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A Multilingual Infobot in Airports**

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ABSTRACT

A Chatbot is a smart software that responds to natural language input and attempts to hold a conversation in a way that simulates humans. Chatbots have the potential to save any individual's time, hassle, and tedium by automating mundane tasks. The idea about this research is that to investigate how to help the user to efficiently interact with the robot receptionist through an intelligent assistant dialogue. Chatbots are an effective way to improve services with their 24 /7 up time, their cost efficiency, and their multi-user quality. Despite the, Chatbots reduce human errors and give more answers that are accurate. Successful implementation of a Chatbot requires a correct analysis of the user's query by the bot and ensures the correct response that should be given to the user. This research develops a Chatbot for the airports, which provides the visitors to the SWE Chatbot relevant information about the department.

1 Introduction

In the era that is especially demanding of multicultural Employees in vital environments like hospitals, airport, information technology continues to contribute to improve performance. Mobile Artificial Intelligence Technologies have been shown to significantly help with mundane tasks so we can apply our precious time and effort into more imperative duties. With the advancements in artificial intelligence (AI), data mining and human cognitive studies, a lot of companies have started releasing personal assistants or what is also referred to as a Chatbot. A Chatbot is a software that can simulate a conversation (or chat) with a user in natural language through messaging applications, websites, and mobile. They are built to automatically engage with received messages. Chatbots can be engineered to respond the same way each time, to respond differently to messages containing certain keywords and even to use machine learning to adapt their responses to fit the situation. It is often described as one of the most advanced and promising expressions of interaction between humans and machines [1]. Chatbots establish interactions between people and services, enhancing the customer experience. At the same time, they offer organizations new opportunities to improve the customers' engagement process and operational efficiency by reducing the typical cost of customer service. According to Google Trends, the term Chatbot has been searched 40% more in 2018 than in previous years. In addition, a report published by "Business Insider Intelligence", suggests that 80% of businesses will want to use Chatbots by 2020. Most companies want to use it as an important channel to communicate with their target market. Chatbots have also been engineered to be applied in academia [2],

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with campus technology already sorely outdated, AI and Chatbots could be the catalysts that finally bring campus tech into the modern era. From applying to college, to arriving on campus, inquiring about study plans, signing up courses and even searching faculty members. There is a multitude of ways Chatbots can help to streamline the process, universities and colleges spend an excessive amount of their resources on maintaining their visibility and relevance. The fact that they cater to the younger segment of the population automatically implies that their approach to sales, marketing, and management needs to be prevalent. This is precisely why building Chatbots for websites is an effective strategy for universities and colleges [3]. In this project, we are focusing on the application of Chatbots in higher education, specifically King Saud University's Software Engineering Department, and how adopting such an application will help reduce time related costs, improve user experience, offer assistance 24/7, and most importantly assist college students with FAQ's briskly and accurately. Resulting in a delightful and promising overall experience. The purpose of this research is a proof of concept to resolve the constantly faced situations in vital areas such as hospitals, airports and/or international firms where one can meet multicultural environment and needs to instantly communicate with people and overcome the language barrier. The Chatbot will be able to take queries or questions from users and reply with relevant answers. In cases where the Chatbot may be asked a non-related or unknown question, the user will still be guided towards a proposed solution. Our AI Chatbot is engineered with the main purpose; which is to ensure information retrieval in a timely manner for all who are inquiring about the SWE department.

2 Background

This section talks about the Chatbots systems and their history. A Chatbot is an artificial intelligence (AI) program that simulates interactive human conversation by matching user input to a pre-calculated phrase. For example, a user saying, "Thank you" will result in the Chatbot saying "You're Welcome". The predefined set of phrases can be set up to simulate a normal conversation between two humans. Problems can arise when a user says something the Chatbot does not recognize, an example could be the user meaning to say "Thank you", but instead says "Thanks a lot", this can confuse the Chatbot as it will be looking to match the "Thank you" input with "Welcome". This leads to a lot of manual work by trying to define every combination of a user saying "Thanks" [4]. It started in 1950 when Alan Turing developed Turing Test, a way to measure whether one was speaking to a human or to a Chatbot, and this was the beginning of AI [5]. In 1966, ELIZA was developed as a program to make natural language conversation possible with a computer. ELIZA's key method involves the recognition of words or phrases in the input, and the output of corresponding pre-prepared or pre-programmed responses that can be meaningful to the users, see Figure 1. ELIZA's method of operation is then copied by Chatbot designers ever since. However, ELIZA failed to pass Turing Test [6]. Since ELIZA, there has been progress in the development of conversational intelligent bots. In 1972, PARRY was created, and it was the first bot to pass Turing Test. In 1995, A.L.I.C.E was created, a more complex bot that generated responses by pattern matching inputs against (input) (output) pairs stored in documents in a knowledge base. ALICE is a three-time winner of the Loebner prize, a competition held each year which attempts to run the Turing Test, and awards the most intelligent Chatbot [6].

