Michade Bot Software And Prototype And Technical Report(AE2)

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[1. Introduction 3](#_Toc29742)

[2. Problem Statement 3](#_Toc29121)

[2.1 Proposed Solution 4](#_Toc15060)

[2.2 Aims and Objectives 4](#_Toc21671)

[wdwdwdwdqd 4](#_Toc14521)

1. **Introduction**

With the ever-evolving technological advancements, integrating chatbots has become a popular solution for various industries. Chatbot also known as “conversational agents” are software applications that are backboned on

Artificial Intelligence, Machine Learning and Natural Language Processing. Chatbot will process human speech either in text or voice form, for the purposes of simulating a conversation or interaction with a real person.( R. J. Ong et al 2021)

This report focuses on creating and implementing a specialized chatbot for the agricultural domain, specifically providing information about a Michade Farms and assisting individuals looking to start their own animal farm business. The JYPD chatbot is a dynamic and interactive tool that engages users in conversations ranging from inquiries about ranch details and services to providing comprehensive guidance on establishing and managing an animal farm. As technology intersects with agriculture, the deployment of chatbots facilitates efficient information dissemination and addresses the diverse needs of users within the agricultural community. This report explores the ethical considerations, technical intricacies, and broader implications of introducing a agricultural chatbot, highlighting the transformative potential of this technology in the agricultural landscape.

* 1. Ethical Consideration

Developing a chatbot for ranch-related information entails navigating various ethical considerations. These include ensuring user privacy through transparent data practices, addressing biases in training data to promote fairness, and providing accurate information for informed decision-making, especially for users interested in starting their ranch. Accessibility, security, and user consent are crucial ethical dimensions, emphasizing inclusive design, robust data protection, and user-controlled data sharing. Additionally, the chatbot must be transparent about its nature, limitations, and inability to handle emergencies. Upholding these ethical principles ensures that the chatbot operates responsibly, respects user autonomy, and provides valuable and unbiased assistance while maintaining a commitment to privacy and security. Regular audits and updates are essential to align the chatbot's ethical framework with evolving standards and user expectations.

1. **Problem Statement**

The chatbot aims to provide a multifaceted solution for users interested in a specific ranch and those aspiring to start their own ranch. It addresses queries about the ranch's general information, including location, history, and acreage. Additionally, the chatbot informs users about the services and facilities offered, such as livestock types, agricultural practices, and recreational activities. For those looking to start a ranch, the chatbot offers guidance on land acquisition, legal requirements, equipment, and potential challenges. It also assists with queries related to upcoming events, purchasing ranch products, livestock care, environmental sustainability practices, community engagement initiatives, and seasonal information. By covering a broad spectrum of topics, the chatbot becomes a valuable resource for individuals seeking comprehensive information about a particular ranch and those embarking on their journey to establish a ranching venture.

* 1. Proposed Solution

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* 1. Aims and Objectives

1.General FAQ’s for the Michade Farms

* To Introduce and provide information about Michade Farms.
* To inform customers about variety of products and available service that the business offers
* Address user inquiries on pricing details and orders. Also guiding user to contact the customer service for more information
* Provide details about the farm's location , working hours, sales and inquiries on partnership etc.

2.Essential information for ranch beginners on the Michade Farms animals

* Guide on starting egg,chicken and beef production
* Recommending beginner-friendly tips and advice on different animals
* Tips on caring , raising, sales and breeding of farm animals

1. **Prototype Development and AI Algorithms Used**
   1. Structure of the prototype

JYPD Chatbot was designed using Jupyter which consist of two notebooks. JYPD\_training module which is an own defined module and JYPD\_main contains the model and functions to implement the graphical user interface (GUI) of the chatbot.

* 1. Programming language, libraries/modules used

Python is the language used to implement the JYPD chatbot due to the extensive machine learning libraries it supports.

