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Baristax: The Coffee Selection Recommender Bot

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ABSTRACT

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This study aims to develop a prototype of a coffee recommender bot that uses the expert's knowledge to give its users a standardised suggestion based on their preferences. This prototype is integrated with Telegram Bot for more accessible and convenient use, as Telegram is safer than any other online communication platform. Furthermore, it uses Google DialogFlow with Natural Language Processing (NLP) tools that enable the chatbot to identify what the users want. Finally, the project is validated on students, mainly from the UiTM Shah Alam campus and a barista, to determine the usefulness and correctness of the prototype chatbot's overall performance. This initiative received evaluations from 45 students and ten baristas. The research intends to be integrated into the company's mobile application, allowing for other functionalities. As a result, coffee enthusiasts may now have customised applications to satisfy their coffee addiction.

1. Introduction

Malaysia has a robust coffee-drinking behaviour; on average, Malaysians take about 2.5 cups of coffee daily. Nowadays, the consumption of coffee behaviours among university students can be seen to be increasing. Among the reasons behind taking caffeine is associated with their activities. Most take coffee to feel more awake, enjoy the taste, socialise, and increase their physical energy [1]. Caffeine can also improve their mood and alleviate stress. The primary reason for taking caffeine is to feel more awake [2]. According to a poll of 107 students at Universiti Teknologi MARA (UiTM) in Shah Alam Campus, 40% drink coffee for the flavour, and 28% drink coffee to remain alert. Most students who want to pull an all-night study session will consume coffee to stay awake more frequently during test season. However, choosing coffee is critical to ensuring they drink the most probable compatible type of coffee.

Previously, many solutions have been developed to assist in the determination of people's preferences. For instance, a recommendation system is created to overcome the issue of choice. A recommendation system is a function in which input is given in a user model or items to find the

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relevance score or is used for ranking [3]. The recommendation system models users' interests by analysing their historical behaviour to recommend information that tally with their interests and needs [4]. Among the traditional approaches in recommendation systems are collaborative filtering, content-based filtering, and knowledge-based filtering. The basic idea behind collaborative filtering is that if users have preferences in the past, they will have the same likings in the future. If two users' preferences are most likely similar, they can recommend each other [5]. It is called a collaborative filtering technique because selecting interesting items comes from filtering results from many collections, and users implicitly collaborate with others. Another essential aspect of ensuring a good selection is determining the criteria for the preferences. Implementing a recommendation system for coffee selection helps the user get a suitable coffee drink. Therefore, this project proposes recommender bots for coffee selection to assist the customer, focusing on the university student to reach the nearest piece of coffee drinks based on their preference with the assistance of bots. A chatbot in Telegram Bot will be the virtual assistant that handles the interactions with the user. The coffee drink culture in Malaysia has increased over the years. However, some customers may still lack coffee knowledge. In The New Consumer article written by Marcus Young, Community Outreach and Customer Coordinator, Batdorf and Bronson, the outcome of the barista surveyed stated that customers at the café frequently ask for more information about their coffee. They are curious about flavours, freshness, and even coffee production.

Meanwhile, giving options for coffee selection is also vital to baristas as it increases the customer experience. In one of the posts by Perfectly Daily Grind on Barista Careers: How to Make Drinks Recommendations, the coffee expert must guide the customer in making the best choice for their coffee drinks. Hence, new baristas could still lack this coffee experience and knowledge, and they might suggest something that does not satisfy the customer. Several existing coffee recommender systems can be found on the internet. However, most are web-based, and some can only be viewed if the users use a computer or laptop due to a lack of mobile view settings. A mobile-based application or system is more convenient as people always bring their smartphones everywhere. Furthermore, using social sites like Telegram, which most people nowadays use for communication, will be easier for the user to search and use the service.

Moreover, a chatbot gives a better and more interactive user experience during the recommendation process [6]. Therefore, the problems mentioned before can be solved by having a recommender system that will provide choices for the customer altered on their preference and a chatbot function that will help the user to get a coffee recommendation and assist the new baristas in giving recommendations for the most suitable drink to their customer. Hence, this study aims to determine coffee preference characteristics for students and develop a coffee recommender bot.