3 Domain Analysis

In this section we will take a look at similar applications that considered as an AI "Artificial Intelligence" virtual assistant and talk about what are the common features that they provide. In the last few years, Chatbots are extensively used as a point for interaction between users and computers. Chatbots are used as a source of information where users can ask questions and the bot will answer them. These bots are ranged from simple option-based Chatbots to complex Chatbots that communicate with users in their natural language. Moreover, Chatbots can be mobile apps, web-based bots, or artificial users at the social media sites like WhatsApp, Slack, Skype and Facebook Messenger. As the number of available Chatbots is considerably huge, we, in the following, only refer to the famous Chatbots or educational Chatbots that are mobile apps or web-based bots. The social media Chatbot are not a concern for this report [7] as they are simple and developed mostly with predefined template. Most of the famous Chatbots are purpose-free bots that provides information in different fields. The educational Chatbots that we found are mostly Facebook messenger bots like the UoM Timetable Bot [8] that can answer simple questions about the University of Manchester's timetable. One of the more mature Chatbot that is provided by universities as a mobile app is the following.

3.1 Genie

Genie is an AI personal Assistant for students. Genie is a smartphone application developed by Deakin University. It is designed to ensure student feel supported, organized and in control throughout his/her studies [9]. Genie provides access to learning resources, set a reminder for assignments that are due, helps

students with referencing (articles, journals etc.), provides classes' timetable.

3.2 Siri

Siri is a personal assistant developed by Apple Inc. released on October 12, 2011. Siri supports apple devices only such as iPhone, iPad, Mac, Apple TV, Apple Watch and HomePod. It helps its user to translate texts, make calls and much more [10]. Siri sends text to a specific person, sets events date and time, helps to show you contact information and provides the ability to run specific apps upon command.

3.3 Google Assistant

Google Assistant is an AI service developed by Google on May 16, 2016. It is supported by multiple platforms such as Android and IOS. It is very useful to control and organize your everyday routine by keeping track of tasks, deadlines and notifications it can also is able to be accessed by home devices [11]. Google Assistant provides communication services (sending messages, making calls and recording voice messages), provides the latest news, and provides the ability to run specific apps upon command. Similar to these Chatbot are Amazon's Echo and Alexa and Microsoft's Cortana. In addition to these Chatbot the following Chatbot Mitsuku [12].

3.4 Mitsuku

Mitsuku female Chatbot who is a four-time winner of the Loebner prize Turing Test. Major features provided by Mitsuku are: Chat with people and telling jokes, stories, poems and horoscopes, show pictures and websites on the net and play games too, tell the weather forecast, and tell what happened on a date in history [13].

3.5 BOTTA

BOTTA's persona is that of a friendly female Chatbot, who aims to simulate conversation and connect with as many Arab users as she can. She is the first Chatbot that converses in an Arabic dialect, which supports her purpose of entertaining users who are accustomed to chatting in the dialect. Main features of BOTTA: support Arabic language, keep up with the conversation [14].

4 Proposed Solution

the design concepts of Chatbots are the same, all bots should understand users' questions and then correctly answer them [15]. The model of Chatbots can be seen in Figure 2. When a user asks a question or

Table 1. Comparison between software receptionist Chatbot and similar systems

	Feature	Mitsuku	BOTTA	Genie	Siri	Software
1	Available 24/7	✓	✓	✓	✓	✓
2	Supports text input	✓	✓	✓	✓	✓
3	Supports voice input			✓	✓	✓
4	Used in educational facilities			✓		✓
5	Supports Arabic language	✓	✓		✓	✓
6	Deployed in Web\mobile	Web/Mobile	Web	Mobile	Web/Mobile	Web

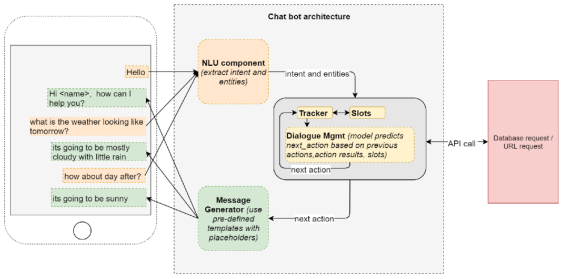

Figure 1. Model Chatbot

request information from the bot the following steps will evaluated to generate an answer [16]:

1. The NLU component (Natural Language Understanding) extracts the intent and entities from the user request. The intent is the general user's intent in the request like "request weather" or "request_restaurant". The entities are the specific intents in the user request like the date-time or location as an answer for when and where questions [17].
2. A dictionary object will be consulted with the current intent and current entities to form the input to the dialogue model (manager), which will be used to provide the target answer to the input. The dialogue model is going to be trained to determine the "next action". The next action can be a respond to the user with an appropriate message or a retrieved data from a database.
3. The message generator component consists of a number of user defined template, which are sentences with some placeholders, as appropriate. Depending on the action predicted by the dialogue manager, the respective template message is invoked. If the template requires some placeholder values to be filled up, those values are passed by the dialogue manager to the generator. Then the appropriate message is displayed to the user.

