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Engaging students to fill surveys using chatbots: University case study

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ABSTRACT

The use of chatbot or conversational agents is becoming common these days by the companies in many fields to make smart conversations with users. Backed by artificial intelligence and natural language processing they provide a strong platform to engage users. These positive aspects of chatbots can be beneficial in the educational sector, especially in conducting online survey. This study aims to explore the feasibility of a new chatbot approach survey as a new survey method in Moroccan university to overcome the web survey's common response quality problems. Indeed, having student feedback before and after graduation is essential for university assessment. This new approach keeps students engaged, supportive, and even excited to offer feedback without getting bored and dropping the conversation, especially in Moroccan universities known by an overcrowding of students where it is difficult to get their feedback. This feedback feeds into our university' databases for further reporting and decision making to improve the quality of educational content and student-oriented services. Finally, we have shown the effectiveness of our approach by a comparative data study between the traditional online survey and the use of this chatbot.

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1. INTRODUCTION

Currently, the university is confronted more than ever with several challenges and constraints expecting its main role, which is the transmission of knowledge. In a world so-called volatility, uncertainty, complexity and ambiguity (VUCA) [1], [2], The digital transformation of the university is an absolute priority in order to be able to adapt better to this world but also to evolve and to re-evaluate its assessment system. However, this evolution cannot be done without a continuous evaluation by the various actors of the university and more particularly by its students before and/or after obtaining their diplomas in order. Generally, the most widely used representative research method is based on surveys by gathering information from a large number of students to ensure adequate response rates for the evaluation of services and quality of training. Nevertheless, in order to obtain their feedback, it is most often difficult to encourage or motivate the students to fill in the evaluation questionnaires considered too heavy [3], [4].

In emerging countries, especially in Moroccan universities, the problem persists even more because of several reasons: lack of information system, overcrowding of students with a low administrative and

pedagogical supervision rate, lack of resources and others constraints, [5]-[7]. It is therefore necessary to use other more innovative and interactive approach to establish good contact with students in order to have their feedback and to receive the information necessary for university assessment. To establish a fruitful relationship with the students, a conception of an interactive and attractive system is fundamental. With the emergence of artificial intelligence, it is time to rethink the way we communicate with students. Artificial intelligence could disrupt society in several ways. It is gradually affecting our habits and therefore our way of life. It actually influences our daily behaviors and the way we involve by designing intelligent "bot" agents able of performing various functions previously done by humans. The opportunities for using bots are endless [8]-[11]. Particularly, young people are affected by the impact of this technology and use it almost all the time. The exponential proliferation of smartphones and their widespread use by students offers universities enormous opportunities in terms of innovative technological approaches to interact with students in order to improve the quality of its strategies [12]. Chatbots or conversational agents are becoming a very important tool in our lives. Chatbots are computer programs replacing some of the jobs that are traditionally performed by humans, such as online customer service agents, museum guides, technical support, language teachers and educators [8], [13]. Through a person-machine interface [14], the chatbot is an agent who communicates with a user on a well-defined subject or domain using text and voice in order to provide interactive services [9], [10], [15]-[17]. The chatbot is an interactive tool, which aims to respond to requests made by users on a specific area [18], [19]. Frequently, it is equipped with artificial intelligence that allows it to understand the context and react according to the data available on the subject in the database servers. The chatbot architecture integrates calculation algorithms, natural language processing (NLP) and psychological knowledge to interact with humans or other chatbots in human language by text or voice [20]-[23]. Everything started from 1964 to 1966, when Weizenbaum developed the first bot ELIZA, an early natural language processing computer program at the minimum ignition temperature (MIT) artificial intelligence laboratory [24]. Then Alice [25] to Alexa from Amazon [26], [27], Amazon Echo [28], Google assistant, Microsoft's Cortana [29], Siri from Apple and others. Today chatbots are getting smarter and accessible with the progress of artificial intelligence algorithms, natural language processing [22], [30] and messaging platforms such as Facebook.

