartphone screen. Users can do all these things with just their voice. This is something that makes it very easy for its user [19]. All can be done without the need to touch the smartphone screen, users can do all these things only with their voice. This is something that is very easy for users.

3. RESEARCH METODOLOGY

The concept of the research methodology used is Design Science Research Methodology, which is to approach a goal-based solution, identify problems, define goals for solutions, design and develop solutions, create simulations, discuss and draw conclusions [20].

Goal-based solution: Identifying the phenomenon of smartphone technology development and Artificial Intelligence technology that is increasingly influencing all aspects of life, one of them is in the education and then provide new innovations to improve service and user experience. Then collect system requirements by listening to users through the interview method so that the system is made according to needs.

Identify problems: Provides an explanation of the objectives of the study based on the results of the needs of the system identification that have been done previously. Then identify how the current system mechanism works and carry out data collection in order to find the problem.

Define goals for solutions: Write down all the required requirements in detail obtained from various sources, after which an analysis of which application menu will be carried out can be integrated with Voice Assistant. And will be given an explanation of the benefits that will be obtained after voice assistant system has been successfully integrated with the application.

Design and develop solutions: Analyze and process the data that has been collected and make a proposal for the integration design of the Voice Assistant technology on application according to the data that has been collected and from the proposed solution, namely by making a simple design of the solution obtained to provide an overview of how the system will be made by making a system sequence diagram of the system.

Create simulations: started to create simulations of Voice Assistant technology which is integrated with the application, namely temporary design or prototype that can be directly tested by the user and stakeholder in accordance with the initial design and focuses on presentation to the user.

Discuss, and draw conclusions: conducted a discussion by presenting the prototype results to the application development team and user to get feedback. This certainly helps to find the advantages and disadvantages of the design that has been done. To conclude whether the results of this integration will be accepted or not by the stakeholder and students. and also to conclude this innovation can create effectiveness and efficiency for the students or not.

This study focuses on technological proposals from innovation to search for information in the continuity of student learning activities during lectures using Voice Assistant. In designing a system or application to meet the user needs, a user interface design is needed to facilitate user interaction with the system or application [21]. The method used to develop this application is the prototyping method which is part of the stages in the User Interface design. In designing the integration of Mobile Application with Voice Assistant, researchers will create a prototype which is a temporary design according to the initial design and focuses on user needs. After the prototype has been completed, the prototype will be shown to the Mobile Application development team and students. This will help in knowing the advantages and disadvantages of the system design that has been done. And also to conclude whether the results of this integration will be accepted or not.

3.1 Method of Collecting Data

Data collection in this study was carried out using three methods: interviews, document analysis, and literature review. Interviews were conducted with the IT department of XYZ University to find out the current system and to get an idea of the current problems, which can become a reference for the improvement process. This information will be useful in the design and development of the Voice Assistant system that will be integrated with the mobile application later. Then document analysis, collecting data from written sources by researchers in order to obtain data that support this research. Data retrieval is done by reading, recording, and collecting data from written data sources regarding the mobile application system. The data that has been collected

is then matched with a pre-existing problem formulation for analysis. And last literature review, the reference in this research uses Voice Assistant technology. The references are obtained from books, journals, news, and online publications.

3.2 Current Business Process

This Mobile Application was made as a platform to support lectures activities for all students, both undergraduate program students and graduate program students. Currently, this application already has 13 main menus that can be accessed by students. For students who want to open a menu in the application, students are required to click on the menu first, then the page on the menu will open. If students want to open a semester or period other than what appears on the page, students can filter according to the period or semester they want to see by clicking the filter button. (Figure 3).
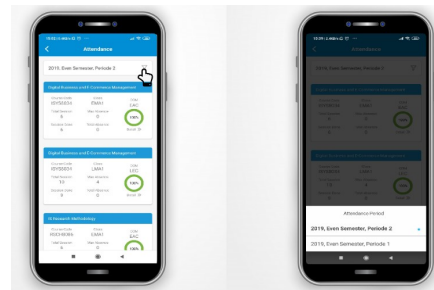

Figure 3: Current The Use Of The Application Still Needs To Be Click

Currently, to access all the menus available in the application, students still have to click the menu or touch the smartphone screen. This study focuses on technology proposals from innovation to search for information to enhance student's learning process during lectures using Voice Assistant technology.

