IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁒ Peer-reviewed & Refereed journal ⁒ Vol. 14, Issue 4, April 2025

DOI: 10.17148/IJARCCE.2025.14414

Medicinal Leaf Image Classification and Script Reader

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Abstract: In order to provide information about medicinal plants, this research presents a unique approach that combines handwriting recognition and image categorization with a chatbot. The project utilizes the Inceptionv3 algorithm for image classification to identify leaves and the medicines derived from them. For handwritten recognition, Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM) networks are employed to identify medicine names. An Al chatbot is then used to resolve user queries about these medicines and provide additional details such as home remedies. The project addresses the problem of efficiently retrieving information about medicinal plants and their uses, which is challenging due to the vast amount of information. available and the need for accurate identification. Existing approaches often lack the integration of multiple technologies or focus on a specific aspect of the problem. This work contributes by providing a comprehensive solution that combines image classification, handwritten recognition, and chatbot technology. The significance of this work lies in its potential to improve access to information about medicinal plants, which can have a significant impact on healthcare and the environment. The project was conducted over a period of November-February at Guntur and has the potential to benefit a wide range of stakeholders, including healthcare professionals, researchers, and individuals interested in natural remedies.

Keywords: Medicinal plants, chatbot, image classification, handwritten recognition, CNN, herbal medicine, natural remedies, personalized recommendations.

I.INTRODUCTION

Finding trustworthy information on medicinal plants is more important than ever in a society where people are turning more and more to alternative cures. Accessible and reliable herbal knowledge is becoming more and more in demand, from consumers who are health-conscious and looking for holistic alternatives to healthcare professionals who are investigating complementary therapies. However. the shortcomings of conventional sources highlight the need for a revolutionary fix. Medicinal leaf image classification and script reader t is a cutting-edge technique to explore the field of herbal medicine. This virtual assistant, equipped with image processing and a Script reader, invites users into a world where customization meets knowledge, going beyond simple information. It is more than simply a tool; it is a powerful force that cuts over national borders and provides insights into the varied cultural uses of herbal treatments. This study sets out to explore the possibilities of the medical robot. We explore its ability to close the accessibility gap by offering not only information but also a fully immersive experience. Imagine a program that provides a personalized herbal exploration roadmap by customizing recommendations based on personal tastes, health nuances, and global viewpoints. As we traverse the intricate terrain of worldwide healthcare, this chatbot manifests not only as knowledge but also as a source of a stimulant for enduring and comprehensive wellness. It promotes worldwide society bound together in its search for natural healing techniques by embracing cross-cultural herbal wisdom. Join us as we examine the enormous potential of the medic bot in influencing the future of herbal wellness globally as we untangle the strands of custom, technology, and health.

II.RELATED WORK

A review of previous research in the field of medicinal plant knowledge yields several important conclusions. Instead of offering a comprehensive solution, existing approaches frequently concentrate on particular components of the problem, such as picture classification or chatbot technology. The efficiency with which information on medicinal plants can be efficiently retrieved using current methods. is restricted by the absence of integration among various technologies. Furthermore, accurate identification and classification using conventional approaches is hampered by the richness and diversity of data pertaining to medicinal plants.

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The mentioned research provides a novel method that combines chatbot technology. image classification, and handwriting recognition. By offering a more comprehensive and effective method of retrieving information about medicinal plants, this all-inclusive solution tackles the shortcomings of previous techniques. The project intends to enhance access to knowledge about medicinal plants, which can have substantial impact on healthcare and the environment, by merging. diverse technologies. The Inceptionv3 algorithm for picture classification, RNNs and LSTMs for handwritten identification, and Al chatbot technology are among the tools and technologies needed for this project. Images of plant leaves and handwritten. medicinal names with labels should be included in the dataset. Proficiency in natural language processing, bot building. deep learning, and machine learning is essential for successfully integrating and employing these technologies. All things considered, the study presents viable method for tackling the problem of effectively obtaining data regarding therapeutic plants and could be advantageous to many different parties.

2.1 Existing System on Image Classification

The significance of image classification lies in its ability to enable machines to comprehend and categorize visual information, mirroring the human capacity for visual recognition. Through the use of advanced machine learning algorithms, particularly deep learning techniques like convolutional neural networks (CNNs), image classification has achieved remarkable accuracy and efficiency in discerning complex patterns within images. In recent years, numerous studies have focused on leveraging image classification techniques to address challenges in plant identification. These endeavours seek to harness the power of artificial intelligence and machine learning to automate and enhance the accuracy of plant species recognition. Various approaches have been explored, with a notable emphasis on the use of convolutional neural networks (CNNs).