In the education field, many type of research have been done in the implementation of a pedagogic conversational agent that discuss a certain topic with a student assuming the role of the teacher [31], [32], or helping student in university orientation [33]. As well delivering pedagogical content and covering a wide variety of lessons and subjects by using multimedia content and speeches [34], [35]. In recent years, there has been a particular interest in the use of Chatbots in education. Different advantages offered by these systems combined with the benefits of digital technology: instantaneous availability, low cost, consistency, quick response times, scale up and interactivity [36]. Which makes it possible to ensure involvement and motivation as well as the revision of educational objectives and strategy. The advantage of the chatbot is also that its use is simple and intuitive and it can be integrated into group conversations or shared like any other contact [37]. Recently, to examine educational chatbots for Facebook messenger, a study was conducted which evaluated 47 out of 89 chatbots for learning identified using the Facebook messenger platform. The results of this study confirm that chatbot programming (especially on Facebook messenger) is still in its early stages [15]. In a changing educational environment, every university needs to collect feedback from its students, whether through interviews or by conducting online surveys and it's a daunting task because no human being likes to spend a long-time filling form, and this is where chatbots will come to action.

Our research purpose is twofold. First, this study aims to propose a new approach based on chatbots to hook students to the use of the conversation system by making it more affordable, useful and fun to use. This chatbot will collect significant and qualitative data from students by making them engaged in the conversation on a daily or weekly basis without getting bored and dropping the conversation in order to process them for quick and accurate reports on the university. Second, a comparative data study between the traditional online survey and the use of this chatbot was carried to show the effectiveness of our approach. In the first section, we give a general introduction of the chatbot framework and we describe the conversation flow of the chatbot and its composing blocks. In the next section, we give some results from its daily usage by national school of applied sciences students from Sidi Mohamed Ben Abdellah University. In addition, we show the effectiveness of our approach by a comparative data study between the traditional online survey and the use of this chatbot and at the same time, the findings are discussed and conclusion are drawn at the end.

2. RESEARCH METHOD

2.1. Chatbot framework

There are several categories of chatbots classified using different parameters like the input processing, the knowledge domain, response generation method or other categories [8], [13]. A chatbot can belong certainly to more than one classification at a time [38], [39]. Depending on the algorithms and techniques adopted, two

approaches exist to develop chatbot. The first one uses pattern matching [8], [40], [41], and the second approach based on machine learning extracts content from user input and has the capacity to acquire conversations using NLP, [8], [42], [43].

In this paper, we use knowledge domain-based categorization that takes into account the knowledge a chatbot can access and the quantity of data it is trained upon. The design of chatbot is based on machine learning using NLP. We started with the main chatbot framework as shown in Figure 1 which explains how an end user will interact with the university bot. Let us describe our different framework component and their functionalities:

