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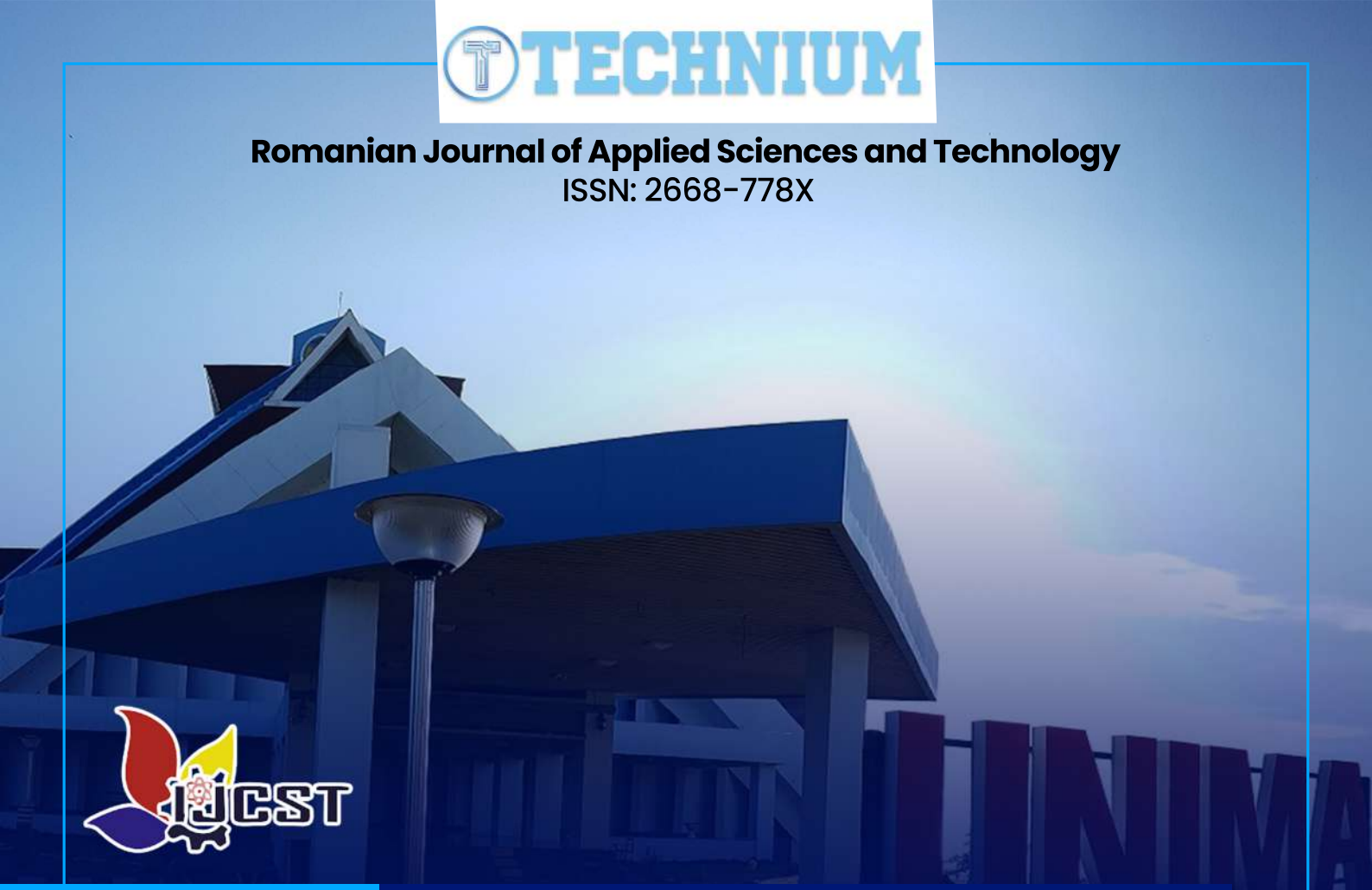

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Streamlining Medical Services: A Virtual Chatbot for Stomach-related Illnesses

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Abstract. The stomach is an important part of the digestive system as it stores and breaks down food for the body's energy. In Indonesia, some people engage in dense work activities but eat late, which can lead to stomach problems. The younger generation often consumes high-fat and junk foods, increasing their risk of stomach-related. Raising public awareness through social media platforms about the various stomach illnesses, including symptoms, risks, and treatments, is important. To achieve this, a chatbot called "A.L.T.H.A" has been proposed to provide information on diseases related to the stomach, utilizing Google Dialogflow and third-party applications, it's programmed to understand different intents, actions, parameters, and entities, and respond appropriately to user queries. The chatbot was tested on 10 end-users and successfully provided relevant information on different stomach-related issues, including welcome, fallback, main, also closing intents.

