Designing Intelligent Personalized Chatbot for Hotel Services

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ABSTRACT

Development of chatbot in customer services and sales are remarkable. However, there is only little research in developing chatbot-hotel in Indonesia. Chatbot has many advantages for both hotel and mobile users to improve convenience, reduce service, sales and support costs, one-to-one marketing and new data collections. Using chatbot, customers using smartphone can reach a hotel anytime and anywhere with personalized services related to their needs. The customers can find out availability of rooms, price, booking and have a personal front office that provide the real-time and context-relevant information about hotel services. Therefore, we develop an interactive intelligent personalized chatbot-hotel by using AIML and Google Flutter. Flutter is used as it is easy to develop the chatbot-hotel in the cross-platform mobile application. The outcome of this work is a prototype chatbot-hotel on mobile platform especially for Indonesian users. This chatbot includes all services in the hotels and able to give the personalized services to the customers before arrive in the hotel. It can accommodate the customer needs and to up-selling the hotel facilities.

CCS CONCEPTS

• Computing methodologies~Artificial intelligence~Distributed artificial intelligence~Intelligent agents • Software and its engineering~Software creation and management~Designing software~Software design engineering

KEYWORDS

Chatbot, Personalized service, Hotel, AIML

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1 Introduction

How the business industries handle product and services inquiries in person through a call center or email have to change as the cost of 24/7 support is too high. Therefore, the use of chat apps has exponentially increased with user friendly chat UI/UX (user interface and user experience). The chat apps are designed with Artificial Intelligence (AI) so they can automate the process to answer inquiries and increase customer satisfaction are popularly called Chatbots. They can manage any scenario of a conversation as they are aware of the requirements of the users [1,2,3]. Besides, discovering many question-and-reply patterns from past interactions via machine learning can be done by AI chatbots [4]. Chatbots have been used in business application such as customers service [5], medical health [6,7], public transport [8], tourism [9], e-commerce website [10] and cultural heritage [11]. There are several types of Chatbots used for several purposes such as for businesses (Chat.io), marketing (Collect.chat), education (Cleverbot) [12], entertainment (Reikobot) [13].

In hotel industry, chatbots help users to book and reserve a room, get the promotional offers, order advanced meal/drink preference, etc. The intelligent chatbots will then understand the topics and give a reliable response. Chatbots are recognized by their ability to understand and process natural language. Natural language processing exists to ease the work of users and also to satisfy the wish to communicate with the computer in common language. Assisting human-computer interaction and examining the behavior of the user is the advantage of the chatbot [14]. It will ask the questions and respond to the user's questions. Florian Daniel *et al* developed chatbot that is personal and helpful by providing services that are configured by the users themselves [15]. Therefore, the users can control their own personal bot that really respond to their needs.

In this paper, we proposed a personalized chatbot hotels in Indonesia, called Bershca. The hotel industry needs the personalized chatbot hotel in order to increase the sales and customer satisfaction. This personalized chatbot is focus on the service recommendation that available at the hotel but relevant to the customers. The hotel offers in-room services such as in-room dining, in-room amenities offered and all pay-for-use products and services that related to the customers need. A hotel property with the right mixture of desired in-room amenities and services can charge higher rates for their customers and increase the revenues [16]. Therefore, Bershca will track the habits of their customers and to make sure that the hotels are readily available to cater to all the

requirements of their customers at every step before arriving at the hotels. The chatbot mobile application will be chosen rather than chatbot website to increase the efficiency of users in using it.

2 Chatbot Design Model

Bershca is divided into four main parts: semantic network generation, text pre-processing, Artificial Intelligence Markup Language (AIML) process, and personal question generation as depicted in Figure 1. Ontology or semantic network is a set of hierarchically and relationally interconnected concepts that have natural language and used directly in chatbots. This ontology is used to figure out hyponyms, synonyms and other relations

between the concepts. The interconnection between these concepts can be represented in a graph enabling the computer to search by using particular rules for reasoning. The generated semantic can be network will be used to build the AIML structure as the knowledge base of the chatbot.

Text-preprocessing used to process the string message sent by the user. The text pre-processing is performed This step consists of four steps below:

1. Case folding
   Case folding converts the string message to lowercase letters.
2. Tokenization
   This technique used to convert the string message into a list of words or tokens.
3. Stopwords removal
   This step eliminates common words which are likely to be meaningless for information extraction.
4. Stemming

A process to change the correspondent words in the same root word. Prefix, infix, sufix, and confix or word repetition often contained in some words in Indonesian. Nazief-Adriani algorithm implemented in the stemming process as it overcomes overstemming problem by using basic words

dictionary and the understemming problem by adding rules [17].