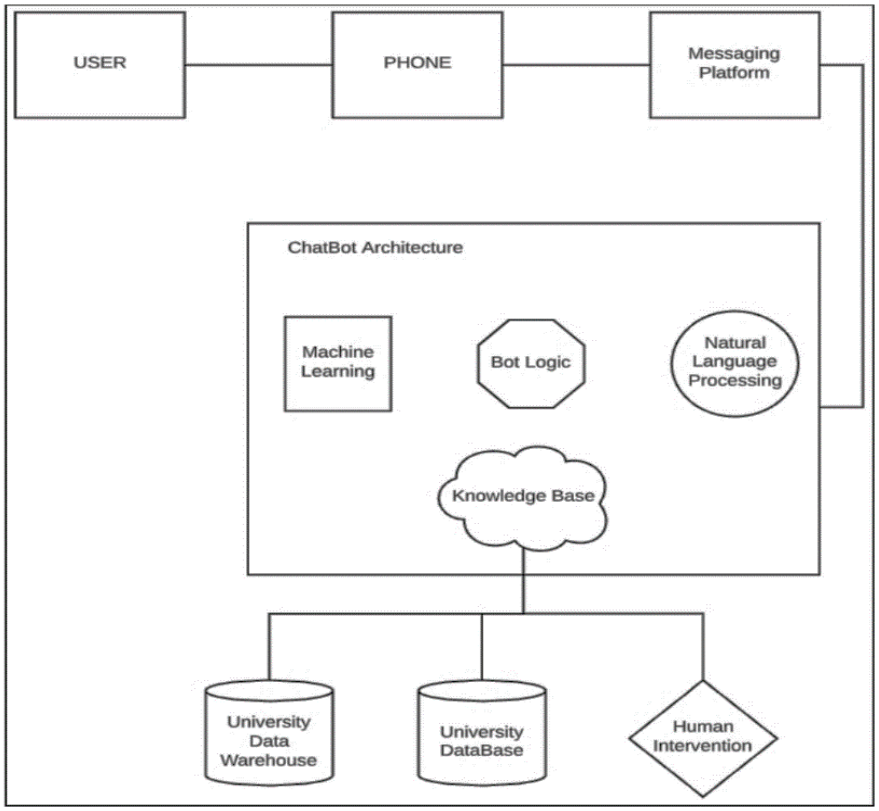

Figure 1. Chatbot framework

- User (mobile user): the student engaging in the conversation.
- Phone: is the device the student using to converse. The process starts with a user's request, for example, "How easy is it to obtain the resources you need from the university library system?" to the chatbot using a messaging platform [44].
- Messaging platform: the platform that the conversation will be based on. Many options exist here (Facebook messenger, Slack, Twitter and Allo). We used the Facebook messenger platform because a large majority of Moroccan university students uses Facebook especially with this period of pandemic that the world is experiencing in the face of Covid-19.
- Natural language processing: after the chatbot receives the user request, every received message is processed through NLP, [18], [22], [23], [45].
- Bot logic: the bot logical flow of interactions
- Machine learning: every time the bot receives a message, it can improve its answers.
- Knowledge base: it is the wisdom of the bot and it can be a data lake, a data management platform, database, data warehouse and some human interaction because not all answers are stored, we might need to ask real humans.

Before starting our bot design, we need to find the best approach to engage our users in a daily basis or at least a weekly basis and push them to use the bot and converse. We wire framed a simple approach that is student centric where the student is the core of the conversation, we will engage him by offering multiple interesting services, and only then, we will ask him one survey question per day and store its answer. We

already know that many students will not answer the questions so we made it more interesting by giving them some free facts about the university and the student major as shown in Figure 2.

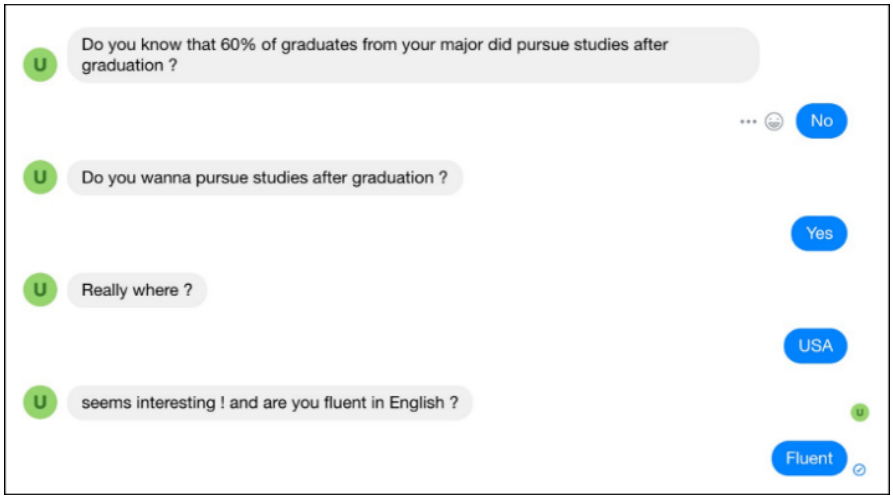

Figure 2. Example of a way to engage students to the conversation

2.2. Design of the conversation flow

The first step is to design the conversation flow or dialog flow by splitting the process into two separate blocks (engaging blocks and survey blocks). An engaging block will help us keep our students in a daily contact with the bot system and a survey block will collect data from students and fill in the survey database. Example of engaging blocks: login block; menu of options; university news; study schedule; example of survey block; graduate survey or questions and answers (Q&A). We will dig deeper into each block and give a flow of dialog to explain how they can make the bot very interesting for our graduates.

– Welcome message

The first thing is to greet our students with a simple welcome message. Its goal is also to explain the role and usefulness of the bot. This type of message makes it possible to establish a bond of trust between the support team university and the students through an exchange of rich and contextual messages. This eventually makes transactions easier between students and university. Figure 3 shows an example of this message.

– Login block

The bot is connected through application programming interface (API) to the university data collection platform backend and can get students data only by asking for it. In order to connect, we need to provide two credentials the national student card identification (ID) and the student ID. At first, the bot asks for the student ID and if no response is given, student indicates whether to cancel login and go to the main menu or retry again. If the student ID is entered, the bot will request for the national ID and perform login operation by calling the API function CheckStudent(). If all goes well, a verification message is displayed to the student showing his full name, degree, university, graduation_year and asks the student for confirmation if it's true. Figure 3 shows the login flow.