1 Introduction

Chronic diseases known as non-communicable diseases (NCDs) are responsible for nearly 70% of global deaths and are not spread from person to person. Although commonly associated with developed countries, NCD-related deaths are also prevalent in Southeast Asian nations, including Indonesia. According to estimates from the World Health Organization (WHO), NCDs were responsible for a significant number of deaths in Indonesia in 2014. According to Indonesian Basic Health Research (RISKESDAS), there has been a change of leading causes death in the country, with a decline in the prevalence of communicable diseases (28.1%) and maternal and neonatal factors (6.0%) and an increase in non-communicable diseases (59.5%) from 1995 to 2007. Stomach ulcers are one of the factors of deaths caused by non-communicable diseases (NCDs) in Indonesia, accounting for approximately 3.4% of all deaths in the population regardless of age [1].

The stomach plays a crucial role in the digestive system, serving as a storage and digestive site for food before it is absorbed by the body's cells for energy. In Indonesia, individuals face a range of risk factors for stomach-related diseases, including genetic factors as well as lifestyle-related factors such as age, gender, smoking, stress, obesity, a diet lacking in fruits and vegetables, insufficiency of exercise, unbalanced diet, and alcohol intake [2]. In addition, there are various types of stomach-related illnesses, one of which is stomach ulcers caused by Helicobacter pylori infection [3], gastroenteritis (stomach flu) [4], dyspepsia [5], and GERD [6]. Many individuals experience stomach problems that are commonly associated with symptoms such as diarrhea, feeling sick, stomach burning, heartburn, stomachache, and throw-up [7]. Some individuals may experience more critical indication like bloody vomiting and darkened stools [8].

It is common for some Indonesians, particularly millennials, to engage in dense work activities and consume high-fat and junk foods, often resulting in late eating habits [9]. The habits increase probably of developing stomach-related diseases, which some individuals may dismiss as regular stomach pain. Chronic stomach-related diseases, including those that lead to inflammation and cancer, may go unnoticed without early screening and diagnosis. However, these conditions can worsen over time if left untreated and the diseases already in advanced stages [10]. Informing the public about stomach-related diseases, including their associated risks, symptoms, and treatments, is crucial and can be achieved through easily accessible social media platforms. Therefore, this paper has proposed the use of a chatbot called "A.L.T.H.A." which uses Google Dialogflow and third-party application to provide automated virtual conversations about stomach-related disease information. This application allows users to engage in text conversations with the chatbot in real-time, enabling two-way communication, and allowing individuals to access information related to stomach illness at any time.

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2 Related works

Surya R. et al. proposed the research about the use of a microservice chatbot architecture for patient that has chronic conditions. It's designed to monitor patient's health status, offer detail information, and medication supervision. It provides question and answer about patient like Thyroid Disorders, Ischemic Heart Disease (IHD), Chronic Obstructive Pulmonary Disease (COPD), Asthma, Diabetes Mellitus, etc. To give an accurate answer, the chatbot requires information about patient's height, weight, blood pressure, pulse rate, medication, glucose, and other factors. There are three keys to develop its architecture, which are expansion using micro-service architecture, consistent data sharing techniques using Fast Healthcare Interoperability Resources for health-related characteristics, Conventional user-bot communication modeling via Artificial Intelligence Markup Language for creating software agents [11].

Patricia. et al. proposed the research about the use of communicative agents in mHealth for empowering individuals with Parkinson's disease to better manage their condition. The research emphasized the significance of offering technology-enabled communication services that Parkinson's patients and their nurse can utilize to tackle medical problems. There are three types of treatment, including IBM Watson Assistant, Google's Android Speech to Text API is utilized to convert spoken Portuguese language into text format, and Google's Android Text to Speech. The application, called "ParkinsonBot," that serve as a chatbot for individuals with Parkinson's disease. It comes with an API that lets users send messages to the cloud platform and receive responses processed through the Watson Assistant service [12].