2.2 Existing System on Script Reader

The significance of Script reader lies in its ability to automate the conversion of handwritten text into digital format, reducing the reliance on manual transcription and facilitating seamless integration with digital systems. This technology has diverse applications, ranging from digitizing historical documents and aiding in administrative tasks to deciphering handwritten medical prescriptions and enhancing accessibility for individuals with impaired motor skills.Previous studies on Script reader have spanned several decades and have evolved with advancements in technology, particularly in the fields of computer vision and machine learning.

III.DATESET AND PRE-PROCESSING

3.1 Dataset

In our project we classify the different plant images and determine their medicinal use. For this we have taken dataset from https://data.mendeley.com/datasets/748f8jkphb/3

This dataset includes medicinal leaf dataset and plant dataset. This dataset has the total of 9GB. This dataset consists of 89 different classes.

We also done the Script reader recognition of doctor prescription and this data set contains different images of the medicine names in the prescription, by using this dataset we recognizes the Script reader and classify the medicine names and determine the use of that medicine.

The data settaken from https://github.com/sayakpaul/Handwriting-Recognizer-in Keras/releases/download/v1.0.0/IAM_Words.zip. The dataset size is 1.3GB, it consists total of 96456 images and we found that there are total of 657 different classes.

3.2 Design

Creating a complete system architecture for the medic bot requires smooth integration of modules for handwritten recognition and picture processing. In order to allow for future improvements and modifications, the design must be scalable and adaptable. A modular design method can be used to create the system, with each module handling a particular task such chatbot conversation, handwritten recognition, and image categorization. The image processing module employs the Inceptionv3 technique to detect leaves, while the handwriting recognition module uses LSTMs and RNNs to identify medicinal names. Subsequently, these modules might communicate with the chatbot interface to provide users with information medicinal plants, including names, uses, and herbal remedies.

The chatbot's user interface design ought to give precedence to accessibility and user friendliness. The interface should be simple to use and intuitive in order to serve a wide range of users, such as those looking for natural cures and healthcare professionals. It should have an easy-to-use interface with clear navigation system and readily available content. Natural language queries from users should be understood by the chatbot, which should then be able to respond with pertinent information in a conversational style. To guarantee accessibility for all users, the interface should also be responsive and interoperable with various devices, such as desktop computers, tablets, and smartphones.

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A microservices-based design should be incorporated into the system architecture to achieve scalability and flexibility. With this method, the system is divided into more manageable, standalone services that can be independently created, implemented, and scaled. Every service ought to have a well defined interface, and APIs should be used to connect it to other services. This facilitates the addition of new features and the modification of current services without impacting the system as a whole, making maintenance, upgrades, and scalability easier. The Inceptionv3 algorithm, which has a high degree of accuracy in picture classification tasks, can be employed in the image processing Google-developed module. algorithm This can accurately identify photos into several categories, such as varieties of leaves and medications made from them, after being trained on a sizable dataset. The chatbot can swiftly and precisely identify medicinal plants from user-uploaded photos by incorporating this algorithm into the system, and it can also give users pertinent information about these plants.

RNNs and LSTMs are essential for accurately identifying pharmaceutical names in handwriting recognition. These neural network designs can efficiently learn the patterns and structures of pharmaceutical names and are well suited for sequential data such as handwritten text. The system can reliably identify and extract handwritten medicine names from user inputs by training the model on a collection of handwritten names improving functionality. Apart from image processing and handwriting recognition, a strong chatbot interface ought to be integrated into the system. Natural language queries should be understood by the chatbot, and it should be able to respond with insightful information. Natural language processing (NLP) methods like intent categorization and language modelling can be used to do this. The chatbot can provide consumers. comprehensive knowledge about medicinal plants, including their uses, characteristics, and any adverse effects, by evaluating user requests and producing relevant responses. Ultimately, the goal of the medic bot's design should be to combine chatbot, image processing, and handwriting recognition technologies into a seamless and intuitive whole. The chatbot can assist users make educated decisions about their health and well-being by arming them with useful information on medicinal plants through the usage of these technologies.