1.1 About Coffee

Coffee is well-known for being the most widely consumed beverage in the world. It first started in Mecca at the end of the 15th century. Since then, coffee consumption has inclined worldwide [7]. There are about 3 billion cups of coffee consumed globally every day. Among over 66 species of coffee, two of the most known are Arabica and Robusta. Arabica has less caffeine than other species of coffee, while Robusta is about twice as much caffeine as arabica. According to the US, Food and Drug Association (FDA), in their post "*Spilling the Beans: How Much Caffeine is Too Much?*", the cited safe consumption amount for healthy adults would be 400 milligrams a day. Therefore, coffee has no health risks if taken moderately, except for people with a low tolerance for caffeine. As a better option for this problem, decaffeinated coffee is created for those who cannot metabolise caffeine normally. Espresso is the brewed coffee extraction that serves as the foundation for coffee beverages

such as lattes, cappuccinos, and americanos. Depending on the customer's preference and mood, these drinks can be served chilled or hot. People may now consume coffee at any hour of day or night. It is no longer a beverage that is solely consumed in the morning.

1.2 Coffee Culture in Malaysia

The number of coffee specialities and cafes can be seen growing in Malaysia. According to the statistics of total coffee consumption in Malaysia from 2009 until 2018, posted by R. Hirschmann, coffee consumption can increase. In 2018, it was said that about six hundred thousand 60-kilogram bags of coffee were consumed in Malaysia. This coffee-drinking culture has risen through the continuous expansion of cafes from international and local brands such as Coffee Beans, Starbucks, and Old Town White Coffee. Starbucks was brought into Malaysia in 1998 by Berjaya Corporation and Starbucks Coffee International. In 2020, the total number of Starbucks outlets in Malaysia reached 300. It has shown the increasing trend of demand for coffee speciality in Malaysia.

As a result, Malaysians are getting a lot better at coffee appreciation. According to Jasen Lee, General Manager of Global Coffee Resources, in his interview with the New Strait Times, people ordered milk-based coffees such as cappuccino and lattes or even flavoured concoctions. However, at least 20 per cent of those people have changed their preference to black coffee without sugar nowadays [8]. It shows how Malaysian are getting more sophisticated with their coffee knowledge.

1.3 Barista Recommendation Skills

Apart from preparing coffee beverages, a barista should also provide suggestions. Indeed, giving a suggestion is one of the most challenging and crucial components of being an exceptional barista. A barista should guide customers in finding the perfect coffee cup. Therefore, the knowledge of each coffee drink on the menu should be well-digested in the barista's mind so that recommendations can be made. A statement made by Goh Chee Wan, Coffee Consultant for Classic Fine Foods, in the article "*Perfectly Daily Grind: Malaysian Coffee Pros Explain the Third Wave*" says that a barista should explain the coffee so customers can understand their drink and also give feedback for the baristas' improvement. To become a coffee expert, one should undergo coffee training to learn the techniques of brewing coffee and gain knowledge about coffee drinks.

1.4 Coffee Consumption among Universities Students

Coffee consumption among university students is no longer a rare thing among the customers that often come to the would-be cafe students. Indeed, coffee is one of the primary sources of caffeine. For example, the University of Kentucky conducted a study in 2008. It is said that over 76% of surveyed students took caffeine to stay awake. Another study on 1248 students from five U.S. universities between 2009 and 2010 stated that 92% of students consumed caffeine. This study also concluded that the reasons for taking caffeine are 79% to feel awake, 68% because they enjoyed the taste, 39% for social aspects of consumption, 31% to improve concentration, 27% to increase physical energy, 18% to improve their mood and 9% to alleviate stress [2]. Therefore, it can be concluded that students often drink coffee to stay awake to study. This is because the caffeine inside the coffee stimulates the brain to stay alert and awake.

1.5 Recommender System

This study uses a recommender system (RS) to provide suggestions based on user's preferences. This mechanism handles issues in several sectors [9]. Therefore, these strategies are used to offer user-friendly suggestions. Nowadays, practically everything may be represented using systems, including music, films, novels, and news articles [10]. Therefore, RS has been mostly utilised in knowledge management and e-commerce applications. Several techniques for developing recommender systems include collaborative filtering, content-based filtering, knowledge-based filtering, and hybrid recommender systems [11].