Duen-Huang H. et al proposed the research about developing a chatbot prototype that can provide veterinary consultation. The chatbot was created to analyze the conduct of pet owners while conversing with them, utilizing artificial intelligence and big data. To collect information, a questionnaire was distributed to the community of pet owners via Google Forms, and the responses were analyzed with partial least squares structural equation modeling. According to the research result, pet owners who utilized the chatbot for veterinary consultations reported increased satisfaction with the application. The users reported that the chatbot was accurate, complete, and easy to use. The research could be beneficial in reducing the cost of veterinary consultations for pet owners [13].

Numerous chatbots have been developed by various researchers to simplify tasks in diverse areas such as healthcare, disease management, agriculture, and more. For example, Florence: a chatbot which focuses on providing healthcare-related assistance [14], Darwin: intelligent health assistant based on a convolutional neural network [15], kBot: personalized chatbot that utilizes knowledge to support self-management of asthma [16], ECHO: a tool specifically developed to assess the effectiveness of cloud-based chatbots through empirical evaluation [17], Disha: Bangla healthcare chatbot that utilizes machine learning for its implementation [18], Krushi: the farmer chatbot [19], Medbot: chatbot powered by conversational artificial intelligence designed to provide telehealth services after the COVID-19 pandemic [20], and COVIBOT: smart advisory chatbot for COVID-19 that uses WhatsApp as a platform for communication [21]. There are many chatbots that have been built by other researchers to help in the disease field, such as asthma, Covid-19, and health care. We propose a different chatbot application with the aim of helping patients who have stomach-related diseases called "A.L.T.H.A.". The aim of this chatbot is to simplify the process of obtaining information about various stomach-related diseases, their symptoms, risks, and treatments for patients.

3 System design

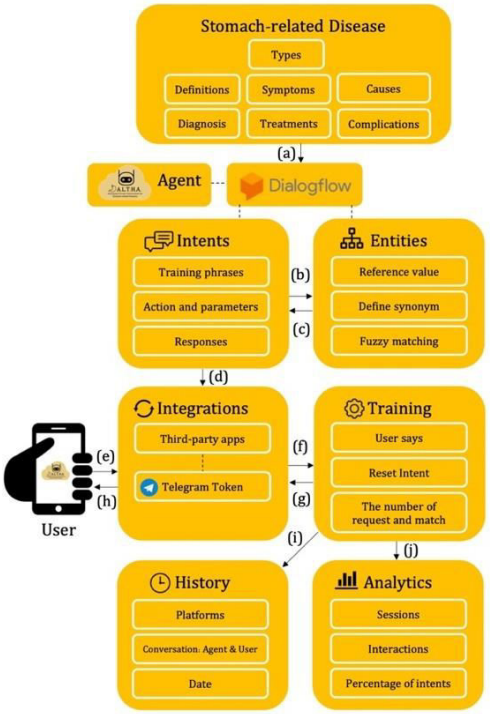

Fig. 1. The Proposed System Design of A.L.T.H.A. Bot

The research proposes system design of A.L.T.H.A. bot which is illustrated in Fig. 1. The chatbot is built by integrating third-party application and Google Dialogflow. The chatbot's input information comprises a database of illnesses associated with the stomach. With Google Dialogflow, an agent program is available that can manage, interpret, and reply to human-machine interactions. Chatbot can comprehend and communicate using everyday language, it necessitates functionalities like intents and entities. These features provide the basis for training the chatbot's knowledge of sentences, understanding similar sentences, responding to questions and answers.

After configuring intents and entities in Google Dialogflow, the A.L.T.H.A. bot was linked with third-party applications like Telegram. The user must request a Telegram token from BotFather to integrate the bot with Telegram. When the user sends a text message to the bot, Google Dialogflow records the conversation and responds accordingly. If the user thinks that the agent's reply is inaccurate, they can restore the agent's response in the Google

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Dialogflow training function. The history and analytics are monitoring functionalities also offered by Google Dialogflow. These functionalities enable the user to view all chat logs between the agent and user on various third-party applications, also the frequency of interactions over time and the proportion of intents used. Additionally, user has the ability to monitor the user's exit rate per intent and the agent's response time.