4. PROPOSED SYSTEM

This section discusses the details of the proposed system. A number of menus in the application will be integrated with voice assistant technology so that students can find information quickly using voice without having to touch the screen.

4.1 Flow Sequence

In the application, there are several menus that can be filtered, and that cannot be filtered. The

following is an explanation of the flow sequence for filtered and unfiltered menus when the application has been integrated with voice assistant technology. Because it uses voice technology, there will be a Voice Assistant and Speaker Identification object. This Speaker Identification functions to verify incoming voice messages, whether they match the code in the application or not. If it doesn't match, then the menu in the application will not open, but if it matches, then the menu that was requested by the user will open immediately. speaker identification happens at every utterance, authenticating each request (Figure 4 and Figure 5)
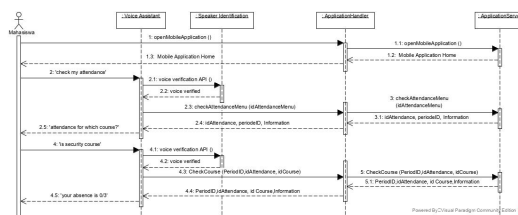
Figure 4: Flow Sequence Menu That Has A Filter Feature

When the application is first opened, user can immediately search for information on the menu contained in the application using voice technology. The example in Figure 4 is when the user trying to find out the information on the Attendance menu using voice. User only need to give a clear voice commands, then the system will verify the API, whether the menu requested by the user matches the menu code contained in the application. If it is match, the system will provide voice feedback to the user by first asking to know the attendance information for which course, then the user can give a voice command for the name of the course. If it is match again, the system will provide voice feedback to the user regarding the requested attendance information.
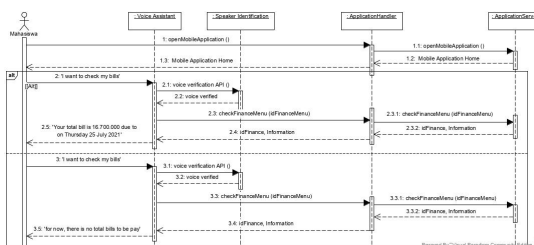

Figure 5: Flow Sequence Menu That Does Not Have A Filter Feature

When the application is first opened, user can immediately search for information on the menu contained in the application using voice technology. The example in Figure 5 is when the user trying to find out information on the Finance menu using voice. User only need to give clear voice commands, then the system will verify the API, whether the menu requested by the user matches the menu code contained in the application. If it is match, the system will provide voice feedback to user regarding the requested Finance information.

4.2 Voice Menu

Currently, the design of the Voice Assistant system will only be integrated with several menus on the application and commonly used by students, such as Schedule, Exam, Forum, Assignment, Attendance, Score, and Finance. The language that will be used for Voice Assistant in English.

4.2.1 Menu Schedule

In the Schedule menu, there will be an intense schedule menu,' and it is connected to the 'schedule_menu' entity with each entity's contents are schedule, menu schedule, classroom, and class schedule.

If students want to know their class schedule, then the student can immediately speak clearly using one of the available entities, for example, 'I want to know about my schedule's today, then the system will provide the information requested by the student in the form of voice, 'You have three classes today. First, IS Security class at 821 at 09.20 - 13.00 WIB. Second, Digital Business class at 800 at 15.20 - 17.00 WIB. And lastly, Colloquium class at 821 at 17.20 - 19.00 WIB' (Figure 6).
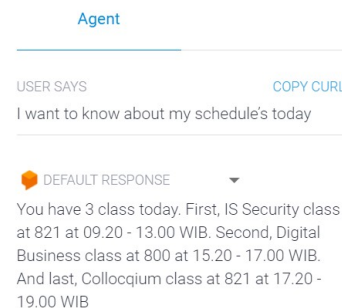