– Successfully connected block

After the login, the bot starts by taking the student on a guided tour of the different available functionalities such as checking the study schedule, exam schedule, next exam date, university and weekly activities. As shown in Figure 4, each option is backed by a call to an API to get the latest data. The student can choose to open the main menu if none of the shown options is needed. We will take the study schedule function as an example, if the student writes to the bot one of the following sentences: 'My study schedule','study schedule','my schedule 'the bot will call the API function getStudentStudySchedule() with the parameter studentID (arguments are omitted in the diagrams for simplification) and the function will return the result in JavaScript object notation (JSON) format.

Figure 5 shows an example of the conversation flow after response from API. We can see that the chatbot informs the student of the next day's schedule. He also asks him if he is interested in accessing the learning management system for the course material. This ultimately facilitates transactions between students and the university. This chatbot can potentially extend the reach and visibility of the university. It will also

improve the quality of service and strengthen the bond of membership in the university. At the same time, it will increase conversions and have an impact on student satisfaction.

- University news block

This is a particular block of subscription type and is used to give the students the ability to subscribe to updates from their university, whenever something new happens the Bot will pop up with some news. The bot makes it easy to unsubscribe from this block as a good usage pattern. The Figure 6 below shows how the subscription is implemented.

- Graduate survey block

This is the most important block, because it collects the answers to our questions from students and to make it an easy process, we developed a new bot surveying approach based on free facts, where the student will be given interesting information about his university, class, degree. In return, the student will be asked to give his opinion to enrich the answers database. Figure 7 describes the key steps in this process.