4.1 Client component

User Interface: This is where the user will interact with the Chatbot either throw text messages or voice commands. The user's questions will be sent to the

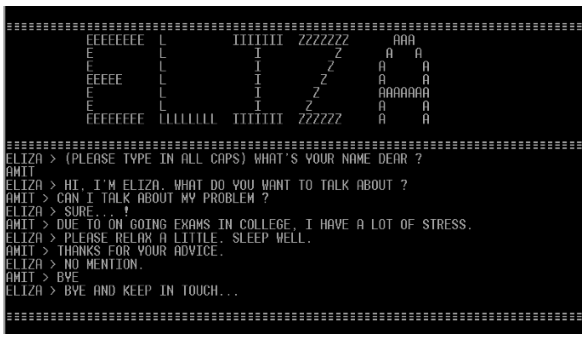

Figure 2. Conversation with ELIZA

Inference Engine and the later will send back the response.

4.2 Server Component

1 Inference Engine: This component will get the commands from the user and send them to the Inference Engine to get from the later to send the response to the User Interface. It will also communicate with an external component that is: Web Speech API to translate the voice commands into structures. Then it will query from the Knowledge Base the appropriate answer for the question.

2 Knowledge Base: This is where the question bank is stored with the number of site visitors and the average number of answered questions. When the Inference Engine queries an appropriate response from the Knowledge Base, it will choose the appropriate one based on the rules and the facts that are stored in it. The response will be sent to the Inference Engine which will send it back to the User Interface.

4.3 Heterogeneous architecture

(1) Client-Server and Knowledge-Based. since Knowledge-Based architecture is also suitable for artificial intelligence systems.

(2) Another considered heterogeneous architecture that might be suitable to our system is: Client-Server and Master-Slave. The reason was because the Master-Slave is a good approach for critical systems that needs accuracy. After making a tradeoff depending on the nonfunctional requirements, we are seeking in our system we found that the most applicable architecture is: Client-Server + Rule-Based architecture (with 84.95 points).

Once the Knowledge Base and the Inference Engine respond to the user properly, the server will save simple statistics about the user and the asked questions. When the user reloads from the User Interface, the server will send the collected data into the real time database (Firebase).

Table 2. Architecture Trade-off Analysis

	Performance (20%)	Usability (20%)	Reliability (20%)	Correctness (25%)	Interoperability (10%)	Maintainability (10%)	Sum
Client-server	60	95	40	60	75	80	67.5
Rule-Based	90	95	60	95	60	75	83.25
Knowledge-Based	85	95	50	95	50	75	79.75
Master-Slave	40	40	100	95	50	75	67.25
Client-server+Rule-Based	85	95	60	95	77	85	84.95
Client-server+Knowledge-Based	77	95	50	95	70	77	80.35
Client-server+Master-Salve	50	68	70	95	63	77	71.85

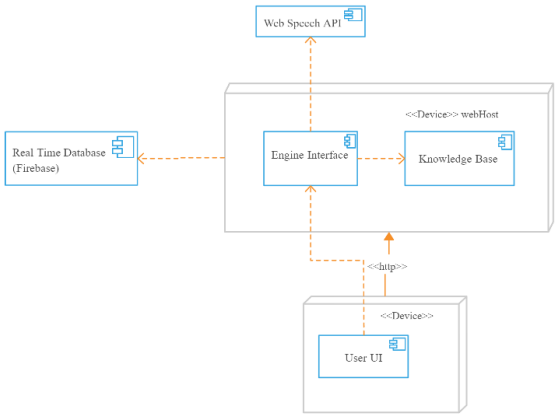

Figure 3. Deployment diagram

5 Conclusion and Future Work

Throughout our extensive search since the very beginning of our project, we have been through multiple resources and endured a strenuous vetting process. It was apparent that there still exists a plethora of untapped knowledge. Currently we hold a firm introductory understanding about the core algorithmic, machine learning, and data collection process that goes into the building of a Chatbot has been developed. Additionally, as it was hoped we have been successfully able to create our Chatbot using NLP (Natural Language Processing) while using NLTK (Natural language Toolkit) that enabled us to make the system support the Arabic language. All that being said, there are still some more possible ideas that may be adopted in the future for a system such as ours starting with the concept of deep learning, which is a type of machine learning that trains a computer to perform human-like tasks, such as speech recognition, identifying images or producing predictions [18]. Specifically, recent advances in deep learning introduced powerful methods in processing input text through the use of word embeddings. Embeddings are a way to encode text into a numeric vector of fixed length which makes it possible to compare the similarity of two pieces of text. In the context of a Chatbot, using embeddings enables the Chatbot to handle input that is similar in meaning but not necessarily exact to the pre-defined

data intents. This allows us to increase the intelligence of our Chatbot in the future. Furthermore, after analyzing the results obtained by the usability survey. We remain to be fervent to revisit the option of deploying it on KSU's website. This is based on the number of students who showed interest towards our system. Conclusively, we hope by producing this project we can make the college experience move a little more swiftly and joyfully for our Chatbot users.

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