

Review of Chatbots Design Techniques

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ABSTRACT

Recently, the development of conversational system as a medium of conversation between human and computer have made a great stride. This human and computer communication has covered the way for enormous natural language processing techniques. A chatbot is a computer system that allows human to interact with computer using natural language. The chatbots system are widely used in various field such as in businesses, education, healthcare and many more. The design and development of chatbots involves variety of techniques. Therefore, in this paper, we presents the review of techniques used to design Chatbots. A few examples of chatbots design is also discussed to give an understanding on how chatbots works and what are the type of approaches available for chatbots development. With rapid development in Chatbots technology, it is hoped that it could complement human constraints and optimize the productivity.

General Terms

Pattern Matching, Natural Language Processing.

Keywords

Chatbots, Instant Messaging, Bots, Natural Language.

1. INTRODUCTION

In general, bot is a computer system that can perform automated task, and bot may also serve in messaging platforms which known as Chatbot. Chatbot is similar to the normal messaging application however the different is when one of the message receiver is a robot. In other word to describe the situation is like when human is chatting with the robot (computer). The conversation message could be send through several medium such as voice commands, text chats, graphical interfaces or graphical widgets.

Nowadays, Chatbots is a trending system which with it in hand may assist human in doing many task [1]. It offers many advantages of using Chatbots, for instance, Chatbot are able to assist human inquiry and giving feedback 24 hours per day as well as it also can improve efficiency by taking over tasks for which humans are not essential. But the biggest advantages of Chatbots is that it is able to reach a broad audience on messenger system and the ability to automate personalized messages [2]. Chatbot has been used in various industries to deliver information or perform tasks, such as telling the weather, making flight reservations, answer the educational based queries [1] or purchasing products. These technologies also are used by various famous application such as Telegram,

Cortana, Slack, WeChat, Facebook Messenger, Google Assistant and Siri.

In terms of Chatbots system development, in order to create a medium of speech conversation between the human and the computer involves several different design techniques. As stated by [3], the design techniques that usually chosen by developers can either be by pattern matching, cleverscript, chatscript, Artificial Intelligence Markup Language (AIML) or by using language tricks. However the most popular technique is the pattern matching whereby the bot will matched phrases to the keywords in a pre-specified dictionary [3]. Therefore, this paper aims at reviewing several types of Chatbots design. Examples of Chatbots system is also presented in this paper. The findings are discussed and conclusions are drawn at the end.

2. BACKGROUND

2.1 Chatbot System

Chatbot also known as Chatterbots or chatter robots [4], is the computer system that can communicate with human in the form of messaging app [5]. They can understand multiple question requested by human. They also have the ability to differentiate between uniqueness of word including emoticons. In order to get best quality of Chatbot conversation, they need to have the richness of vocabulary of conversation among people [6].

Chatbot may look like a normal messaging app, they have the application layer, a database and also APIs (Application Programming Interface) working at the background. User interface represent the interface to make easy contact with user. While Chatbot is easy to use, at the background it has the complexity to achieve. Most of Chatbots have logs of conversation and the developer use the logs in order to understand user requests. The logs is then used to improve the Chatbot conversation [7]. Chatbot works by matching the question from user with the help of machine learning. For instance, if the user question is, "Show me the university list of programs" or "I need the program list", both mean the same thing. The developer need to train the Chatbot to understand both questions by delivering the same output. According to [3], the Chatbot is being trained through the analysis of thousands of logs from human conversation. If there are more logs, the application will become more intelligent [7].

2.2 The Use of Chatbots

Chatbot system has been widely used in various field. Due to its flexibility, Chatbot is used for education, healthcare and business industries particularly for marketing purpose. In example, there are several company embedded Chatbot into their system environment like Facebook (Facebook Messenger), Google (Google Assistance), Apple (Siri) and Microsoft (Cortana). Company like Facebook has implemented Facebook Messenger with the support of Chatbot system. The Chatbot is able to assist company by serving an automatic customer responder.

