

Conversational Bot for Pharmacy: A Natural Language Approach

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Abstract—Apart from selling health products and supplements, Sharifah Nur Pharmacy also offers medical and nutrition consultations, patient profiling management system and healthcare programmes for its clients. However, no online system that allows the staff and clients to directly communicate has been developed. Thus, there is a need for a chatbot application for smartphones that allows the customers to have online conversation with the bot to be developed. The chatbot is able to advice the types of medications to be taken based on the information provided by the customer. The development of the application is able to improve the communication process between the customers and the pharmacy and at the same time helps the pharmacy to have a better customer management system.

Index Terms—conversational agent, chatbot, bot

I. INTRODUCTION

Conversational bot or chatbot is an online human-computer dialogue system with natural programming language [1]. Chatbot is usually used in dialogue system for various practical purposes including customer service and information gathering. Natural Language Process (NLP) is also used in mathematical and computational modelling research for various languages and purposes. This includes verbal language that integrates speech and natural language, operational interface: data servers, human interaction models in different languages, machine language translation and messaging interpretation system [2].

Natural language processing technologies provide an interface mechanism for a system to understand the user's input in natural language. Generally, chatbots interact with the users over text, hence the bots must appear to understand user's questions and able to identify the main keywords for the system to answer appropriately to the users. Among

the natural language processing tasks important to chatbot development are sentence segmentation, tokenization, stemming/lemmatization, part-of-speech tagging, parsing [3].

In developing conversational bots, some of the best programming languages in Artificial Intelligence (AI) development are Java, Personal Home Page (PHP) and Hyper Text Markup Language (HTML). Java was introduced in 1995 by [4]. PHP was developed by [5] and HTML by a physician [6]. Turing Test which was developed by [7] was a test administered on artificial intelligence programming. Among recent applications of conversational bots include in business process management [8], home automation [9], and travelling [10].

Sharifah Nur Pharmacy is a well-known pharmacy at Parit Raja Batu Pahat Johor. This pharmacy provides health services and sells health products. The pharmacy however does not have any online system for the staff and patients to communicate with each other. The objective of this project is to design, develop and test an online chatbot system. The project consisted of two parts; customer and system administrator. It is expected that the development of chatbot app for Sharifah Nur Pharmacy would be able to simplify and expedite the process of identifying the suitable medications based on the information provided by the patients. The developed chatbot will also allow the customers to get accurate information on the type and detailed prescriptions of medications for their illness.

The remaining of this paper is organized as follows. Section 2 presents systems similar to the proposed system. Section 3 presents the development methodology. Section 4 presents the prototype implementation and testing. Finally, Section 5

concludes with some indication for future works.

II. RELATED WORK

In developing the system for the pharmacy, a few applications as listed below have been studied. The study enables the writers to see the strengths and the weaknesses of the readily available systems. The development of the new system for the pharmacy will take into account the strengths and weakness of the studied applications.

- **Healthmir Sympler:** Healthmir Sympler (<http://healthmir.com/>) was developed to assist the users to learn more about healthcare, symptoms and disease management. It answers questions posed by the users on any health issues the users are experiencing. The system has four login modules; 'Login with Facebook', 'Login with Google', 'Login' and 'Sign Up'. If a user has an account with Facebook or Google, the user can choose to 'Login with Facebook' or 'Login with Google'. Next, if the user is not a registered user of Healthmir Sympler, he has to register by clicking on the button provided. For existing users, they just need to simply hit the login button to enter the application.
- **Babylon:** Babylon (<https://www.babylonhealth.com/ai>) helps the users to learn more on the symptoms and sicknesses. This application also allows the users to make an appointment with the doctor or pose questions to the bot.
- **Zini:** Zini acts as a personal health buddy to the users (<http://zini.ai/>). It has two login modules; 'First Time User - Register' and 'Already Registered - Login'.

All the features available in the three existing systems available under the healthcare were identified and compared. The comparisons had helped the writers to design and develop a more effective and practical system for the pharmacy. The features compared were platform, target users, registration and logging in, functions, notifications and methods of conversation. Overall, the main distinctive feature is the functionality, which ranges from medicine selection process, general information on healthcare, and information on symptoms.