It made use of the following libraries Natural Language ToolKit(which includes ), random for randomazing the selection of basic greeting intents, json to allow the loading and use of the intent file, the NumPy library is used to convert datasets into arrays for modeling, also using Keras Sequential API to implement the model and tkinter for the graphical user interface (GUI). The pickle module converts Python objects such as dictionaries into a byte stream and saves them as a binary file

* + 1. JYPD\_training

This contains thefollowing functions

1. load\_intents function which loads the a JSON file named ‘michade\_farms.json’ containing intents.
2. Process\_intents function that processes intents and patterns to extract the word, documents and classes from the loaded intent file, it also stores the lemmatizated data.
3. Create\_training\_data creates bag-of-words representing the loaded words, documents and classes and split the training data to features and labels.
4. Split\_data this function split the data into testing and training data for use later
5. Train\_neural\_network defines and trains a neural network model using tensorFlow/Keras, it consist of input,dropout and output layers of the model. It also uses stochastic gradient descent(SGD) as the optimizer and categorical cross-entropy as the loss function as seen in fig ..
6. Evaluate\_model this makes use of the testing data to evaluate the model using confusion matrix, accuracy and a classification report to show the model’s performance.
7. Main is the final function that calls all the other functions in the notebook.
   * 1. JYPD\_main
        1. Main Functions
8. Handle\_gibberish\_response function generates a response whe chatbot encounters unintelligible input from the user
9. Handle\_fallback\_response function is called when the chatbot does not comprehend user and it also provide an option for to prompting user if they would like to get in touch with the support team
10. Clean\_up\_sentence function tokenizes and lemmatizes the word in a given sentence preparing it for use
11. Bag\_of\_words converts a sentence into a bag-of-words representation
12. Predict\_class function predicts the class or intent of a given sentence using the loaded trained model
13. Get\_response select random response for a given intent from the response associated with that intent.
    * + 1. Initialization and setup
14. ChatContext class initializes a context object to keep track of various aspects of the chat including last response, input history etc.
15. Init is the method of the ChatApplication class that sets up the main window of the chat application, it initializes the GUI elements.
16. \_setup\_main\_window cofigures the main window of the chat application including the appearance of labels, text widgets etc.
    * + 1. User input handling and display
17. Run method initiates the main event loop of the Tkinter application, allowing the user to interact with the application
18. \_on\_enter\_pressed handles the event when the user ‘Enter’ key and calls the *handle\_user\_input* function.
19. Handle\_user\_input this takes user input and predicts the intent and generate a response and also helps handle the commands for users to exit the application using special commands like ‘quit’ or ‘exit’.
20. Insert\_message this inserts a user or chatbot message into the chat display to update the text widget.

This also includes an If statement to call the ChatApplication and runs it.

1. **Evaluations**

JYPD chatbot was tested “manually” by the Pathfinder team. The hyperparameters were continued to be changed and the dataset was modified until the bot was able to produce a considerably consistent conversation.

It can also been seen in the JYPD\_training file where the confusion matrix, accuracy and a classification report.as in fig… The confusion matrix is also visualized with a heatmap using seaborn seen in fig …

1. **Limitations**
   1. Limitation
2. Can give inconsistent responses. 
3. It may not remember past interactions or maintain context across multiple turns, limiting its ability to engage in coherent and contextually relevant conversations.
4. The chatbot relies on a predefined set of intents and responses, making it limited
5. Limited to English language users only
   1. Challenges encountered
6. Defining clear and distinct intents that cover a wide range of user queries while avoiding ambiguity.
7. **Conclusion**

JYPD chatbot is based on retrieval-based approach using natural language processing and deep learning. It is designed to enhance the accessibility of farm details to customers of Michade Farms and also help develop beginners to the animal farm. JYPD targets people customers of the business and people with interest in animal farming and will also provide adequate information to users.

JYPD can be improved to make use a more advanced model such as Bidirectional Encoder Representations from Transformers(BERT) or Generative Pre-trained Transformer 3(GPT-3) based recurrent neural network and also be able to create and store the history and time stamps of the chats and also using a well developed and detailed intent to better understand the users and to provide more personalized enquiry responses.