The recommendation system collects user preferences before producing the results of recommended items. Therefore, it is giving options that are only related to what the user wants and ignoring the things that are not related. Consequently, it is more effortless and time-saving. Giving recommendations based on the user's preferences will increase the user's satisfaction. Besides, a well-designed recommender system with a user-friendly interface will make users more comfortable using the system. Furthermore, having a recommender system sometimes will enable the user to get a better option rather than asking the same question to the person. It is because a person's thinking may change from time to time. Therefore, the recommendation may not always be consistent rather than having the system recommend what the user wants. Meanwhile, a chatterbot, or chatbot, is an intelligent agent which simulates human conversation using text messages or voice [12]. Natural language processing (NLP) is a part of artificial intelligence that interprets whatever the user gives to the chatbot to understand the desired process [13]. These days, many NLP tools can be used. For example, Google has developed DialogFlow, previously known as Api.ai, which able its users to create a chatbot with the implementation of the NLP [14].

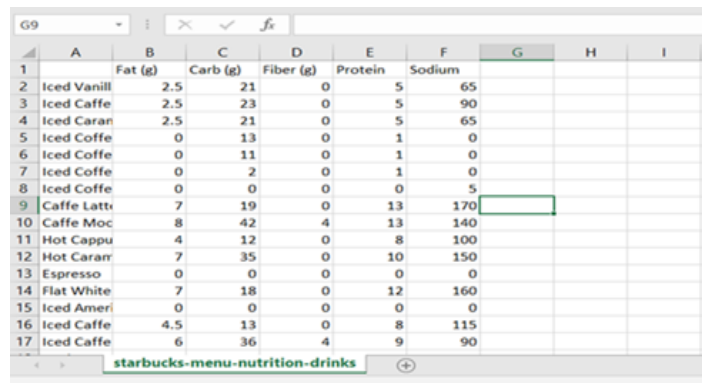
2. Methodology

2.1 Data Collection

The data is derived from primary and secondary sources. The expert system's data is collected directly from the expert. These data were gathered through an expert interview to ascertain the coffee suggestion procedure. The dataset containing the nutritional details for coffee was retrieved from Kaggle by utilising the 2017 Nutrition Facts for Starbucks Menu given by Starbucks. This information is then supplemented with Nutritional Facts from The Coffee Bean and Tea Leaf.

2.2 Data Pre-Processing

The dataset is cleaned to eliminate duplicates, missing values, and superfluous special characters in the coffee name. After integrating nutritional information data from the Kaggle dataset and the Store Website, the data were integrated into a single Excel file. A total of 36 rows of data were obtained.



	A	B	C	D	E	F	G	H	I
1		Fat (g)	Carb (g)	Fiber (g)	Protein	Sodium			
2	Iced Vanill	2.5	21	0	5	65			
3	Iced Caffe	2.5	23	0	5	90			
4	Iced Caran	2.5	21	0	5	65			
5	Iced Coffe	0	13	0	1	0			
6	Iced Coffe	0	11	0	1	0			
7	Iced Coffe	0	2	0	1	0			
8	Iced Coffe	0	0	0	0	5			
9	Caffe Latti	7	19	0	13	170			
10	Caffe Moc	8	42	4	13	140			
11	Hot Cappu	4	12	0	8	100			
12	Hot Caran	7	35	0	10	150			
13	Espresso	0	0	0	0	0			
14	Flat White	7	18	0	12	160			
15	Iced Ameri	0	0	0	0	0			
16	Iced Caffe	4.5	13	0	8	115			
17	Iced Caffe	6	36	4	9	90			

Fig. 1. Data After Undergo Cleaning Process

2.3 Data Storing

After cleaning the data, it is transformed to JavaScript Object Notation (JSON) and uploaded to Firebase Realtime Database. Initially, the data is recorded as a comma-separated values (.csv) file. After that, it is submitted to an online JSON converter (csvjson.com) to convert it to the required format. JSON is a good and lightweight data format that can transmit the data across any programming language. After converting the data to JSON, it will be published to Firebase Realtime Database. The database contains data in the form of parent and child relationships. For example, the coffee's name is set to match the parent, and the nutritional information is set to match the child.

2.4 Chatbox

Google DialogFlow is used to construct the chatbot. This tool includes a natural language processing component that enables the chatbot to process the user's input and perform the necessary action. A few measures must be taken during the chatbot development process to guarantee that the chatbot works appropriately.