After the text pre-processing steps complete, chatbot will answer the question from the user based on the AIML response. AIML represents the knowledge put into chatbots. It has the ability to characterize the AIML objects and describe partial conductance of the process programed. These objects consist of two units which are topics and categories that contained either parsed or unparsed data [18].

Chatbot learn the customer personal information to give a personalized question or response to the user. It maintains a suitable user profile, not only basic information but also user preferences and long-term conversational context data. This information gathers from the transaction history in the hotel database. The question given by Bershca focused on the services and facilities offered in the hotel, such as laundry services, airport transfer, smoking room, breakfast, spa or massage, etc. The hotel also has the opportunity to offer other services such as room upgrade, or the room view which usually charged to customers with different prices. When the user sends the response message to chatbot, the message goes through the text pre-processing steps again.

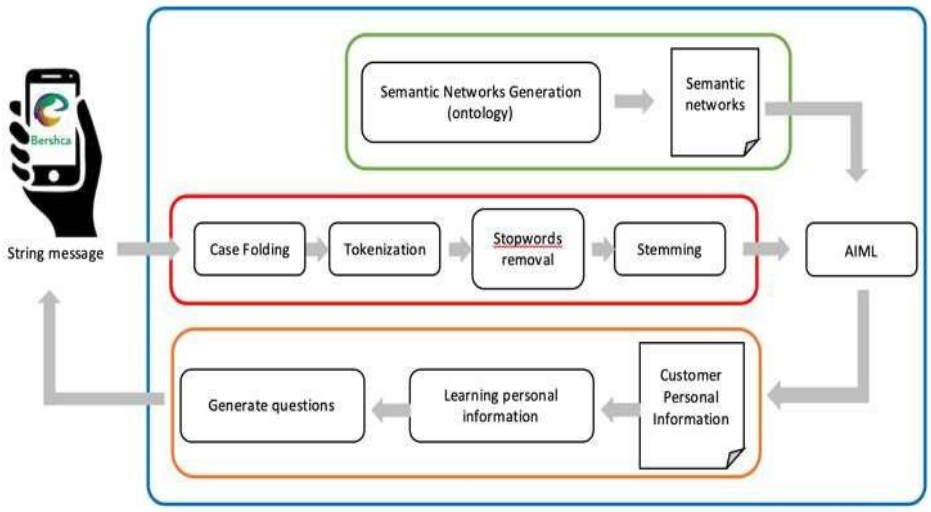

Figure 1: Design of chatbot system

3 Nazief-Adriani Algorithm

We are using Nazief-Adriani Algorithm for stemming process in returning a derivative word into its root word by removing the affixes. This process is important to maintain a better information retrieval system. The stemming algorithm Nazief-Adriani gives a better support for information retrieval compared to other stemming algorithm such as Porter [19] and Idris [20]. In this work, we use natural language processing that consist of intents, entities, agents, actions, and contexts.

The model of Nazief & Adriani's algorithm has its own prefix rules:

[[[[AW +]] AW +] AW +] Basics [[+ AK] [+ KK] [+ P]]

AW : Prefix AK : Suffix
KK : The pronoun P : Particles

The steps of Nazief & Adriani algorithm are as follows.

1. At each step, check the words that are input with the basic words in the dictionary. If the word is in the dictionary, the word is assumed to be the root word and the algorithm stops. If not, will proceed to the second step.
2. Eliminate words that contain suffixes and pronouns that belong to them. First, remove the particles {"-kan", "-lah", "-tah", "-pun"} and the pronouns belong to {"-ku", "-mu", or "-nya"}. If after the particles have been removed the word results stemming are in the dictionary, the algorithm stops.
3. Removes the suffixes {"-i", "-kan", and "-an"} according to the following affix model.

[[[AW +] AW +] AW +] Basic words

For example: the word "membelikan" is stemmed to "membeli", if it is not in the basic word dictionary, the prefix removal process will be carried out.

