

AI-based CHATBOT in Nutrition and Dietetics

Siraj Ahmedin Mussa

Abstract

In recent years, the integration of artificial intelligence (AI) technology such as chatbots has revolutionized many industries, including health and wellness. AI-based chatbots have proven to be useful tools in the field of nutrition, where personal guidance is desperately needed. But their integration requires quality insurance providers to be more careful to maximize their benefits while reducing or eliminating their risks.

Chapter 1:

1.1. Introduction:

Healthcare industry is one those leading sectors that is continuously going through changes and thanks to advanced technology it is experiencing major revolutions. Talking about the top areas of application of AI-based chatbots for nutritionists and dieticians, the use of such chatbots is the most essential. Traditional approaches towards eating or lifestyle-related habits have altered as these devices offer personalized guidance and encourage healthy lifestyles, which ultimately lead people to better control their eating habits.

1.2. Background:

An AI-driven food-related chatbot in nutrition and dietetics is a digital entity illustrated to offer diet-based optimized guidance, support, and advice based on individual requirements, goals, and health conditions. Such chatbots utilize of AI (artificially intelligent) algorithms, natural language processing (NLP), and machine learning models to collect and analyze what the user says, and then respond that represents the queries or the problems.

1.3. Problem statement:

The AI chatbot plays an important role in nutrition and dietetics by promoting healthy lifestyle to individuals. However, most of the research have challenges that they couldn't overcome. The first one is the accuracy of the chatbot is not at its best, the response in the user related to calories and

exercises needs an improvement. [1]. In addition to the fact that sometimes they lack of concise information about healthy diets. Also, the restriction to English language papers leads to exclusion of relevant non-English papers.[2]

1.4. Objectives:

To design solution to increase the accuracy and reliability of the Chatbot in providing health dietary plan by

- To Include All related papers regardless of their language (Translate the non-English articles)
- To Enrich the diet plan with ingredients and nutritional information to improve the quality of food recommendation and expand the scope of goal-setting.

1.5. Research scope:

In this research scope the aims are to increase the understanding and application of AI-based chatbots in nutrition and dietetics, with the ultimate goal of improving dietary behavior, health outcomes, and accessibility to nutritional guidance and include more non-English researches to improve the reliability of AI chatbot.

Chapter 2:

2.1. Literature review:

1-Foodbot A Goal-Oriented Just-in-Time Healthy Eating

Summary:

The main contribution of Foodbot is in its open-source design incorporating: a natural language user interface, a large-scale food knowledge graph and goal-setting and Just-In-Time (JIT) intervention and recommendation to overcome the burden of manual dietary self-tracking and provide users with a personalized guidance toward a healthy eating lifestyle. The Foodbot system consists of three main components: the conversation engine, core services, and data store. The conversation engine is responsible for processing natural-language inputs, determining user intents, and managing dialog state. It utilizes Dialogflow services for intent detection, entity recognition, and dialog state management, as well as a webhook server to bridge Dialogflow and core services. The core services component provides back-end functionalities such as food logging, food recommendation, and goal setting and tracking. It also includes request-based services and just-in-time (JIT) intervention services. The data store component holds the food knowledge graph and user data, including food journal data. The food knowledge graph provides a comprehensive knowledge base of local food items available from restaurants and grocery stores, while the user data are stored in a MySQL database. These components work together to enable Foodbot to process user inputs, provide personalized recommendations, and support goal-oriented just-in-time healthy eating interventions.

Limitation: Food knowledge graph supports various core services' modules by providing a comprehensive knowledge base of local food items available from restaurants and grocery stores in Singapore only.

2-SlimMe, a Chatbot with Artificial Empathy for Personal Weight Management: System Design and Finding

Summary:

SlimMe is an AI Chatbot designed to support personal weight management through artificial empathy. The Chatbot was built on language processing platform and LINE mobile messaging platform using Dialog flow. Artificial empathy was designed to recognize user's emotion and produce and evaluation to investigate the user experience after 7 days. Users found the experience is fun. Evaluation included measures of performance, usability, usefulness, and satisfaction.

Limitation: such as the need for enhanced accuracy in the chatbot's responses and improvements in the user experience related to calorie and exercise.

3-Dietbot - Diet Recommending Chatbot

Summary:

Dietbot is user-friendly conversational agent that provide and health-related information to users via chatbot interface with users and offers a recommendation based on their individual needs. The approach involves a natural language processing (NLP) technique to acquire user response, extract relevant health information, calculate parameters such as BMI and ideal body weight, and make dietary recommendation. The system architecture includes components such as Rasa NLU and Rasa Core for intent extraction, entity extraction, and dialogue management.

Advantage: promote a good nutrition to improve health

Limitation: lack of concise information about healthy diets.