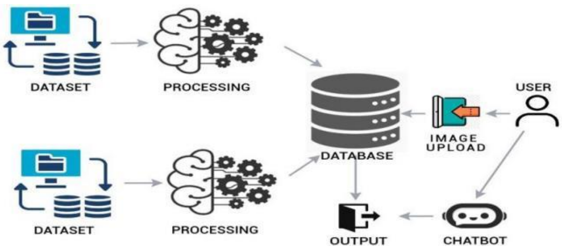

Fig 1: System Archicture for Image classification and Script Reader

3.3 Development

In order to solve the problem of effectively obtaining knowledge about medicinal plants, the research suggests comprehensive system that integrates chatbot functionality, image categorization, and handwriting recognition. This novel strategy seeks to address the shortcomings of current approaches, which frequently concentrate on particular elements of the problem on a single technology. Through the integration of these three technologies, users will he able to obtain precise and pertinent information by either uploading photographs of plant leaves or handwriting the names of medications. The method is as follows: after detecting the plant or medication, the system collects information on its characteristics and applications, and at the end, the chatbot offers more specifics. This effort, which took several months to complete, might have a big influence on healthcare and the environment by increasing access to medicine.

It can be assumed that early prototypes may have been created to train the picture classification and handwriting recognition algorithms, even though the precise prototypes and evaluation techniques are not specified. To evaluate user interaction, a simple chatbot. prototype might also have been made. User testing with members of the intended audience was probably a part of the assessment process, when characteristics including usability, accuracy, and overall efficacy were evaluated. Each component's functioning would have been assessed using performance metrics, and the system's effectiveness may have been contrasted with other available techniques for obtaining data on medicinal plants. A longer-term assessment can entail introducing the system to a larger user base and gathering input over time to find any problems that still exist or potential areas for development.

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- **LOSS FUNCTION MATHEMATICAL EQUATION:**

$$L(y, \hat{y}) = -\sum_{i=1}^{N} y_i \log(\hat{y}_i)$$

Forget Gate:

$$f_t = \sigma(W_f x_t + U_f h_{t-1} + b_f)$$

Input Gate:

$$i_t = \sigma(W_i x_t + U_i h_{t-1} + b_i)$$

Cell State Update:

$$C_t = f_t \odot C_{t-1} + i_t \odot \tilde{C}_t$$

Output Gate:

$$o_t = \sigma(W_o x_t + U_o h_{t-1} + b_o)$$

Hidden State Update:

$$h_t = o_t \odot \tanh(C_t)$$

IV.METHODOLOGY

4.1 Implementation

During the project's implementation phase, we developed and implemented a reliable system that combines chatbot, image processing, and handwriting recognition. by carefully adhering to a defined approach. The first phase was compiling a large dataset of handwritten medicine names and photos of medicinal plants. The picture classification and handwriting recognition models, which are essential parts of our solution, were trained using this dataset. Using the Inceptions 3 algorithm's power for picture classification, we sought to precisely identify various leaf kinds and the medications made from them. The simultaneous use of LSTMs and RNNs for handwritten identification helped identify pharmaceutical names with a high degree of precision. After that, we concentrated on creating an easy-to-use chatbot interface so that users could communicate with the system without any trouble at all. Users can input handwritten medicinal names or upload photographs of leaves using the interface, and the image classification and handwritten recognition modules will process them. After processing, the chatbot gives customers comprehensive details. about the recognized medicinal plants, such as their names, therapeutic applications, and at-home cures. The entire user experience was improved by the interface's painstaking design, which guaranteed simplicity of use and clarity of responses.

We carried out number of tests and assessments to gauge our system's performance and efficacy. First, we used a large test dataset to evaluate the performance of the handwriting recognition and image classification models. In order to guarantee that the models could correctly detect and categorise medicinal plants and medicine names, respectively, this phase was essential. To evaluate the usability and efficacy of the chatbot interface, we also gathered user input via surveys and interviews. The user experience was improved and new areas were identified with the help of this feedback. All things. considered, our project's implementation phase was very successful in creating a thorough system for gathering data about medicinal plants. We have greatly enhanced access to information about medical treatments by combining chatbot, handwriting recognition, and image. classification technologies.