3.1 Knowledge base of stomach illness

A.L.T.H.A. bot was created with a specific purpose in mind, which is to facilitate virtual conversations for patients with stomach-related illnesses. It is designed to provide information about seven types of stomach-related illnesses, including gastroesophageal reflux disease (GERD), gastritis, dyspepsia syndrome, gastric ulcers, gastroenteritis, gastric cancer, and gastroparesis. To enable the chatbot to understand user queries, each type has a set of parameters, such as type, diagnosis, definition, causes, symptoms, complications, and treatments. These parameters serve as the chatbot knowledge base input and play an important role in training the chatbot's conversational abilities.

3.2 Google dialogflow

Google Dialogflow is a suite provided by Google Compute Platform, which enables chatbot developers to integrate cognitive virtual agents with third-party application. This suite allows developers to create conversational interfaces and implement them across multiple platforms, including text messaging, 24/7 customer service, and audio processing for phone calls. Since it runs on Google infrastructure, the chatbot can scale up to millions of users. Additionally, the chatbot can be connected to different apps and data sources using Cloud Functions or Firebase, enabling it to access relevant information to respond to customer queries. Google Dialogflow utilizes natural language understanding, speech synthesis, speech recognition, and other technologies to enable the chatbot to interact with users. Developers can customize the chatbot to answer specific questions as required by the users.

3.3 Agents

The Dialogflow Agent utilizes machine learning to comprehend the meaning and situation of user inputs, enabling it to provide accurate and relevant responses. It can also be trained to recognize entities, which are specific pieces of information that the user provides, such as names, dates, and locations. These entities are then used to customize the response provided by the agent. Dialogflow also allows for integration with other Google services, enabling the agent to interpret and generate natural language speech.

The configuration of agents allows for control over the behavior of the chatbot, including:

- General: allows the user to specify the agent designated for web demo integration, provide the agent avatar URI, establish the time zone, activate beta features and APIs, Google Project ID, and arrange log settings such as logging interactions to Google Cloud and DialogFlow.
- Languages: allows setting primary language and any other languages of chatbot.
- Machine Learning Settings: allows the user to set the confidence score threshold for machine learning classification, enable automatic spell correction for user queries, enable automatic agent training after modifications, and allows automatic validation of agents while training by enabling agent validation.
- Export and Import: allows the user to make a ZIP format backup of the agent, install a new version from the ZIP file (which will remove all previously defined intents and entities), and upload updated intents and entities while retaining the current ones (overwriting any intent or entity with a matching name with the newer version).
- Environments: allows the user to generate and set modify settings for the chatbot, allowing the provision of distinct agent versions to diverse user groups
- Speech: allows users to enhance the quality of speech recognition, various voice configurations, including text or Speech Synthesis Markup Language (SSML) and activate automated text-to-speech.
- Share: allows the agent owner to invite new users via email to access and collaborate on the agent, either as developers or reviewers.
- Advanced: to activate Sentiment Analysis which utilizes Cloud Natural Language to generate a sentiment score to every user query in the agent.

3.4 Intents

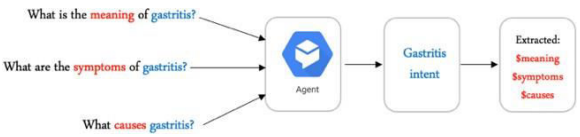

Fig. 2. Agent's Ability to Identify and Address Inquiries From End-users.

In a single conversation turn, Dialogflow's intents can categorize a user's intentions. The agent can be designed with multiple intents, allowing it to handle more complex conversations. When a user provides input in the form of text or speech, Dialogflow utilizes intent classification to match the user's input to the appropriate intent within the agent.

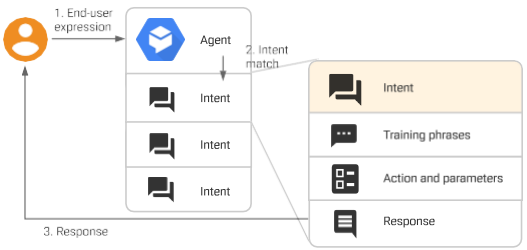

Fig. 3. The Fundamental Procedure for Identifying Intent and Providing a Reply to The User

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Dialogflow allows users to create agents that can identify and give feedback to various queries, such as questions related to healthcare. In this example, the Dialogflow user has the option to create an intent that is exclusively dedicated to addressing inquiries related to the meaning of gastritis. If a user asks a question such as "What does gastritis mean?", Dialogflow would identify the appropriate intent for this query, which in this case would be the definition of gastritis intent. Additionally, Dialogflow allows users to define intents that can extract important information from the user's query, such as symptoms and causes of the desired illness, which is important for the system to provide accurate responses to the user.