4-Exploring the design and utility of an integrated web-based chatbot for young adults to support healthy eating: a qualitative study

Summary:

The goal of this study to explore the potential utility of a chatbot integrated into website to support healthy eating among young adults. The findings identified three potential roles of a chatbot for supporting healthy eating in young adults: improving healthy eating knowledge and facilitating discovery, reducing time barriers related to healthy eating, and providing support and social engagement. Specific features were suggested to support these roles, such as chatbot-generated recommendations, nudges or behavioral prompts, and enhanced interactivity.

Advantage: The use of positive and professional language, with minimal small talk and short sentences, to engage the target audience effectively

limitations. small and predominantly female sample, potential selection bias, and the use of examples based on the Behavior Change Wheel framework, which may have limited responses

5-Nudging Towards Health in a Conversational Food Recommender System Using Multi-Modal Interactions and Nutrition Labels

Summary:

This study explores the impact on a conversational food recommender system (CRS) and its ability to encourage healthier food choices. The study investigates the influence of three interaction modalities: pure textual, multi-modal (text plus visuals), and multi-modal supplemented with nutritional labeling. The findings revealed that users engaged on a wide range with the multi-modal system annotated with labels compared to the system with a single modality.

Advantage: understanding the underlying decision factors in food selection, such as mood, dietary constraints, and visual appeal, and emphasized the potential of multi-modal conversational information seeking in the context of food recommendation

Limitation: The inability to infer a reliable construct for choice satisfaction, also the challenge in analyzing the choice satisfaction evaluation aspect

6-The Artificial Intelligence (AI)-Based Chatbot for Promoting Physical Activity and Healthy Diet Protocol for a Systematic Review

Summary:

The paper discusses the protocol for a systematic review using (AI)- based chatbots to promote physical activity and prevent obesity. The aim is to summarize the characteristics of chatbot interventions evaluate their effectiveness in improving physical activity and dietary habits. The systematic review will search six electronic bibliographic databases (PubMed, EMBASE, ACM Digital Library, Web of Science, PsycINFO, and IEEE) to identify relevant studies and will assess outcomes such as changes in physical activity, diet, and body weight, as well as feasibility, acceptability, safety, and user satisfaction of chatbots.

Advantage: Systematic review chatbot interventions helps maintaining healthy life style

Limitation

-Systematic review is the possibility of a paucity of quantitative data to answer some research questions, which may require a qualitative and narrative synthesis of the findings.

-The restriction to English language papers may lead to the exclusion of relevant non-English papers.

No	Title	Authors	Publication year	Methodology employed	limitations
1	Foodbot A Goal-Oriented Just-in-Time Healthy Eating	- Philips Kokoh Prasetyo - Palakorn Achananuparp - Ee-Peng Lim	July 2017	Just-In-Time (JIT) intervention	Food knowledge graph supports various core services' modules by providing a comprehensive knowledge base of local food items available from restaurants and grocery stores in Singapore only
2	SlimMe, a Chatbot with Artificial Empathy for Personal Weight Management: System Design and Finding	- Annisa Ristya Rahmanti - Hsuan-Chia Yang - Bagas Suryo Bintoro4 - Aldilas Achmad Nursetyo - Muhammad Solihuddin Muhtar - Shabbir Syed-Abdul - Yu-Chuan Jack Li	June 2022	LIN mobile messaging platform using Dialog flow Artificial empathy	such as the need for enhanced accuracy in the chatbot's responses and improvements in the user experience related to calorie and exercise.
3	Dietbot - Diet Recommending Chatbot	- Dipti Patil1 - Surekha Iyer - Pooja Mehta - Deesha Gavand4	April 2021	Conversational agent	lack of concise information about healthy diets.
4	Exploring the design and utility of an integrated web-based chatbot for young adults to support healthy eating: a qualitative study	- Lee M Ashton - Marc TP Adam - Megan Whatnall - Megan E Rollo - Tracy L Burrows - Vibeke Hansen - Clare E Collins	October 2023	Chatbot integrated into website	small and predominantly female sample, potential selection bias, and the use of examples based on the Behavior Change Wheel framework, which may have limited responses
5	Nudging Towards Health in a Conversational Food Recommender System Using Multi-Modal Interactions and Nutrition Labels	- Giovanni Castiglia - Ayoub El Majjodi - Federica Calò - Yashar Deldjoo - Fedelucio Narducci - Alain Starke - Christoph Trattner	2022	Conversational food recommender system (CRS)	The inability to infer a reliable construct for choice satisfaction, also the challenge in analyzing the choice satisfaction evaluation aspect
6	The Artificial Intelligence (AI)-Based Chatbot for Promoting Physical Activity and Healthy Diet Protocol for a Systematic Review	- Yoo Jung Oh - Jingwen Zhang - Yoshimi Fukuoka - Min-Lin Fang	December 2020	Systematic review using (AI)- based chatbots	-Systematic review is the possibility of a paucity of quantitative data to answer some research questions, which may require a qualitative and narrative synthesis of the findings. -The restriction to English language papers may lead to the exclusion of relevant non-English papers.