III. METHODOLOGY

To develop the system for the pharmacy, a systematic and measurable methodology is required. The process model, tools and techniques need to be determined first before a high quality chatbot system can be developed. The first part of this section will explain the development phases involved in developing the chatbot while the second part discusses the activities required in the development of prototype model for the system. Fig. 1 shows the prototype development model [11], which consists of planning, analysis, design, implementation and testing phases.

The tasks involved in planning include setting up the objectives, identifying the problems, setting the scope and modules involved, determining the development framework, strategizing the scope and modules as well as the development

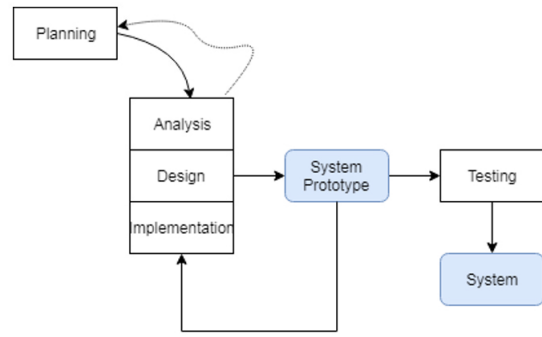


Fig. 1. Prototyping methodology [11].

framework. During analysis, more focus are put in defining user needs, determining the content, and the contextual diagram. Next the design phase focuses on designing the interface for the chatbot as well as the knowledge base for natural language responses. During implementation, suitable language programming are sourced out and coding begins for all functionalities of the chatbot as well as its database input. Finally, the developed prototype will undergo the first round testing during the testing phase and the process reiterates.

IV. PROTOTYPE DEVELOPMENT

A. Analysis and Design

Each process involved in developing the system is detailed out so that it is easier to be understood. Diagrams, entity relationship models, data flow models and flow chart systems are used in designing the system for Sharifah Nur Pharmacy. A good system design helps to clarify the flow of system so that it fulfils the needs of users. Component design consisting the database and interface architectures are also developed during this phase. The system design is drawn as a reference to facilitate the development. Fig. 2 shows the Use Case Diagram for the application.

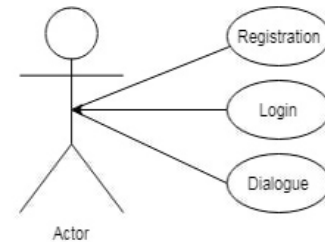


Fig. 2. Use case diagram.

Next, Fig. 3 shows the Activity Diagram for the conversational bot application. In this figure, a new user is required to create a new account first before he could login. For registered user, he just needs to provide the username and password to login. Under the dialogue activity, the user informs the bot about the illness and the bot will suggest what medicine to take, its functions and how the medicine should be consumed.

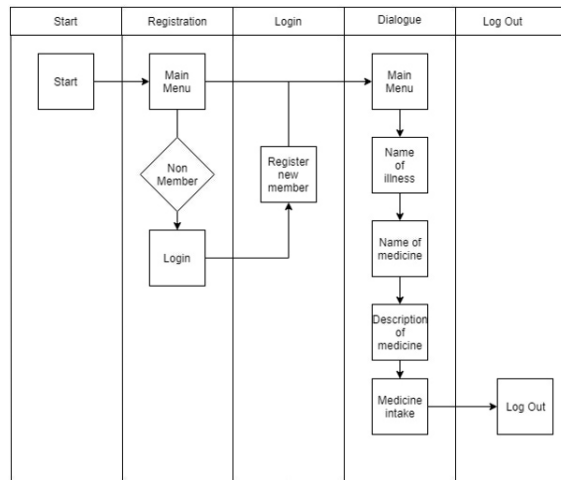


Fig. 3. Activity diagram.

Fig. 4 shows the flowchart where the bot suggests and answers questions from the user.