Fig. 3 displays a simple intent from Google Dialogflow that comprises of 4 components: training phrases, action, parameters, and responses. These components are described as follows:

- Training phrases: Dialogflow intent refer to the question that the user provides to teach the agent what kinds of inputs it should expect from the end-user. These phrases are used by the agent to learn how to recognize similar expressions in the future. Dialogflow's machine learning algorithms can also analyze the training phrases to identify similar phrases and generate additional variations, reducing the amount of manual input required from the user.
- Action: Each intent in Dialogflow can be associated with an action that the system will take when that intent is matched. When Dialogflow identifies a matching intent, it sends the corresponding action to the system, which can then utilize the information to activate the relevant action.
- Parameter: When an intent is identified in Dialogflow during runtime, the values extracted from the end-user input are provided as arguments. These extracted values are called parameters, and the entity type of each parameter determines the process of obtained data. Different from unprocessed user input, parameters are organized so it can be used to carry out rational or give replies.
- Response: Dialogflow allows users to define text, audio, or visual replies to be returned to the end-user. the responses can be used to provide answers to the end-user's questions, request more details from the user, or conclude the dialogue.

3.5 Entities

To better identify as well as extract particular information from end-user expressions, entities can be utilized to generate reference values and synonyms. The main expression key is reference value which refers to the synonym word, meanwhile to offer an alternate sentence expression that conveys similar meanings to the value. Providing another possibility expressions can enhance the agent's capability to reply more accurately to users.

Dialogflow offers various matching techniques of entity, such as:

- Define synonyms: allows users to define synonyms that correspond to create a list of values that include references to other entities, or to specify reference values within the list.
- Regexp entity: allows users to define a regular expression in the values of an entity. This regular expression is then used for parameter extraction when queries are being classified.
- Fuzzy matching: an alternative way of extracting parameters where the match of an entity is approximated. This allows Dialogflow to find matches even if the user misspells terms or only enters parts of words from entity entries.
- Allow automated expansion: can be used to assist with identifying values that are not explicitly specified. This option allows the agent to expand its understanding of the entity by recognizing values that were not explicitly defined.

3.6 Integrations with third-party client apps

Dialogflow has integrations with various popular conversation platforms that allow for direct handling of end-user interactions. These platforms include One-click Telephony, Google Assistant, Text-based, Open Source, and Telephony. Dialogflow offers many kinds of incorporation including Dialogflow built-in integration, partner built-in telephony integration, independent integrations and Google-contributed open-source integrations. The research involved utilizing Telegram, a third-party messaging application, to enable convenient access for end-users looking information related to stomach diseases.

3.7 Training

To enable agents to respond appropriately to end-users, a machine learning model is created by Dialogflow using training data. The training data consists of phrases and expressions that are evaluated for similarity to other phrases within the intent. Dialogflow provides a training tool that allows users to import, export, and analyze conversation data history to improve the quality of the training data. Additionally, Dialogflow provides information about user input, resetting intents, and total of requests and matches.

3.8 History

Dialogflow offers a history feature that displays details of all the platforms the agent is operated on, including Google Hangouts, Google Assistant, Telegram, Facebook Messenger, and others. The history feature links to all dialogue between the agent and the user, and permits the user to select a start and end date for the data they wish to view.

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3.9 Analytics

To provide insights into the performance of the agent, Dialogflow offers analytics that displays the number of sessions and interactions for all requests in the last 30 days based on the specified start and end dates. Users can view the analytics chart by selecting the available options from the dropdown button, including overall data, languages, integrations, session path, status codes, sentiment, intents, intent path, speech, knowledge, and webhook. This feature helps users to evaluate the effectiveness of their agent and identify areas that need improvement.

3.10 End-user

The "A.L.T.H.A" bot is designed to assist users with stomach-related issues, and it is organized into seven different types, such as gastritis, GERD, and gastric ulcers. Users can engage in conversations with the chatbot to learn about the definitions, diagnosis, causes, symptoms, treatments, and other information about stomach illness. It responds with text-based answers that are provided in the form of paragraphs. To use the chatbot, the user simply needs to open Telegram and look for the name of the chatbot, "altha_bot". Once a conversation is initiated, the chatbot will initiate contact and welcome the user.