Figure 6: Conversation To Request Class Schedule

Meanwhile, if a student only wants to know the classroom, the student can immediately speak

clearly 'where is my classroom for IS security course?', then the system will provide the information requested by the student in the form of voice 'your classroom for IS Security is 822' (Figure 7).
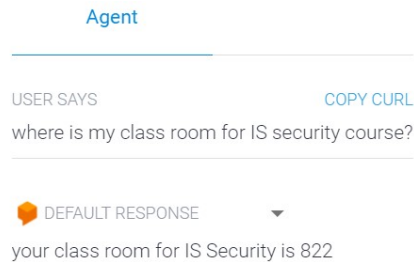

Figure 7: Conversation To Request Class Room

If the student does not have a class schedule on that day, the system will provide information 'you have no class's schedule for today. The schedule informed by the system is the student's overall schedule according to the schedule data of the day/date/year requested by the student.

4.2.2 Menu Exam

In the Exam menu, there will be exam menu and it is connected to the 'exam_menu' entity with each entity's contents are exam, exam menu, and exam schedule.

If students want to know their exam schedule, then student can immediately speak clearly using one of the available entities, for example 'I want to know about my exam's schedule today', then the system will provide the information requested by student in the form of voice 'your exam schedule for today is IS Security courses for theory at 822 at 10:00 - 12.00 WIB. your sear number is 12. Don't forget to bring your KMK and Flazz Card (Figure 7).
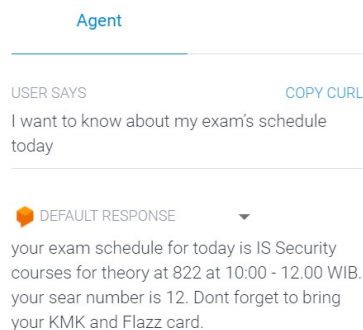

Figure 8: Conversation To Request Exam Schedule

Meanwhile, if student want to know the overall exam schedule, student can directly speak clearly 'my exam's schedule for this week', then the system will provide the information requested by student in the form of voice 'you have 3 exams for this week. IS Security for theory on 25 June, Digital Business for practicum on 28 June, and Collocqium for theory on 3 July' (Figure 9)
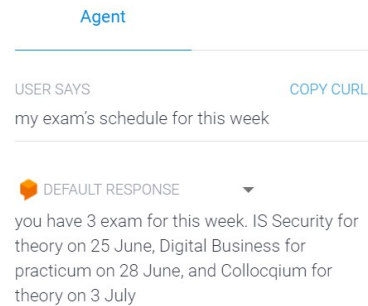

Figure 9: Conversation To Request All Exam Schedule

If student does not have an exam schedule on that day or week, the system will provide information 'you have no exam's schedule for today' or 'you have no exam's schedule for this week'. The schedule informed by the system is the student's schedule according to the schedule data of the day/date/year requested by the student.

4.2.3 Menu Forum

In the Forum menu, there will be intens' forum menu' and it is connected to the 'forum_menu' entity with each entity's contents are forum and discussion.

If student want to know whether there is a new forum thread, then student can immediately speak clearly using one of the available entities, for example 'is there a new forum?', then the system will provide the information requested by the user in the form of voice 'You have 4 forum that has not been replied. 3 for IS Security course and 1 for Digital Business course'. The number of Forum mentioned by the system is the number of Forum that student never replied to. If the forum has already been replied to, it will not be mentioned by the system. If there is no new forum, the system will provide information 'there is no new forum' (Figure 10).
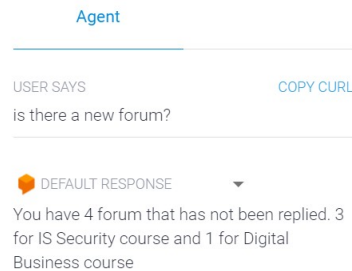
Figure 10: Conversation To Request Forum

4.2.4 Menu Assignment

In the Assignment menu, there will be intense assignment menu' and it is connected to the 'assignment_menu' entity with each entity's contents is assignment.