2.4.1 Smalltalk

Small talk allows the agent to learn how to have a short conversation between the user and the bot without adding additional development. The response is customised by filling in the form. Some of the other responses are predefined phrases.

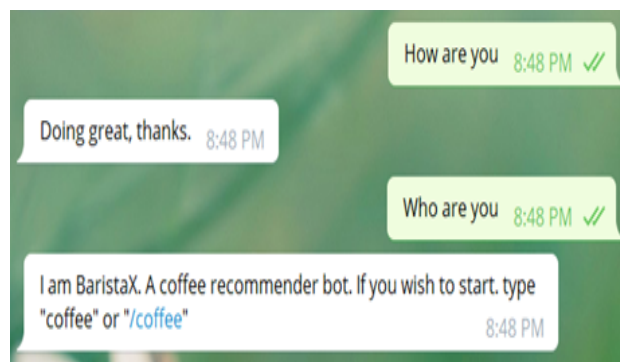


Fig. 2. Example of Smalltalk response

2.4.2 Fallback handling

A fallback method is necessary to keep users from abusing the bot when given specific input when a chatbot can only do a job when given a particular input. This message is sent if the user enters information the chatbot does not recognise or understand. DialogFlow has a fallback intent as one of its defaults. The fallback intent is used when the user's input does not match the usual intent.

2.4.3 Intent

In DialogFlow, the recommendations flow is arranged in terms of intents. Each intent consists of contexts, events, training phrases, actions and parameters, responses, and fulfilment. The context will catch and remember the value to be passed across another intent. Events can be defined as an optional way to trigger the intent without matching it with the input. Instead, it uses a predefined or custom platform to create an event. Training phrases is where natural language processing (NLP) does its work. The phrases in this part are trained with the expected word that the user will use to trigger the intent. Finally, the action and parameters serve as a value container, storing the data entered by the user for the actions of another function. Finally, responses and fulfilment are the features inside intent that let the agent respond to the user. The difference between these two is that response will provide default or media-rich responses, while fulfilment allows you to add code in the Node.js to add more functions which cannot be done in default responses or when it involves the database. For this project, 97 intents are created, including two predefined intents, the fallback handling intent and welcome intent.

2.5 Recommender System Process

The interview with Mr Rais, a coffee specialist, provides insight into the coffee suggestion process. According to him, a few questions must be asked of the buyer before offering a recommendation. First, discover if the client prefers milk or black coffee. This is where coffee originated. Next, consider the flavour, the type of drink requested (cold, hot, or ice-blended), whether milk foam is necessary, and the desired thickness.

2.5.1 Entities of the chatbot

All the above processes are turned into a few entities within DialogFlow. These entities will store the value supplied by the user while utilising the chatbot, allowing the chatbot's capabilities to do more than deliver a recommendation.

2.5.2 Knowledge-based intent

Knowledge-Based intent is used to organise the questions for the recommendation process. Furthermore, DialogFlow's purpose allows it to have a follow-up intent. As a result, the selection process will be allowed to proceed. In general, follow-up intentions are expected to behave similarly to other functions in other programming languages. Consequently, the outcome is possible as long as the follow-up intentions are carried out [15]

2.5.3 Fulfilment Method

The fulfilment method is used to get results for purposes. First, the inline editor must set the intent using JavaScript language to map it to the related functions. For example, the chatbot provides extra information about the coffee's nutritional benefits and recommendations. To perform this function, the DialogFlow must be connected to the database of coffee nutritional information contained in the Firebase Realtime Database. Furthermore, to communicate data between DialogFlow and Firebase, an inline editor connection code must be inserted.

After the connection is successful, the function will get the name of the recommended coffee by using the parameter. Then, the code in the inline editor will match the parameter with the related parent name of the data stored inside the database. Once matched, the Telegram chatbot will display the relevant data about the nutritional fact, and the total calories will be calculated.

2.6 Telegram Bot Deployment

2.6.1 Setup telegram bot with BotFather

The first step in developing a Telegram bot is to create a profile. This is required to receive a token for the Telegram API. Then, to begin setting the bot, it must be registered with BotFather (@BotFather), an official account allowing the bot's building. Next, the bot will prompt you to enter the bot's chosen name and username. Furthermore, this official bot account oversees the creation of the bot's profile photo and predefined commands.