4 Experimental result and discussion

This part discussed the process of configuring an agent in Dialogflow, including setting up intents, actions, and parameters, as well as configuring entities. It also discussed how to test the agent and provided an example dialogue in Telegram between an end-user and the chatbot. Fig. 4 displays Dialogflow with the default settings of the agent and the customized setting options available. Users can configure the agent's name, icon, and description, enable beta features, and default time zone and APIs. Additionally, users can enable interaction logging to Google Cloud and Dialogflow.

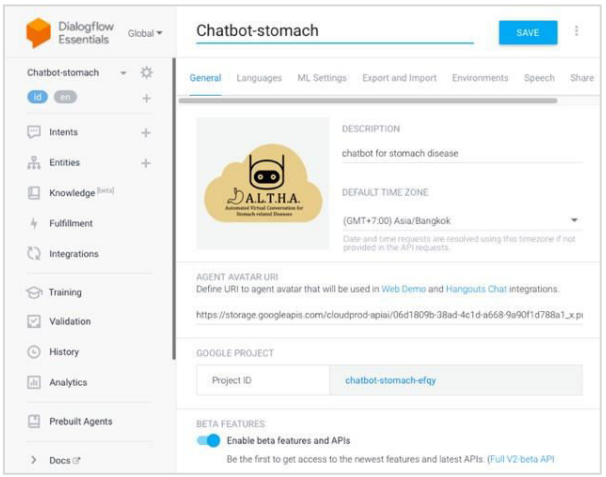

Fig. 4. The Dialogflow with Default Settings of The Agent and The Available Customized Setting Options

To enable communication between end-user and the agent, configuring intents is essential. “A.L.T.H.A" bot was programmed with various intents that address phrase expressions including "what is the meaning of?", "what are the causes of...", "what are the symptoms of...", and so on. Each intent is associated with one of the seven types of stomach-related diseases, as well as actions and parameters.

Table 1. Intent, parameters, and action of “A.L.T.H.A” bot towards stomach-related illness

Intent	Stomach-related illness category	parameters and Action
How is the diagnosis of…	Gastroesophageal reflux disease Gastritis Dyspepsia syndrome Gastric ulcers Gastroenteritis Gastric cancer Gastroparesis	For example: Parameter name: *definitiongastritis* Entity: *@definitiongastritis* Value: *$definitiongastritis*
What is the meaning of…		
What causes of…		
What are the symptoms of…		
What are the complications of…		
How to treat…		

Table I displays the intent, parameters, and action of “A.L.T.H.A" bot designed towards stomach-related illness. For example, agent answers an end-user's query about gastritis definition. The agent has an parameters and action to reply to the query with reference to the name of parameter: definitiongastritis, entity: @definitiongastritis, and value $definitiongastritis, that are connected to entities. In addition to configuring the parameters and action in intents, the agent has text, verbal, and media-rich replies that it will provide to the end-user.

Table 2. Entities of “A.L.T.H.A” bot towards stomach-related illness using fuzzy matching and synonyms

Reference Value	Synonyms
How is the diagnosis of…	How is the examination of…
What is the meaning of…	What is … mean
What causes of…	What triggers …
What are the symptoms of…	What is the indication of… What is the sign of…
What are the complications of…	What is the new disease triggered by… What are the comorbidities of… What are the additional diseases of…
How to treat…	How to recover… How to cure… How to manage…
Entity Matching	Fuzzy Matching Define Synonyms
Stomach-related disease types	**Synonyms**

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Gastroesophageal reflux disease (GERD)	Acid reflux disease
Gastritis	Inflammation of the stomach
Dyspepsia syndrome	Ulcer pain
Gastric ulcers	Bacterial infection of the stomach
Gastroenteritis	Stomach flu
Gastric cancer	Cancers form in the main part of the stomach
Gastroparesis	Delayed emptying of food in the stomach

