UNIVERSITI TEKNIKAL MALAYSIA MELAKA

INTELLIGENT CONVERSATIONAL BOT
FOR INTERACTIVE MARKETING

ADITYA PRADANA

MASTER OF COMPUTER SCIENCE
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Aditya Pradana

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ADITYA PRADANA

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DECLARATION

I declare that this thesis entitled "Intelligent Conversational Bot for Interactive Marketing" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : ……………………………

Name   : ……………………………

Date   : ……………………………

APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Master of Computer Science in Software Engineering and Intelligence.

Signature   :   ………………………

Supervisor Name   :   ………………………

Date   :   ………………………

DEDICATION

To my beloved mother and father

ABSTRACT

Interactivity of corporate website is important as marketing products through it become popular. Moreover, the usage of Artificial Intelligent application is growing. In order to improve the interactivity and effectiveness of corporate website in providing information, a conversational bot is developed. As a part of Artificial Intelligent application, it can respond to users' question and prolong the conversation with its intelligence. The conversational bot in this research is called as SamBot. It is integrated to Samsung IoT website as the corporate website. SamBot contains the knowledge of Samsung marketing domain which is useful to deliver appropriate answer to the users' questions. The knowledge base includes Samsung promotion, Samsung product Frequently Asked Question, and general knowledge. In default, this bot will generate random answers if matching knowledge cannot be found. It usually happens if novel issue or information is asked. In this research author would like to overcome this problem by improving its knowledge maintenance capability either performed by botmaster or users. Some functions are added to support the knowledge maintenance process such as random answer enhancement, conversation log-based knowledge maintenance module, and user-centric learning capability. The latter one allows user to directly teach the bot a new knowledge. In addition, enhancement to reuse recently asked question as questions recommendation is developed in order to solve a problem where users need to be updated to current issues. With this enhancement, the bot can give recommendation of questions for users to ask. After the development, the system is deployed online and some users are invited to perform evaluation. From the evaluation, the results show that all of the enhancements comply the objectives of the research in which 62% of the questions posed are responded properly and 80% of users agree that SamBot has raised the interactivity and effectiveness of Samsung IoT website. Moreover, there is a positive change on how SamBot responds to questions which were not answered properly before knowledge maintenance. There is also a noticeable usage of pre-defined question recommendation on questions such as "What is Samsung?", "Who is the founder of Samsung?", and "What is Galaxy Gear VR?". In simple words, SamBot is now more intelligent with all of those enhancements.

ABSTRAK

Laman web korporat yang dapat berinteraksi dengan pelanggan adalah sama penting jika dibandingkan dengan memasarkan produk seolah-oleh ia menjadi semakin popular. Ditambah lagi dengan penggunaan aplikasi Kepintaran Buatan yang semakin meningkat. Dalam usaha untuk meningkatkan kebolehan interaksi dan keberkesanan laman web korporat dalam menyediakan maklumat, robot yang boleh berbual dibangunkan. Sebagai sebahagian daripada aplikasi Kepintaran Buatan, ia boleh bertindak balas kepada soalan pengguna dan memanjangkan perbualan dengan kepintarannya. Robot yang boleh berbual dalam kajian ini dipanggil sebagai SamBot. Ia bersepadu dengan laman web Samsung IOT sebagai laman web korporat. SamBot mengandungi pengetahun berkenaan pasaran Samsung yang berguna untuk menyampaikan jawapan yang sesuai kepada pengguna. Pengetahuannya termasuk promosi Samsung, produk Samsung, soalan lazim, dan pengetahuan am. Secara lazimnya, bot ini akan memberi jawapan secara rawak sekiranya tiada pengetahuan yang hampir sama didapati. Ia biasanya berlaku jika isu atau maklumat novel diminta. Masalah ini dapat diatasi dengan mempertingkatkan pengetahuan keupayaan penyelenggaraan sama ada dilakukan oleh botmaster atau pengguna. Beberapa fungsi ditambah untuk menyokong pengetahuan proses penyelenggaraan seperti peningkatan jawapan rawak, log perbualan berasaskan modul penyelenggaraan pengetahuan dan keupayaan pembelajaran user-centric. Yang terkini ialah kebolehan pengguna untuk terus mengajar bot dengan pengetahuan baru. Sebagai tambahan, peningkatan untuk menggunakan semula soalan-soalan yang sudah ditanya sebagai soalan cadangan telah dibangunkan untuk menyelesaikan masalah di mana pengguna perlu dikemas kini untuk isu semasa. Dengan peningkatan ini, bot boleh memberi cadangan soalan untuk pengguna bertanya. Selepas pembangunan, sistem ini digunakan dalam talian dan beberapa pengguna dijemput untuk melaksanakan penilaian. Dari penilaian, keputusan menunjukkan bahawa semua penambahbaikan mematuhi objektif kajian di mana 62% daripada soalan yang dikemukakan diberi maklum balas dengan betul dan 80% pengguna bersetuju bahawa SamBot telah meningkatkan interaksi dan keberkesanan laman web Samsung IoT. Selain itu, terdapat perubahan positif kepada bagaimana SamBot bertindak balas kepada soalan-soalan yang tidak dijawab dengan betul sebelum penyelenggaraan pengetahuan. Terdapat juga adalah penggunaan ketara kepada soalan cadangan yang berasaskan kepada soalan-soalan seperti "What is Samsung?", "Who is the founder of Samsung?", dan "What is Galaxy Gear VR? ". Dalam erti kata yang mudah, SamBot kini lebih pintar dengan penambahbaikan.