Chapter 3:

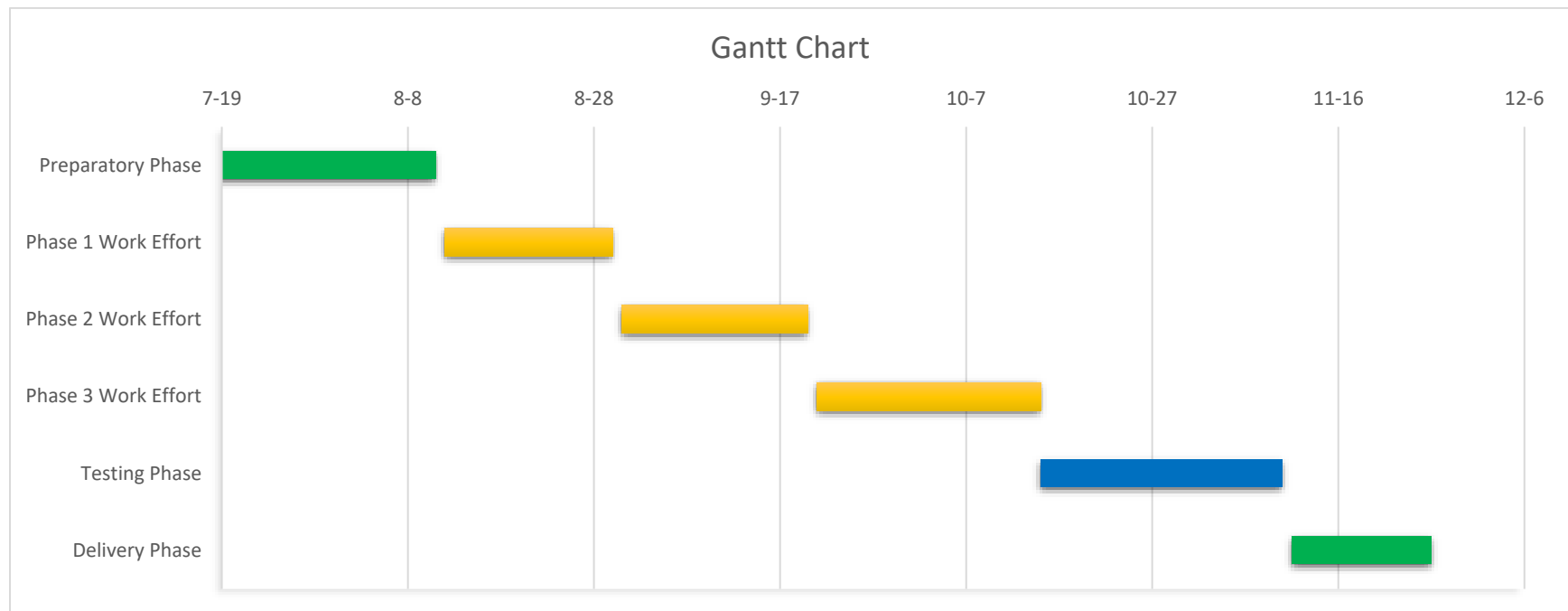
3.1. Research methodology:

Expand researches methodology to include non-English papers will enhance the effectiveness of the chatbot in delivering nutritional information. The study will explore a non-English publication by searching databases, and journals in relevant languages (e.g., Chinese, Spanish, French). The study aims to establish partnerships with international research institutions, universities, and industry collaborators to access, expertise, and resources will increase the reliability of the Chatbot and validate the translation of the translated researches before implementing their data. After getting participant consent the study will create a comprehensive database of healthy ingredients and it will be validated through expert reviews accompanied with users' opinion by conducting a survey or interviews to assess the usefulness, usability, and satisfaction with the chatbot's ingredient-related features.

3.2. Expected outcome:

The expected outcome is to deliver an AI-based chatbots in nutrition and dietetics with improved dietary behavior by reducing or eliminating the lack of concise information about healthy diet by having more access guidance and include more non-English researches to improve the reliability of AI chatbot.

3.3. Gantt Chart:



Reference:

- [1] As Annisa Ristya, Hsuan, Bagas, Aldilas, Muhammad, Shabbir and Yu-Chuan (2022) explained their “SlimMe...Finding” (p.10)
- [2] As Yoo Jung, Jingwen, Yoshimi and Min-Lin (2020) explained their “The Artificial ...Review” (P.4)