To configure each intent with actions and parameters, the user of Dialogflow needs to first set up the entities. Table II illustrates the two main components of entities: reference value and synonyms. For reference values, an example would be "what are the symptoms of...," while the synonyms would include "what is the indication of … and "what is the sign of..." as well as another similar words. For different types of stomach diseases, phrases will be arranged along their synonyms. For instance, a synonym for GERD could be "acid reflux disease", while for gastritis it could be "inflammation of the stomach", and for dyspepsia syndrome, "ulcer pain". Providing more similar words, a better response will be provided by the agent

Table 3. Testing result of "A.L.T.H.A" bot towards stomach-related illness determined by corresponding end-user phrase expression and response

Intent		**Result**
Welcome intent		[√] Corresponding [ ] Not Corresponding
Fallback intent		[√] Corresponding [ ] Not Corresponding
Main intent	Stomach-related disease category	Result
How is the diagnosis of…	GERD	[√] Corresponding [ ] Not Corresponding
What is the meaning of…	Gastritis	[√] Corresponding [ ] Not Corresponding
What causes of…	Dyspepsia syndrome	[√] Corresponding [ ] Not Corresponding
What are the symptoms of…	Gastric ulcers	[√] Corresponding [ ] Not Corresponding
What are the complications of…	Gastroenteritis	[√] Corresponding [ ] Not Corresponding
How to treat…	Gastric cancer	[√] Corresponding [ ] Not Corresponding
	Gastroparesis	[√] Corresponding [ ] Not Corresponding
Closing intent		[√] Corresponding [ ] Not Corresponding

Once the reference value and synonyms are configured, the user can select from the four available entity matching methods in Dialogflow: **Define synonyms**, **Allow automated expansion**, **Regexp entity,** and **Fuzzy matching**. It is possible to use a combination of these methods, besides Fuzzy matching and Regexp entity, that can't be used simultaneously. The entities may also be entered with various reference values and synonyms, but it is important to remember the name of the entity as it will be associated with the intent.

To configure the integration platform for the agent, the Dialogflow user must have already set up the agent's intents and entities. In the proposed research experiment, 10 end-users were used to test the chatbot's conversational ability. The testing scenario involved the end-user sending a text question about stomach-related diseases to the "A.L.T.H.A" chatbot on Telegram, and the bot responding with relevant information. The testing involved four intent components: welcome intent, fallback intent, main intent (which had various intents for the different categories of stomach-related diseases), and closing intent. The end users are allowed to ask any questions related to stomach-related diseases, and all questions asked by end users match the answers of the chatbot. The test results are presented in Table III.

Conlusion

"A.L.T.H.A" bot was created to provide information on stomach-related diseases to end-users using Dialogflow and third-party applications like Telegram. The chatbot was set up in Dialogflow as an agent, with several actions, intents, entities, and parameters. The agent's intents cover 7 categories of stomach illness and the common questions users may ask regarding diagnosis, definition, causes, symptoms, complications, and treatments. To respond to a variety of user questions, the agent was equipped with phrases and synonyms using Define synonyms and Fuzzy matching methods. The testing scenario aimed to evaluate the chatbot's response and included the welcome, fallback, main, and closing intents. The test results showed that the chatbot successfully provided relevant information in response to questions from 10 end-users.

References

1. D. G. o. D. C. a. E. S. National Strategic Action Plan for The Prevention And Control of Noncommunicable Diseases 2016-2019, Jakarta: Ministry of Health of The Republic of Indonesia, 2016.
2. G. S. Indonesia Health Profile 2019, Jakarta: Ministry of Health Republic of Indonesia, 2020.
3. D. Y. Graham, "History Of Helicobacter Pylori, Duodenal Ulcer, Gastric Ulcer And Gastric Cancer," *World J Gastroenterol,* vol. 20, no. 18, pp. 5191-5204, 2014.
4. M. Simadibrata and R. Adiwinata, "Current Issues of Gastroenterology in Indonesia," *Acta Medica Indonesiana,* vol. 49, no. 3, pp. 270-278, 2017.
5. M. D. Schwartz, "Dyspepsia, Peptic Ulcer Disease, and Esophageal Reflux Disease," *The Western Journal of Medicine,* vol. 176, no. 2, pp. 98-103, 2002.
6. A. F. Syam, F. C. Hapsari and D. Makmun, "The Prevalence and Risk Falence and Risk Factors of GERD among Indonesian ors of GERD among Indonesian Medical Doctors," *Makara Journal of Health Research,* vol. 20, no. 2, pp. 35-40, 2016.
7. V. Rastogi, D. Singh, J. J. Mazza, D. Parajuli and S. Y. H, "Flushing Disorders Associated with Gastrointestinal

Symptoms: Part 2, Systemic Miscellaneous Conditions," *Clinical Medicine and Research,* vol. 16, no. 1-2, pp. 29-36, 2018.