ACKNOWLEDGEMENTS

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CHAPTER 1

INTRODUCTION

1.1   Background

Nowadays, companies tend to use their corporate websites to promote their products and sell directly from it. This method is not only used by companies but also salespersons. Marketing products through website is more efficient due to the growth of e-commerce websites like e-bay. Companies don't want to lose their grasp on the online market which several years ago ruled by e-commerce websites. Therefore, they put more effort on their corporate websites to compete with e-commerce websites. Marketing is becoming a dominant force in competitive business environment. It requires attention to customer's needs and desires and wants a little intuition, creative ideas, much planning and a trial-and-error attitude to find out what works best. As a result, customers tend to expect a certain level of interaction on a company's corporate website, regardless of the nature of the company and its services. The rapid growth of social media and crowd sourcing techniques could lead corporate websites toward extinction if companies do not create the tools, technologies, and applications needed to deliver a customer-centric website (Zollet, 2014).

In Web 2.0 era, interactivity is a requirement that all websites should fulfill. It changed the way users interact to a web page (Anderson et al., 2007). However, users' demand of interactivity is still increasing. Therefore, some methods were proposed to give more interactive feel of the website such as live chat window, mini-games, and chatbot. The last example is what this research will look into. A chatbot or conversational bot is an

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implementation of Artificial Intelligence (AI) in a form of software or application which users can interact by having conversations (Russell and Norvig, 2010). It can understand natural language and receive text or voice input. It even intelligent enough to remember user's name and to prolong a conversation. In marketing sector, the chatbot can act as a salesperson to help companies advertise their products. As the bot can talk and influence people, it can help to attract more people, thus increase the advertisement power of the company (Goh and Fung, 2016). In addition, it also has low maintenance cost.

A corporate website usually contains rich information which spread across the links. In order to find a particular information, visitors need to explore the links by opening them one-by-one. It is inefficient, less interactive and time wasting. In order to overcome this problem, a conversational bot called SamBot is introduced in this research. The name of SamBot is derived from the words Samsung Bot which will assist the Samsung's marketing aspect in university level through Samsung IoT Academy. The conversational bot will have all information regarding the company, including the products. Therefore, visitors can simply ask to the bot when they need such information through text or speech. By this way, the information needed can be retrieved efficiently in an interactive approach.

Information of the website is stored in chatbot's knowledge base. The knowledge can be a domain-specific or a general knowledge. Knowledge of a domain-specific chatbot is usually built by a botmaster who gathered it from external resources by various methods. Huge amount of knowledge can be gathered and stored to the knowledge base. However, new information of that particular domain is always coming. Since there is no knowledge related to the new information in the knowledge base, a chatbot will improperly respond to such input and generate random answer. The improper response might annoy users who interact with the bot which lead to unsuccessful improvement of interactivity aspect.

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Therefore, this research proposed a way to maintain the knowledge of a chatbot to keep up with new information.

Botmaster will be provided a list of unanswered questions from conversation logs to be evaluated. From the logs, botmaster can provide proper answers to the questions that previously are answered using random answer. Thus, after the knowledge is updated, the bot will be able to answer those particular questions. This kind of method will be called as knowledge maintenance in the rest of this research. Not only from botmaster, the conversational bot will also be improved with capability to learn new knowledge from users. In conversational bot studies, there is a concern where usually conversational bot can only provide information to users, not the other way around. As mentioned earlier, the information stored in the bot is provided by a botmaster. Therefore, the information is limited to the botmaster's knowledge only. This study will address this concern as conjunction with knowledge maintenance by considering users' perspective into account. This concern is important because users' knowledge may be useful to other users. This function will let users to teach the bot when it generated random answers or they were not satisfied with the bot's answer. In addition, visitors of a website usually need fresh information regarding what other visitors concern. They want to keep updated with the trend of such information. In a conversational bot there is a database which stores all conversation from the users. It is called as conversation log. It might be useful to consider the usage of conversation log in order to let users know what other users are concerning about. It will also helpful to help users to decide the questions to be posed to the conversational bot.