2.6.2 Integrate telegram bot with DialogFlow.API

Users can integrate DialogFlow with any API platform, including Facebook Messenger, WhatsApp, Viber, and Telegram. First, DialogFlow needs an access token to integrate with Telegram. Following the preceding phase in which BotFather created the token, the token is entered into the associated field. Once enabled, the integration will begin [16].

2.6.3 Improving user interface

Initially, the default user interface of the Telegram bot would only offer data by typing in chat. However, the method of input insertion is streamlined to assist and improve the user experience by providing user commands and buttons. The figure below shows the evolution of user interfaces. First, BotFather creates the list of commands on Telegram. These commands are helpful to trigger the chatbot to do specific skills.

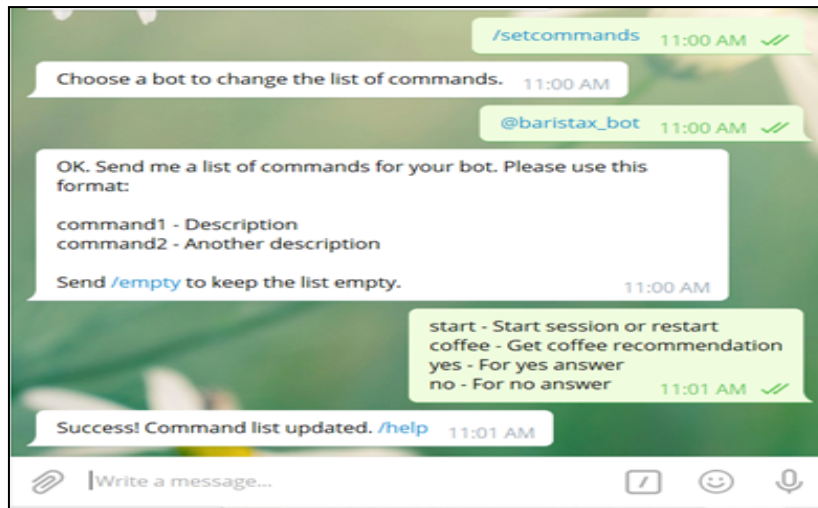


Fig. 3. Adding List of Commands in Telegram Bot

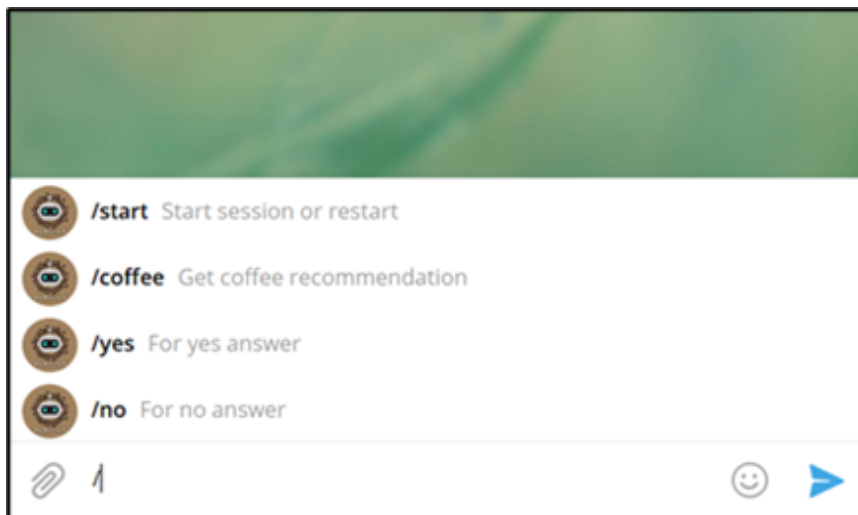


Fig. 4. Example of Commands

Another way to create a user-friendly interface is by providing a quick reply. The quick response can be in the form of a button that allows the user to click it instead of typing their answers. Another benefit of using DialogFlow Essentials is that it has a method to create a quick response that will directly integrate with Telegram.