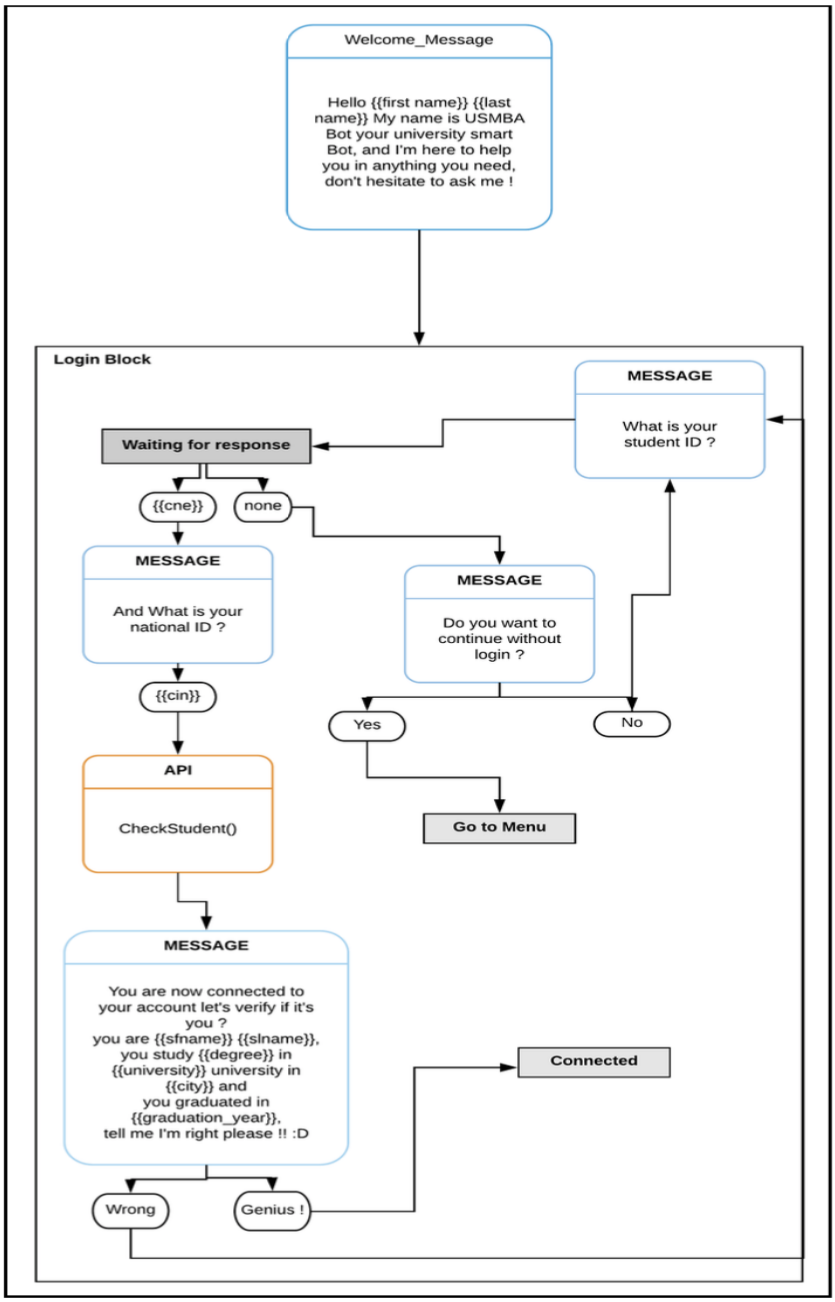

Figure 3. Conversation flow of the login and welcome message example

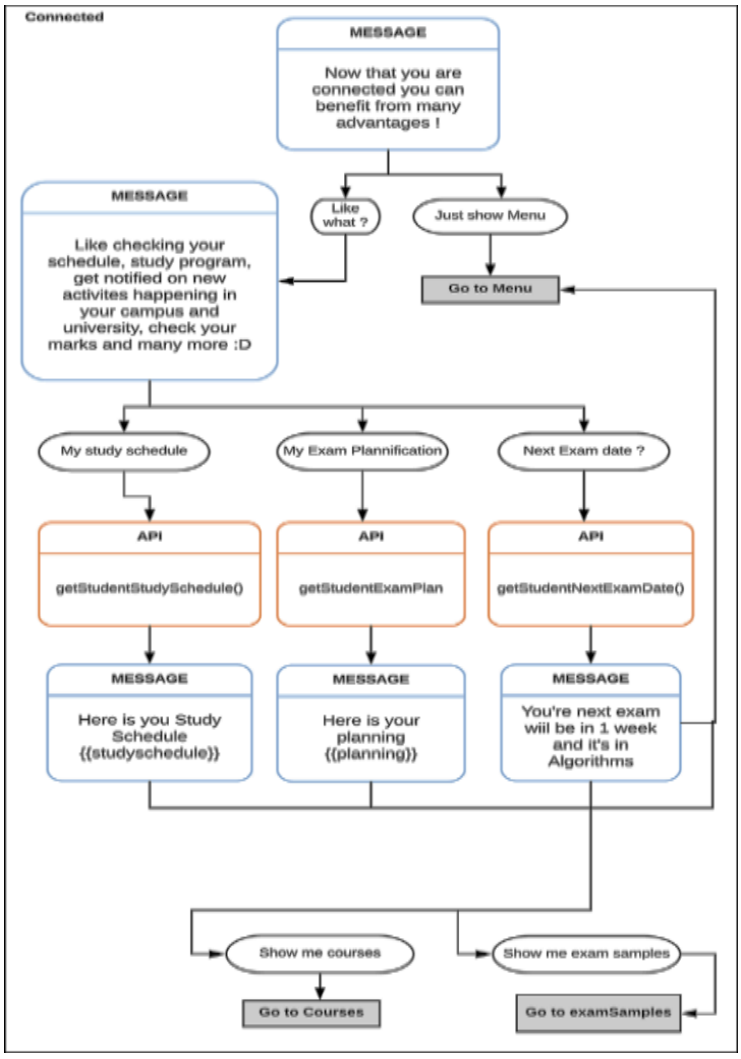

Figure 4. Conversation flow after successful connection

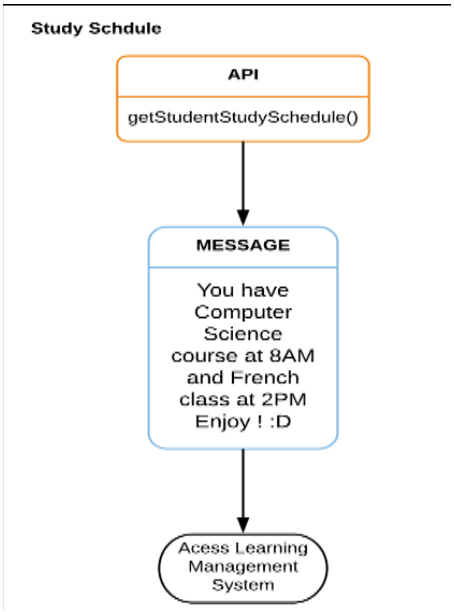

Figure 5. Example of the conversation flow after response from API

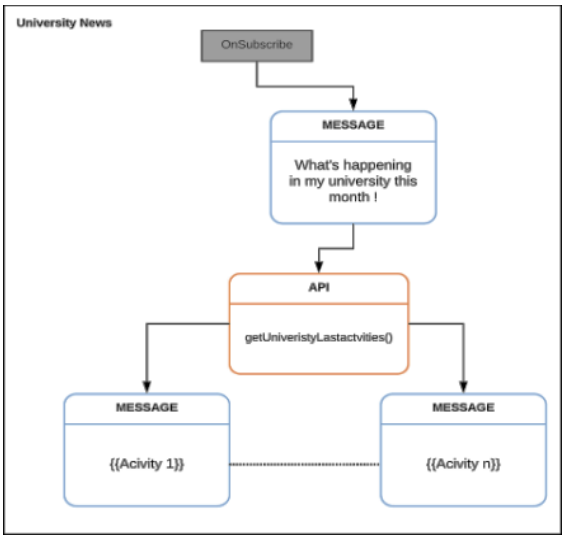

Figure 6. Subscription block to the university news