Other than that, chatbot system is also used in an education field. According to [8], Chatbot can be an intelligent tutor for the online learner. The Chatbot have the capability to analyze natural language and this reflect to the accuracy of conversation. When conversation flow is accurate, that's make Chatbot one of a tool of education. For example, Chatbot are able to solve problem and give support in parallel for 100 students in an individual basis. Whereas in healthcare industry, Chatbot is used to assist the healthcare expert to gives support to patient through computer and application medium. For instance, the AI-Chatbot [9] works as a conversational assistants to facilitate long term adherence to health promotion interventions. In this case, bot act as a bi-directional channel between the healthcare expert and user in consulting user from gaining weight by giving advice on healthy diet habits, physical activities, food preparation and purchasing.

However, current wave of research shows enormous usage of chatbot system in business especially for marketing purpose. For example, the Collect.chat is an interactive chatbot developed to capture customer's data on company's website. This chatbot may be used to collect information regarding product order, doing surveys, answering customer's enquiries, registration and bookings.

3. REVIEW OF CHATBOT DESIGN

The following section discusses about several types of Chatbots used for several purposes such as for businesses, marketing, education and etc.

3.1 Chat.io

This Chatbot system is used to help businesses to communicate with the customer via multiple services in one system. It can also be integrated with Facebook Messenger to help the admin to interact with Facebook users. The Chatbot is designed using modular construction that can be integrated with website, app, native mobile app or web-based application. An artificial intelligence system is used in the development of the Chatbot, whereby the Chatbot can predict the text suggestion and later provide smart responds base on analyzing the conversation history.

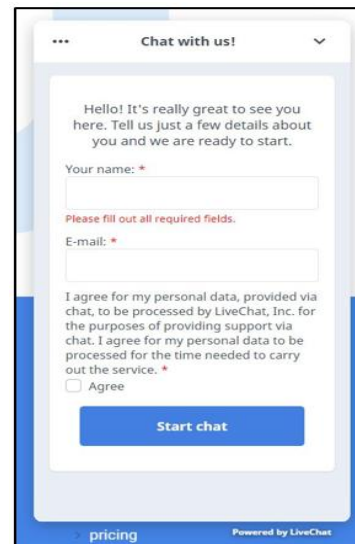


Fig 1: Main Chat.io Interface

The above Figure 1 depicts main interface of Chat.io. This Chatbot start the messaging by asking for the name and email of the new user. User also have to agree with the term and conditions applied before proceeding to start chat.

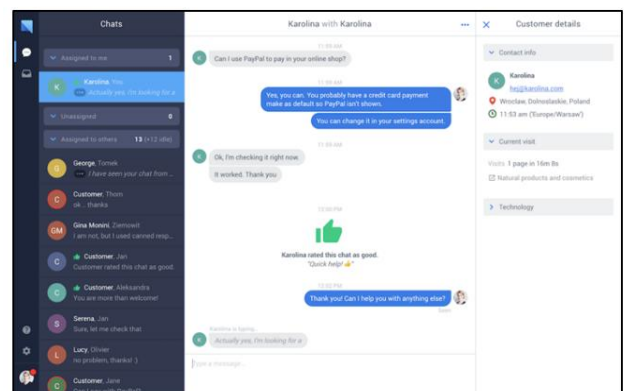


Fig 2: Example of Chat.io Admin Panel

Figure 2 shows the admin panel interface for Chat.io. There are three parts which is customer name list on the left side, messaging on the middle, and the details is on the right side. Major features of Chat.io is integration with Facebook, auto/manual chat assignments, intelligent canned responses, customer message sneak peek, chat ratings, open API, messenger and mobile application.

3.2 Collect.chat

This chatbot is used for marketing service purpose. Collect.chat is an example of chatbot system in which the operations is based on widget interactions with user's enquiry instead of artificial intelligence system. One of the advantage of using Chatbot is that it can convert the visitor into customer and bring them into the conversation without filling many forms. It used widget interaction where visitor choose one of their intent by clicking one of the multiple options.