1.2 Statement of the Purpose

The purpose of this research is to develop SamBot and integrate it into a corporate website. In addition, new methods to maintain chatbot's knowledge is also introduced such as knowledge maintenance from botmaster, capability to learn from users, and pre-defined questions recommendation.

1.3 Statement of Problem

As marketing through corporate website is compulsory in this era, an effective approach to attract visitors is needed. Visitors of a corporate website usually have to go through all the links to find information they need. This kind of one-way interaction is ineffective, less interactive and time wasting. The website might contain a lot of new information but only some of them can be found directly by the visitors. Thus, the website needs to have an effective way to provide such information. It can be achieved by integrating a chatbot to the website. However, as new information is updated in the website or there is new issue related to the company, the chatbot's knowledge also need to be maintained. If the knowledge is not maintained, the chatbot will not respond to new information properly. This can be done by a botmaster who will update the knowledge base. The problem is when the conversation log is flooded with questions and difficult to find which ones are the unanswered questions. In order to overcome this problem, an enhancement to support the knowledge maintenance is needed. In addition, the knowledge could be restricted to the botmaster's knowledge. There is a concern to consider users' knowledge to improve the bot's knowledge. It can be solved by enhancing the chatbot with the ability to learn from user. Besides all of the problems, the users sometimes curious with latest trend about

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Samsung or have difficulties on deciding a question to ask. Therefore, a recommendation list of questions is needed to improve the situation.

1.4 Research Question

Based on the problems stated earlier, research questions for this research can be derived as follows:

1. How to improve effectiveness and interactivity of corporate website to provide information?
2. How to engage users to have conversation with conversational bot?
3. How to maintain the novelty of conversational bot's knowledge?
4. How to engage users to ask questions related to current issues?

1.5 Research Objectives

Based on the research questions, this research will pursue four objectives, which are:

1. To integrate intelligent conversational bot in corporate website (Samsung IoT Academy website)
2. To ensure conversational bot is able to deliver appropriate answers and prolong the conversation with the users
3. To create and evaluate new knowledge by botmaster and users
4. To reuse recently asked questions as pre-defined questions recommendation

1.6 Research Scope and Limitation

The scope and limitation in this research will be as follows:

1. This research will focus on marketing domain of Samsung

2. The knowledge will be focused on Samsung profile and products

3. The input to be responded by conversational bot must be in English

4. The speech input and speech responds are supported on Google Chrome and Apple Safari

1.7 Significant and Research Contribution

This research is expected to solve the issue of corporate website interactivity and effectiveness by integrating a conversational bot into it. The main contribution is to build the knowledge base of conversational bot and to enhance the conversational bot. The conversational bot is enhanced so that it can provide easier knowledge maintenance by botmaster, learn new knowledge from online users, and provide questions recommendation. The enhancements are made to make the conversational bot becomes more intelligent and different from other existing conversational bots.

1.8 Organization of the Thesis

This thesis is organized in the following orders:

Chapter 1: Introduction

This chapter introduces the background of corporate websites, the problems faced, the proposed solution and the objectives of this research

Chapter 2: Literature Review

This chapter reviews the literatures on corporate websites, conversational bots, and retrieval-based model as well as other related fields.

Chapter 3: Research Methodology

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This chapter explains the methods used in this research including the research design, system architecture, and proposed interface.

Chapter 4: Implementation

This chapter explains the implementation process to integrate and develop the conversational bot based on the system architecture as well as to improve the conversational bot.

Chapter 5: Evaluation and Result

This chapter explains how the system is being evaluated and shows the results of the evaluation.

Chapter 6: Conclusion and Future Works

This chapter concludes overall contribution in this study including the strengths and weaknesses and discusses the possibility of future works.

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CHAPTER 2

LITERATURE REVIEW

2.1   Introduction

This chapter reviews related topics in this research such as corporate website, Artificial Intelligence (AI), and conversational bot. This research will integrate conversational bot into a corporate website. Conversational bot also known as Conversational Agent (CA) is a computer software which interacts and adapts with conversation environment. It is a part of AI's intelligent agent which understands natural language. Some examples of earlier conversational bot are ELIZA and ALICE. Within 10 years, the development of conversational bot is promising. Most of them are domain-specific conversational bots which are implemented in various domain such as education, social, politics, networking, entertainment, business, health, tourism, and marketing. This chapter will discuss some conversational bots applied in the domains as well as different types of conversational bot models.

As others' conversational bots, the conversational bot in this research will be developed based on AIML (Artificial Intelligence Markup Language). AIML contains the knowledge of conversational bot which is maintained by botmaster. Botmaster is a person who develops the bot and is responsible for maintaining bot's knowledge. This research proposed a method to evaluate conversational bot's knowledge by filtering unanswered question and update the knowledge based on it. This chapter will also review several important AIML elements.