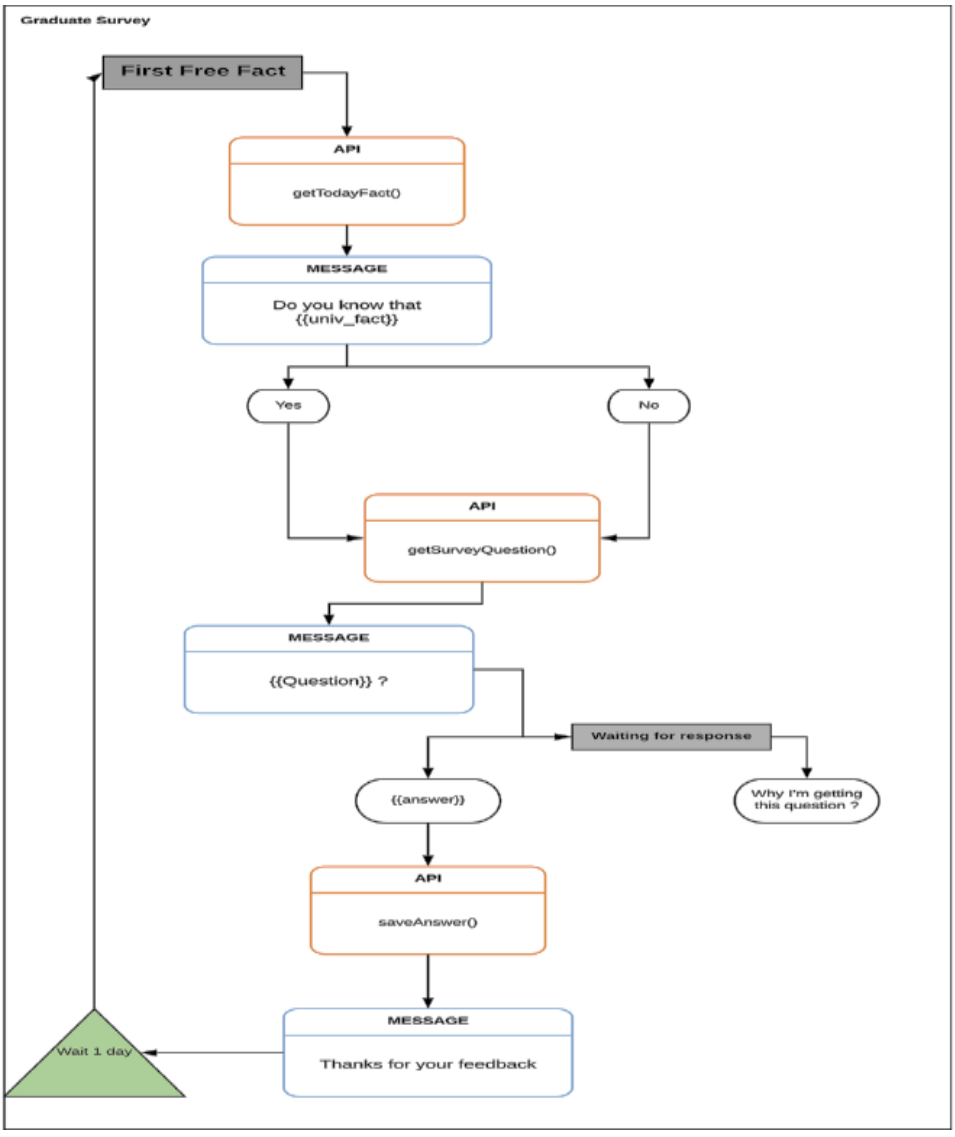

Figure 7. Free Fact and survey conversation flow

- Main menu block

The main menu is needed to simplify the access for information about the university and different bot functionalities. It gives access to several services. Here's a quick overview of what the main menu looks like, from a student's perspective. The below Figure 8 shows how the conversation flow of the menu is implemented.