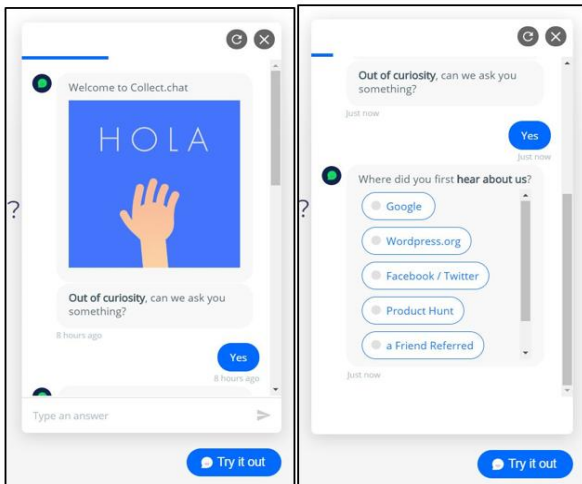


Fig 3: Example of Collect.chat Interface

The above Figure 3 shows Collect.chat main interface. In the main interface, the conversation starts with greeting and interactive picture say 'HOLA', and after that the Chatbot start asking customers few questions. The design work is by using multiple choices of options when asking the question. User's need to answer the question by clicking on template form that appear as an option within each question.

The conversation flow works interactively by the use of web form which avoid the use of old style form. The Collect.chat could also interact with other services like Salesforce, Google Sheets and Slack that will automate the task.

3.3 Cleverbot

The following is another example of web chatbot called Cleverbot. It is an artificial Intelligent Chatbot called Cleverbot. It is a chatterbot web application developed by British AI scientist Rollo Carpenter in 1997. The Cleverbot response are not hard coded programme. Instead, it learns from human input from the conversation process. When the user input some text, the system then search all the exact phrase to match with the input. It give the responds to the input from user by finding how the way user are responded to that input. This Cleverbot is also available in mobile Android and IOS platform [10].

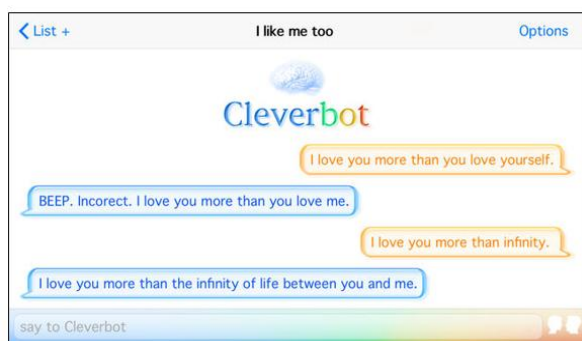


Fig 5: Example of Cleverbot Interface

Basically, Cleverbot responses to human question by learning from previous human answers. Human will type their question in the text box and system will find for all keywords or an exact phrase matching the question. After probing through its saved conversations, Cleverbot will responds to human by finding how human responded to that input before. Version of Cleverbot has been upgraded to use Graphics Processing Unit

(GPU) serving techniques. GPU is a specialized electronic circuit intended to rapidly manipulate and alter memory in order to produce images and frame buffer to be displayed. Nowadays, the part of the engine behind Cleverbot and its API is already available in market for all developers outside there.

4. DISCUSSIONS

4.1 How Chatbots Works

The following Figure 6 illustrates the processes of Chatbot system. Firstly, user must have computer in order to access the chatbot user interface (UI). A text console will appear on the chatbot UI where user can pass text input through the console.