If student want to know whether there is an assignment, student can immediately speak clearly using one of the available entities, for example 'is there an assignment?', then the system will provide the information requested by student in the form of voice 'you have 3 theory assignments that you haven't uploaded yet, 2 for Collocqium due to 25 June and 26 July and 1 for IS Security due to 25 June'. The number of Assignments mentioned by the system is the number of Assignments that have never been uploaded by student. If the assignment has already been uploaded, the system will provide the information 'you've already uploaded all assignments' (Figure 11).
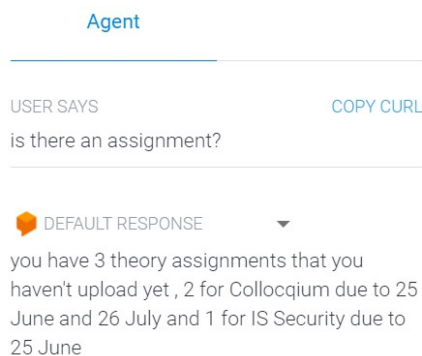

Figure 11: Conversation To Request Assignment

4.2.5 Menu Attendance

In the Attendance menu, there will be intens' attendance menu' and it is connected to the 'attendance_menu' entity with each entity's contents are attendance, absence, and maximum absence.

If student want to know the number of attendance in a particular course, then student can immediately speak clearly using one of the available entities, for example 'my amount of absence?', then the system will ask student again about attendance for which course they want to know , 'attendance for which course?'. After that, student can answer back according to the course they want to know, the 'IS Security course'. The system will provide the information requested by student in the form of a voice 'your absence is 0/3 for theory and 1/2 for practicum'. The information provided by the system is adjusted to the class in the course, whether there is a theory class, practicum, or tutor (Figure 12 & Figure 13).
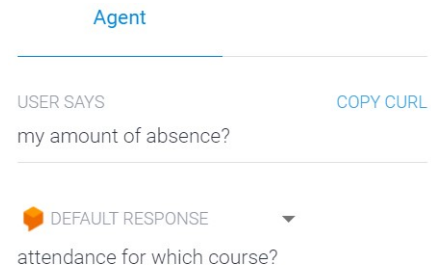

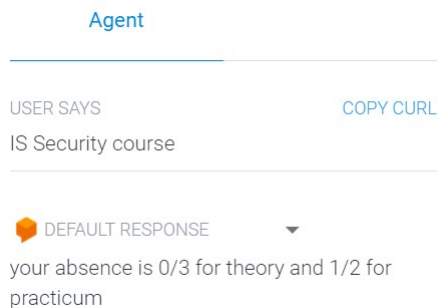
Figure 12: Conversation to request absence

Figure 13: Conversation To Request Absence For Specific Course

4.2.6 Menu Score

In the Score menu, there will be intens' score menu' and it is connected to the 'score_menu' entity with each entity's contents are score, grade, and grading.

If student want to know the score obtained in a particular course, then student can immediately speak clearly using one of the available entities, for example 'my score for this semester please', then the system will ask student again about the score in

which course they want to know, 'score for which course?'. After that, student can answer again according to the course they want to know, 'IS Security courses'. The system will provide the information requested by student in the form of a voice 'your final score for IS Security courses is 90 with Grade A. 85 for Assignment, 95 for Project, 90 for Practicum, 88 for Mid Exam, and 90 for Final Exam'. If the score is not yet available, the system will provide information 'the score for IS Security course is still not available' (Figure 14 & Figure 15).
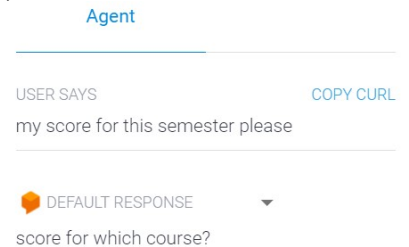
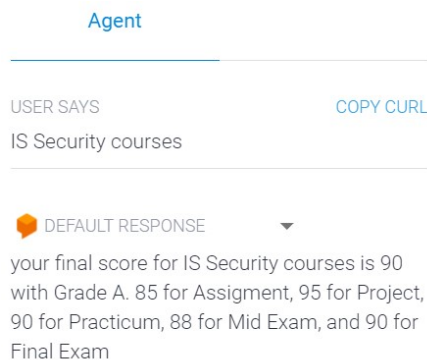*Figure 14: Conversation to request score*

Figure 15: Conversation to request score for specific course

4.2.7 Menu Finance

In the Finance menu, there will be intens' finance menu' and it is connected to the 'finance_menu' entity with each entity's contents are finance, auto debet, and payment.