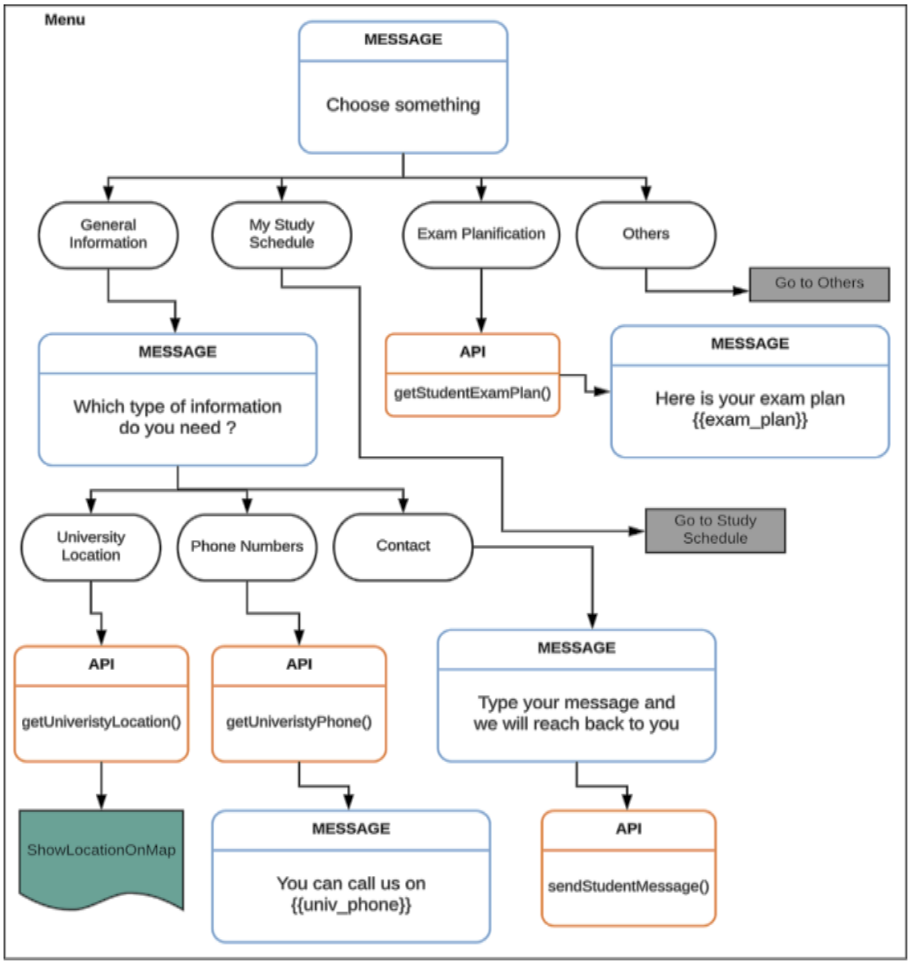

Figure 8. Main menu conversation flow

2.3. Implementing the chatbot

The first step is to choose the right chatbot platform; most of our students use the social network Facebook and its famous messaging app messenger so deciding on the platform was an easy step. The second step is to decide on whether to implement the chatbot from the ground up or use an online service. In our case, we used the Chatfuel service which makes it easy to create a rules-based chatbot. In addition, the chatbot offers a fully implemented artificial intelligence system that makes it easy to configure key-phrases and corresponding bot responses. The third step is configuring the chatbot and adding artificial intelligence (AI) rules. Applying AI rules is like uploading intelligence to the chatbot by inputing keywords, phrases and sentences that we expect our student will type while engaging in the conversation. Figure 9 shows an example of this AI matching rules.