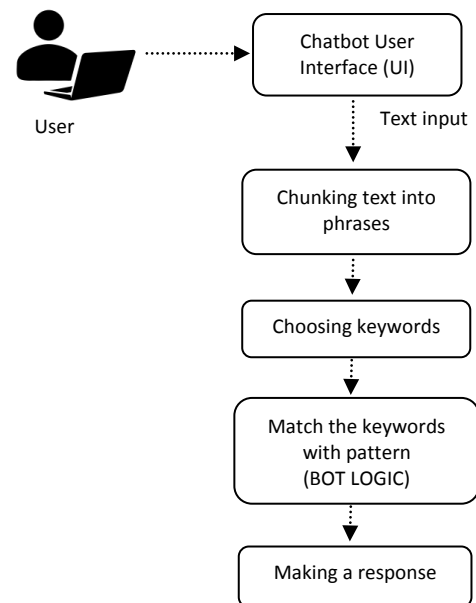


Fig 6: Chatbot System Processes

Secondly, the text input which entered by user in a sentence will then be chunk. Chunking here means the process of splitting text into separate words for tagging [11]. The output from the chunking process is several meaningful phrases which are going to be used later in the matching process. This phrases will act as keyword in the matching process.

Finally, the keywords resulted from the chunking process are then matched with the pattern in the chatbot system. The process of matching the keywords with patterns is called BOT LOGIC. The output from the chatbot system is the programmed response, which will be, for instance, any other text or a template web form as in the previous Figure 3.

4.2 Chatbots Design Techniques

Based on the reviews of several papers, we came to conclusion that designing a chatbot requires several techniques and approaches. Among the most popular techniques used by developers is such as following:

- **AIML:** this is one of the core technique using markup language created by Dr. Richard S. Wallace[12], often used by the developers. The main objective of AIML language is to direct processing the conversational modelling into a stimulus response process. This process is also familiar known as frequent tags. Since AIML does not require expert skill in specific programming language, therefore, this technique is utmost facilitates the development of chatbots.

- *Pattern Matching*: this techniques were used by many chatbots. Basically, this technique deployed matching pattern to generate appropriate response from user's questions, depending on the matching types such as simple statements, natural language or semantic meaning of enquires.
- *Language Tricks*: there are four language tricks that are usually used including model of personal history, canned responses, no logical conclusion, typing errors and stimulating key strokes. This technique used sentence, phrases or paragraph in Chatbots to add variety to the knowledge base and that would make it more convincing.
- *Chatscript*: is an authoring script such as cleverscript that serve developers in chatbot development. It is a technique used when there is no matches occur in AIML. This technique concentration is on giving the best syntax to build a sensible default answer.
- *Parsing*: is the technique used to analyze text or a string of symbol either by using natural language or computer language. In addition, in computational linguistic, parsing is a technique used to analyze either a sentence or another set of strings into its elements that could contain semantic or other information. This technique used NLP functions such as trees in Phython NLTK.
- *SQL and relational database*: it is a recent technique used in chatbots to ensure chatbots remember previous conversations. The algorithm from SQL-based chatbot used to enhance the capability of chatbot's keyword and pattern matching by providing an augment ways of storing data as well as improving the process performance.
- *Markov Chain*: is a technique by building responses which are more applicable and consequently is better. This technique works by identifying probabilistic of letters or word occurrence in the same textual data set.

5. CONCLUSIONS

Most people is attracted to the system that are human-alike. And many of users do not know that Chatbot will not only give feedback in the form of text and voice command whereas Chatbot nowadays have interactive way on serving information using graphical interaction or graphical widget. The main benefit of using chatbots is it able to reach broad audience even from great distance only using the messenger apps. Beside that, this automated human-computer conversational platforms works positively to provide efficient service in various field to serve human in many ways.

In this paper, the reviews has covered several papers that have focused on chatbot design. Initially, we explained about chatbots system and its usage from several main fields such as education, healthcare and business. Next, we provide explanations on some chatbots design in today's market. The reviewed is based on the design work, features, how it interact with user and also its interface. Finally, we presents the chatbot system processes showing how chatbot works in

general. Chatbots is actually an innovative approach to automate user personalize message. If the chatbots is well designed and implemented, it could be a tool to attract user engagement and provide good user experience between human and the served field. However, designing and implementing chatbots is not too easy as it is said. Chatbots technology is moving very fast there are a lot of enhancement and new features released from time to time. The development of chatbots should carefully planned, choosing the appropriate platforms tools is very important since it can helps in boosting the effectiveness and efficiency of the chatbots.

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