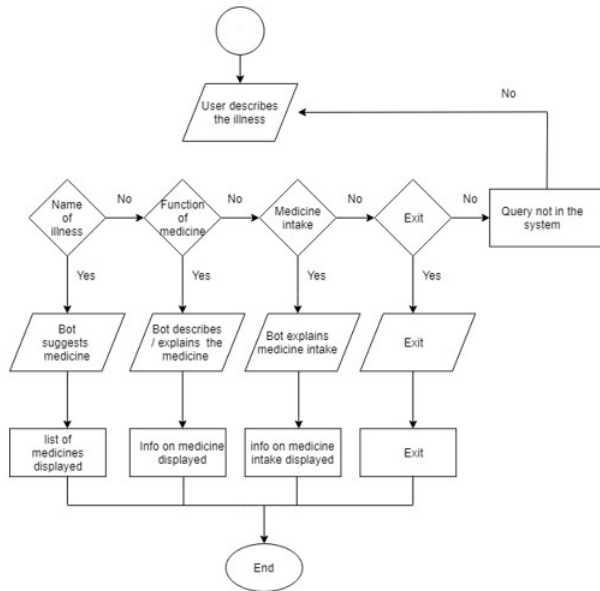


Fig. 4. Flowchart of user – bot conversation.

B. Development

Note that the development of the chatbot refers to the process of programming based on the phases discussed earlier. Under the implementation phase, a number of major modules which include login module, registration module and user-bot interaction module will be developed. Before the chatbot can be fully executed and for the purpose of testing, few other modules also need to be developed. This includes the development of database.

- **Main Menu Module:** The main menu consists with three buttons for login, forget password and registration.

- **Registration Module:** This module is called when the user has completed all the field forms with valid information.
- **Logging in Module:** This module requires the user to provide email and password. Correct information input will bring the user to the next module.
- **Password Reset Module:** This module indicates that the user is required to provide the email address. If the password reset is successful, then the user will go to the next module.
- **User – Bot Interactive Module:** This module allows admin to add and modify the information on medicine. The interface also allows the admin to test the interactive system between the user and the bot (Refer Figure 5).
- **Database Module:** This module is using the Firebase.
- **Extension Module:** This module connects Android Studio, IBM Watson and Firebase. This segment is required before testing can be done.

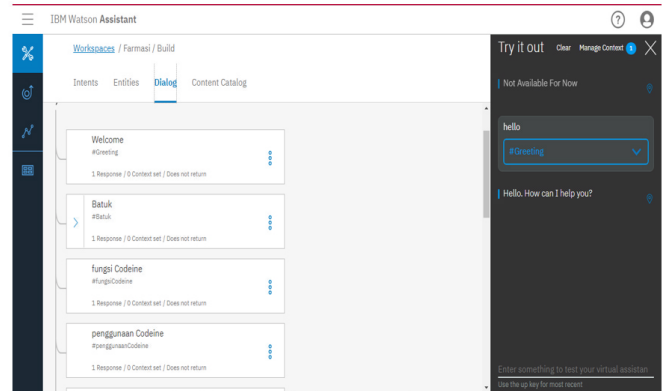


Fig. 5. User-bot interactive module.

C. Testing

The developed conversational bot was tested using the functionality test (Refer Table I) as well as the user acceptance test (Refer Table II). The test was conducted through a survey involving 50 respondents.

TABLE I
SUMMARY OF FUNCTIONALITY TEST FOR CONVERSATIONAL BOT APPLICATION.

Input	Expected / Actual Output
User informs illness	Bot suggests the type of medicine
User asks medicine	Bot explains the functions of medicine
User asks medicine consumption	Bot explains how the medicine should be consumed

V. CONCLUSIONS

The proposed chatbot for the pharmacy is a quick and efficient system that enables the public to get more information on the types of medications for their illnesses. For this reason, it is expected that the chatbot will be well received by the customers. The system which provides a number of

TABLE II
SUMMARY OF USER ACCEPTANCE TEST FOR CONVERSATIONAL BOT
APPLICATION.

Area	Comments
Security	App security worked well. Only admin has the access to the system webpage login
Functionality	All applications functioned well
Font	Text can be read
Image / Graphic	Excellent use of images / graphics
Interface layout	Well organized, can be improved
Colour Scheme	Suitable colour scheme used
Delivery of information	This app improves the process of delivering information about medicines to users
Needs fulfillment	Overall, this app fulfills the users' needs

functional modules consists of two entities; users and types of medications. Apart from that, the motivation for the chatbot development is based on two factors; (1) customers do not have to walk-in to the pharmacy, and (2) the use of natural language. By using the system, a user will be informed on the types of appropriate medicine to be taken.

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