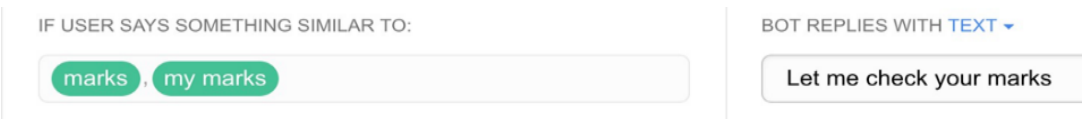

Figure 9. Example of AI rules

As seen in this example we input the two words ‘marks’ and ‘my marks’ expecting the student to type ‘what are my marks ?’ And setting the chatbot to answer back by typing ‘Let me check your marks’ which triggers a marksCheck() function that looks for the student marks on the database and type them back. This AI mechanism has the ability to understand language and also leaning capacity by discovering new patterns and getting smarter when encountering more situations. Machine learning is a core component of chatbot AI by learning by being exposed to a lot of examples, when a chatbot receives an input prompt it analyses the prompt and understands context to form the corresponding output. After the successful implementation of the above conversation flows with the appropriate AI rules. We gave our bot a name ‘University Sidi Mohamed Ben Abdellah ’and an avatar image ‘University Logo’, published its Facebook page in our students emailing list, and asked them to try it out.

3. RESULTS AND DISCUSSION

In this section, we outline the results of some preliminary experiments carried on in order to explore the feasibility of our chatbot as a new survey method to overcome online survey’s constraint caused particularly by students ’inattention and lack of commitment. To this end, we compare the user experience of a chatbot questionnaire, with a standard web survey. More details for this study will be the subject of a future publication. Briefly, the preliminary study experiment was conducted for students from national school of applied sciences students at Sidi Mohamed Ben Abdellah University in Morocco for a period of 3 months. Because of the absence of previous research on this topic, initially, it was applied to a pilot sample of only 70 students and graduates combined with the aim of moving to a larger sample of students spread across several Moroccan universities in the coming months. For ethical considerations, all information concerning participants is anonymously and confidentially. The computer processing of data is not personal. The transmission of information for expertise or for scientific publication is also anonymous. Data analysis primarily consisted of descriptive statistics. All of participated in our study have experienced a web survey and are using Facebook messenger. We established a chatbot questionnaire with same questions to the traditional computer version. The online survey data was collected from students by email using their academic addresses and followed by telephone reminders in order to reach a larger target of graduates. The students were asked to fill both the chatbot and standard web surveys and then, they provided their feedback after about the user experience. Several factors were taken into account to evaluate this study including the difference in score between the two methods and the time to complete a questionnaire. The score is based on several items (20 items in totally), for example, rapid, attractive, and interesting. In total, $1440(20x70)$ terms were scored.

This preliminary experiment establish that the majority of students surveyed prefer to be contacted through chatbot interactive discussion channels when they are available, compared to other traditional channels, such as telephone or e-mail. After launching a first sprint of tests in a group of 70 students and graduates combined, we obtained this first result. Table 1 shows the result of our first test in a period of three consecutive weeks, and we can clearly see that more students preferred using the bot and are engaged in its use. Students preferred the standard computer for 9% (129.6/1440) of the terms; 76% (1094.4/1440) of all terms were scored positive for the chatbot and for 15% (216/1440) of the terms there were no differences. In addition, filling in the questionnaire through the chatbot is faster than the standard web survey. Regarding the completion (average time) of the questionnaire, the average time to complete the web survey took 8 minutes against 7.5 minutes for the chatbot questionnaire as shown in Table 2.

Table 1. Average score per term in the two methods

Survey Method / Preferences	Standard web survey	Chatbot questionnaire	No differences
Preference: items scored positive of all terms	(129.6/1440) 9%	(1094.4/1440) 76%	(216/1440) 15%

Table 2. Average time to completion in the two methods

Survey Method / Completion	Standard web survey	Chatbot questionnaire
Completion (mean time) (minutes by student)	8	7.5

Finally, we have shown the effectiveness of our approach by a comparative data study between the traditional online survey and the use of this chatbot. The results confirm that students preferred the chatbot questionnaire to the standard web survey according to this study. This result seems very interesting because it allows us to predict a high qualitative response rate in future chatbot surveys.

4. CONCLUSION

We have presented a comprehensive chatbot framework to engage students to answer university survey questions. We separated the conversation flows into two different blocks called engaging and surveying blocks and then we made the answering process fact driven where the student gets interesting information about his university, his own course study and career choices. In return, we asked him to provide his opinion and feedback about two methods of surveys and by applying artificial intelligence rules we made it smarter by understanding different words, phrases and sentences. In future, this article could form basis for building a smarter chatbot with sentiment analysis capability to better understand humans interactions and trigger questions based on students engagement and behavior, and also make use of emojis to understand them and answer back using the right emoji depending on the situation. To make use of the collected data this chatbot can also send data through events using apache Kafka to have better analytics and integrate with other streams of data for better decision making.

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