4. Eliminating the prefixes {"be-", "di-", "ke", "me-", "pe-", "se", and "te-"} follows the steps below:
   a. The algorithm will stop if:
      i. the prefix is identified as an unauthorized pair of additions with a suffix (based on Table 1) removed in step 3,
      ii. the identifier prefix identified with the money prefix has been deleted before, or
      iii. the word has no prefix.
   b. Identify the type of prefix and decay if necessary. The prefix type is determined by the following rules.
      i. If the prefix of the word is "di-", "th", or "se", the prefix can be removed immediately.
      ii. Removing the prefix "te-", "be-", "me" or "pe-". For example, the word "menangkap", after removing the prefix "me" then what is obtained is "nangkap ". Because "nangkap" is not found in the basic word dictionary, the character "n" is replaced by the character "t" so that the result is "tangkap". The word "tangkap "is the basic word contained in the dictionary, and the algorithm stops.
   c. If at this stage the word is still not in the dictionary, repeat the steps.
5. If the word is in the basic word dictionary, the algorithm stops. If all steps fail and the word is not found in the base word dictionary, the word tested on this algorithm is considered the base word.

Table 1: Prohibited prefix and suffix

Prefix	Suffix
be-	-i
di-	-an
ke-	-i –an
me-	-an
se-	-i -kan
te-	-an

4 Discussions

The Chatbot Hotel, Berscha, is used for conversational and providing useful services. It can interact with customers and also gives solution of their problems through AIML chatbot instead of human beings. Berscha is an approach to automate user personalize message and provide good user experience between human and the served field. We implemented the text pre-processing steps and AIML to do the question-answering process between chatbot and the user. We are choosing the chatbot mobile application in this work as it is increasing the effectivity of the user. We choose the appropriate platforms tools since it can help in boosting the effectiveness and efficiency of the chatbots.

In this work, Google Flutter is used to develop the cross-platform mobile application, whereas Python is used for the backend of the system. Flutter is used in this work as it provides developers a simple way to produce and deploy visually attractive, rapid mobile apps on several operating systems. However, the effective and successful hotel technology also depend on the technology acceptance and technology readiness of the users [21], that include the hotelier and the customers. If the chatbots is well designed and implemented in hotel industry, it could be a tool to attract user engagement and provide good user experience for the customers.

The knowledge structure of the personalized chatbot is obtained from the hotel staff from different divisions. This knowledge includes the services that can be charged to the customers. This knowledge is divided into 2 part, which are:

1. Room Reservation. This subject consists of questions about room availability check, payment methods, and room cancellation.
2. Other Related Facilities. This subjects gave the opportunity for the hotel to offer other facilities or services such as spa massage, room upgrade, airport transportation, tour, and also the room view which usually charged to customers with different prices.

Figure 2a shows the splash screen of Bershca appeared when the user opens the application. Shortly after the splash screen fade out, Bershca will do the greetings in Bahasa to the user as depicted as shown in Figure 2b. Suggestions are also provided to guide the user while chatting with Bershca. The suggestions consist of several topics: about hotel, hotel room, meeting room, and room availability.

(a) (b)

Figure 2: (a) Splash screen of Bershca; (b) Bershca's greetings and suggestions

User could ask necessary information about services and facilities afford by the hotel. For example, the availability of airport transfers to or from the hotel as shown in Figure 3a. The provided types of vehicle and price are included in the response message from Bershca. One of the advantages of Bershca is not only provides written responses, but also in the form of images as seen in Figure 3b. Pictures are added to provide an overview of the room design as a form of additional information which is more informative to the user. A detailed description of the facilities of each room type is also available.

(a) **(b)**

Figure 3: (a) Airport transfer questions; (b) Hotel room information

When the user asks about the location of the hotel, Bershca will give a response by providing a link to open the map application. The aim is to make it easier for users to find the address of the hotel by using map applications such as Google maps (Figure 4).

Figure 4: Address information

5 Conclusions and Future Work

In this paper, we report the prototype chatbot-hotel Berscha in Indonesia that is developed on mobile applications. This chatbots is actually an approach to automate customer personalize message to the hotel using smartphone, so the customers can reach a hotel anytime and anywhere with personalized services related to their needs. This personalized chatbot hotel is developed to increase the sales and customer satisfaction. Therefore, this personalized chatbot is focus on the service recommendation that available at the hotel and relevant to the customers. Ontology is used to map relationships of the various entities required by the user. The Google Flutter is used in developing this chatbot as it is cross platform for Android and iOS platforms. Therefore, choosing the appropriate platforms tools is very important since it helps in boosting the effectiveness and efficiency of the chatbots.

For future work and development, machine learning can be implemented to learn the characteristics of the user or customer. It will enhance the personalized chatbot system by giving suggestions or recommendations based on the history of user preferences. Moreover, adding conversational booking and payment services to the system can increase the user experience.

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