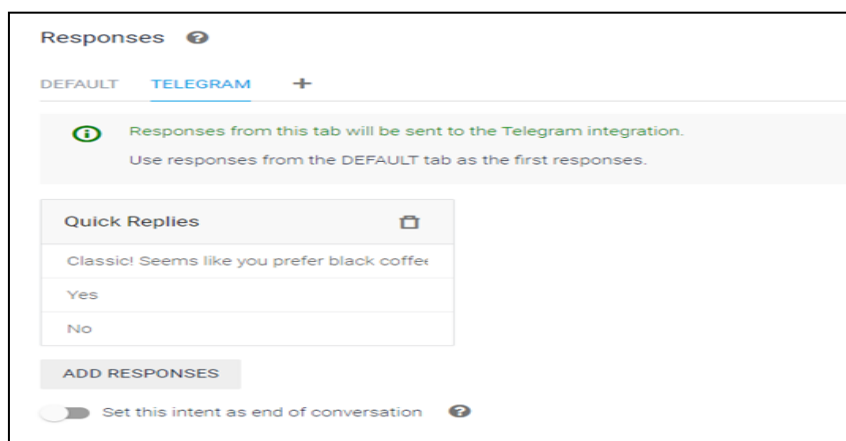


Fig. 5. Method to Create Quick Response in DialogFlow

DialogFlow also has a technique for retrieving images. The image displayed to the user will give them a better concept of how the coffee will appear [17].

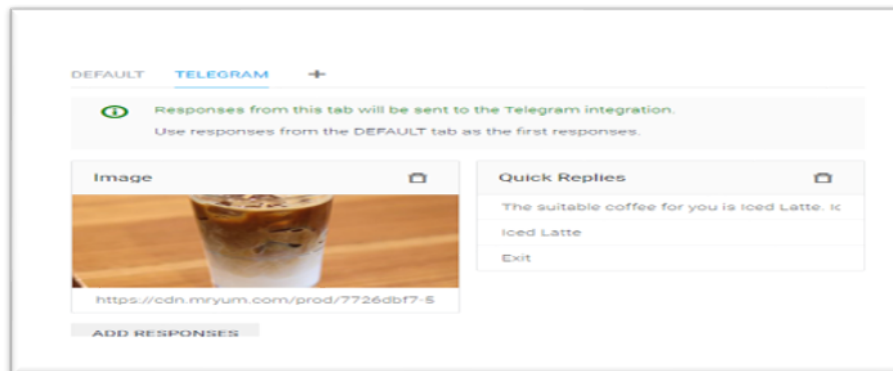


Fig. 6. Method to Fetch Picture into Telegram Bot



Fig. 7. Example of Bot Reply with Attached Picture

3. Results

A survey was distributed to students and baristas to measure the user's experience and satisfaction with the prototype chatbot. The feedback is sent to the barista to examine their thoughts and satisfaction with the chatbot's recommendation. Feedback from the student is necessary to confirm that the bot correctly solves the coffee selection process problem. Google Forms was used to construct and distribute the survey. The survey showed the students' satisfaction when using a bot on Telegram as a medium. However, 11.1% of the respondents were neutral on whether they were comfortable using Telegram. On the other hand, 42.2% of the respondents were comfortable with using the bot on Telegram, and the additional 46.7% were comfortable and already suitable for using Telegram. About BaristaX's total performance response, thirty per cent of respondents agreed that BaristaX has reached its peak performance and is ready for public use. The remaining 70% of respondents were likewise convinced that BaristaX might perform effectively as a virtual barista that assists in making coffee recommendations.

4. Discussions

The main limitation of the project is the limited source of knowledge, time, resources, and computational constraints in developing the bot. In the case of the Telegram Bot, there aren't many documents that show how to make one. Furthermore, a webhook must be created for a telegram bot to function. Most web-hosting sites, however, require payment to use their services, and others

are likely to label the system as phishing due to the presence of a bot [18]. Furthermore, DialogFlow.api only supports JavaScript coding. The difficulty encountered during the chatbot's early development is learning to code in JavaScript in a short time [19]. Due to a lack of language knowledge, a few trials are required to ensure that the chatbot can produce the desired output and understand how the code works. Furthermore, with only one inline editor location provided, the deployment process takes longer to complete if longer code is included in the editor.

5. Conclusions

Telegram's prototype chatbot enables users to use its service at the tap of a finger, from any location and at any time. Furthermore, the knowledge obtained from a qualified barista enables the prototype to make reasonably accurate or almost so recommendations to the user. This knowledge is then included in a few Google Dialog Flow ES intents. This initiative hopes to include the chatbot in its mobile application. Having a mobile app designed specifically for coffee recommender chatbots can add more capabilities than utilising a Telegram bot.

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