8. B. Tan, H.-Q. Luo, H. Xu, N.-H. Lv, R.-H. Shi, H.-S. Luo, J. Li, J.-L. Ren, Y.-Y. Zou, Y.-Q. Li, F. Ji, J.-Y. Fang and J. Qian, "Polaprezinc Combined With Clarithromycinbased Triple Therapy For Helicobacter Pyloriassociated Gastritis: A Prospective, Multicenter, Randomized Clinical Trial," *PLoS ONE,* vol. 12, no. 4, pp. 1-13, 2017.
9. Y. R. Maulina, A. Margawati, R. Purwanti and A. F. A. Tsani, "Differences in Eating Habits and Physical Activity Before and During Distance Learning," *Jurnal Gizi Indonesia (The Indonesian Journal of Nutrition),* vol. 10, no. 2, pp. 122-134, 2022.
10. N. Nagaich and R. Sharma, "Gastric Cancer - An Update," *Journal of Tumor Medicine and Prevention ,* vol. 2, no. 5, pp. 84-92, 2018.
11. S. Roca and J. Sancho, "Microservice Chatbot Architecture for Chronic Patient Support," *Journal of Biomedical Informatics,* vol. 102, p. 103305, 2020.
12. P. Macedo, C. Pereira, P. Mota, D. Silva, A. Frade and R. N. Madeira, "Conversational Agent in mHealth to Empower People Managing the Parkinson's Disease," *Procedia Computer Science,* vol. 160, pp. 402-408, 2019.
13. D.-H. Huang and H.-E. Chueh, "Chatbot Usage Intention Analysis: Veterinary Consultation," *Journal of Innovation and Knowledge,* 2020.
14. J. Gupta, V. Singh and I. Kumar, "Florence- A Health Care Chatbot," in *2021 7th International Conference on Advanced Computing and Communication Systems (ICACCS)*, Coimbatore, India, 2021.
15. S. Rai, A. Raut, A. Savaliya and R. Shankarmani, "Darwin: Convolutional Neural Network based Intelligent Health Assistant," in *2018 Second International Conference on Electronics, Communication and Aerospace Technology (ICECA)*, Coimbatore, India, 2018.
16. D. Kadariya, R. Venkataramanan, H. Y. Yip, M. Kalra, K. Thirunarayanan and A. Sheth, "kBot: Knowledge-Enabled Personalized Chatbot for Asthma Self-Management," in *2019 IEEE International Conference on Smart Computing (SMARTCOMP)*, Washington, DC, USA, 2019.
17. A. R. M. Forkan, P. P. Jayaraman, Y. Kang and A. Morshed, "ECHO: A Tool for Empirical Evaluation Cloud Chatbots," in *2020 20th IEEE/ACM International Symposium on Cluster, Cloud and Internet Computing (CCGRID)*, Melbourne, VIC, Australia, 2020.
18. M. M. Rahman, R. Amin, M. N. K. Liton and N. Hossain, "Disha: An Implementation of Machine Learning Based Bangla Healthcare Chatbot," in *2019 22nd International Conference on Computer and Information Technology (ICCIT),*, Dhaka, Bangladesh, 2019.
19. M. Momaya, A. Khanna, J. Sadavarte and M. Sankhe, "Krushi – The Farmer Chatbot," in *2021 International Conference on Communication information and Computing Technology (ICCICT)*, Mumbai, India, 2021.
20. U. Bharti, D. Bajaj, H. Batra, S. Lalit, S. Lalit and A. Gangwani, "edbot: Conversational Artificial Intelligence Powered Chatbot for Delivering Tele-Health after COVID-19," in *2020 5th International Conference on Communication and Electronics Systems (ICCES)*, Coimbatore, India, 2020.
21. N. A. Khan and J. Albatein, "COVIBOT- An intelligent WhatsApp based advising bot for Covid-19," in *2021 International Conference on Computational Intelligence and Knowledge Economy (ICCIKE)*, Dubai, United Arab Emirates, 2021.