If student want to know the amount of the bill for paying tuition fees, then student can immediately speak clearly using one of the available entities, for example' amount of payment for this semester', then the system will provide the information requested by student in the form of voice' Your total bill is 3,600,000 for fixed tuition fees due to 25 May 2021 and 2,500,000 for lab fees due to 25 June 2021'. If the student's bill has been

paid off, the system will provide information 'all your payment has already been paid' (Figure 16).
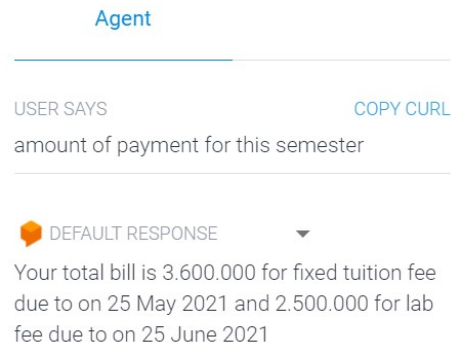
Figure 16: Conversation to request finance

5. DISCUSSION

5.1 Challenge

There are several challenges arise during designing the proposed Voice Assistant and after conducting several discussions with stakeholders,. There is one type of challenge, namely internal challenges. The internal challenge is speech recognition. Speech recognition is an identification process carried out by the system to recognize words or sentences spoken by the user. Speech recognition can be said to be prone to interference. This is due to the sound signal processing which is still frequency-based. When an information in a voice signal has the same frequency component as the frequency component of the disturbance, it will be difficult to separate the interference from the voice signal. Then the number of vocabulary that can be recognized is also limited. This is because speech recognition works by looking for similarities with the existing database.
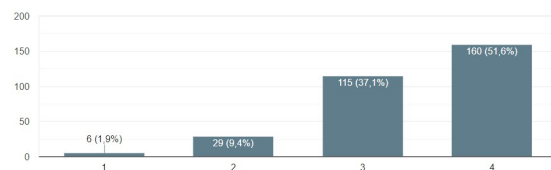
5.2 User Interest

Figure 17: The Results Of Questionnaire Related To Student Interest In The Voice Assistant Feature On The Application

We conducted a questionnaire to gather the user interest after the prototype has been shown to them. The result, as shown in Figure 15, show that it was

found that there were a total of 160 (51.6%) students who were very interested, 115 (37.1%) students were interested, 29 (9 ,4%) students are not interested, and only 6 (1.9%) students are not very interested in the innovation of the Voice Assistant feature.

Based on these results, it can be concluded that more than 50% of XYZ University students are interested in the Voice Assistant innovation on the mobile application. The results of this integration are expected to make it easier for students to find information to improve the student learning process during lectures.

5.3 Benefit

The results of this integration can provide benefits for users and XYZ University including the following. Speed in Interaction: Interaction will be faster because touch is no longer needed. In other words, no more clicking buttons. Increase students satisfaction: the more options offered to facilitate interaction with the application, the higher the level of student satisfaction with the mobile application. Innovations that can bring a new student: by improving the quality of the applications, it can make products more competitive in the commercial market so as to improve service quality. Innovative products usually always arouse curiosity. As a result, this curiosity can bring more new students.

5. CONCLUSION

Based on the discussion of the case study above, there are several conclusions can be drawn, such as the following. Technological trends that are currently developing, one of which is the use of voice assistant technology in the world of education to provide new innovations in digital services and improve quality. The proposal for the voice assistant system design on the mobile application can be accepted by the stakeholder and XYZ university students. The proposed design of the voice assistant system on the mobile application has a possibility to be adopted by XYZ university. The proposed design of the voice assistant system on the mobile application is a supporting innovation of the existing system. so that this innovation can create effectiveness and efficiency for the students. The challenges of the voice assistant system on the mobile application can be considered later in the implementation and development stages.

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