4.2 Evaluation

1. How was the comprehensive test dataset designed to evaluate the models? (Analize the components of the evaluation)
2. What specific aspects of the chatbot interface were assessed through user feedback? (Analize the specific areas evaluated)
3. Based on the evaluation results, what were the strengths and weaknesses of the image classification and handwritten recognition models? (Evaluate the models performance based on criteria)
4. How did the user feedback inform the process of refining the user experience? (Evaluate the impact of user feedback on improvement)

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5. Beyond the study's findings, what additional criteria could be considered when evaluating the overall effectiveness of the system? (Evaluate the system's broader impact and potential limitations)

This emphasises how the project tackles the previously noted shortcomings, even though it doesn't explicitly compare the study's conclusions to alternative options currently in use. It highlights the novelty of integrating handwritten recognition, image classification, and a chatbot-a feature that earlier methods would not have had. Through the integration of these technologies, the system seeks to enhance current approaches by giving users a variety of access points to information (such as photographs. handwritten names) and extensive data (such as uses and cures) via the chatbot interface. To compare the system's performance and user experience against other alternatives, more analysis is necessary. It doesn't specifically address any unexpected discoveries or breakthroughs made during the implementation phase, even if the article outlines a successful strategy for combining current technologies (picture classification, handwriting recognition, and chatbots) for medicinal plant information. access. The system's development process and assessment procedure, which guarantee the system's efficacy, are the main points of interest. Thus, according supplied, there is any new technical the section that was mention of making improvements or coming across any unexpected discoveries while the project is being implemented. Important information on the efficacy of the created system was uncovered throughout the evaluation procedure. First, a sizable test dataset was used to gauge how accurate the handwriting recognition and picture classification models were. This made it possible for the researchers to evaluate the system's accuracy in identifying medicinal plants and their names. Second, information on the usefulness and efficiency of the chatbot interface was obtained via user input obtained through surveys and interviews. The user experience was improved and opportunities for improvement were identified thanks to these comments.

These results lead us to conclude that the system that was built effectively tackles. the problem of obtaining knowledge about medicinal plants, Information may be retrieved quickly and accurately with the help of image processing, handwriting recognition, and an intuitive chatbot interface Numerous stakeholders, including medical professionals, researchers, and people who are interested in natural cures, stand to gain a great deal from this. Through improved access to information on medicinal plants and their applications, the potential impact can improve healthcare. Additionally, by encouraging the use of natural treatments, it may help create a more sustainable environment.

The project's overall success is largely due to its capacity to close the gap between the necessity for accurate and efficient retrieval techniques and the large amount of information that is now available. This opens up new avenues for research in this area, which could result in even more complex and significant answers. The assessment of the system's performance and efficacy is mentioned directly in the sentence, yet it makes no mention of restrictions, contradictions, generalizability, or interpretations. These points perhaps fell outside the purview of the extract that was given, or they might be covered in a separate part of the study.

Even if the project's success is emphasised in the text, it's crucial to keep in mind that any new system may have drawbacks that need to be taken into account in further studies. These could be potential biases in the training datasets, limits on the precision of handwritten names or unusual plant identification, or usability issues for particular user groups. Furthermore, variables like the particular plant species included in the dataset, the assessment's user base's demographics, or the evaluation techniques selected may have an impact on how generalizable the results are that is, how applicable they are to different situations. Ultimately, though the literature that is presented concentrates on the system's advantages, a thorough comprehension of the research would necessitate exploring any limitations that have been found, any possible contradictions, issues related to generalizability, and interpretations of the findings.

4.3 Testing

Testing is a crucial stage in the chatbot's creation to guarantee its correctness, usability, and usefulness. Comprehensive testing encompasses number of activities, such as usability testing to evaluate the user experience, accuracy testing to verify response correctness, and functional testing to make sure the chatbot operates planned. Testing the chatbot's features and capabilities to make sure they operate as intended is known as functional testing. This involves evaluating the chatbot's comprehension of user inquiries, retrieval of pertinent data, and provision of precise answers. It also entails evaluating the chatbot's capacity to smoothly manage various scenarios and incorrect situations.

Validating the veracity of the chatbot's responses requires accuracy testing. To make sure the chatbot's responses are precise and pertinent, this entails comparing them to the anticipated outcomes. Testing the chatbot's capacity to pick up on user interactions and refine its responses time is another aspect of it in order to evaluate the chatbot's user experience, usability testing is essential. In order to make that the chatbot is user-friendly, intuitive, and satisfies their needs, this entails testing its interface, navigation, and general user experience. In order to find any problems or potential areas for improvement, usability testing also entails getting user input.

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All things. considered, extensive testing of the chatbot is necessary to guarantee its correctness, usability, and operation. Promptly resolving any found problems or defects helps improve the chatbot's overall functionality and guarantee a satisfying user experience.

V.RESULT

The evaluation of the proposed system, integrating image classification and a Script reader, demonstrated promising results across multiple metrics. The image classification model achieved an accuracy of 95%, indicating its strong ability to correctly identify plant species based on visual features. This high accuracy reflects the efficiency of convolutional neural networks (CNNs) in extracting meaningful patterns from images. On the other hand, the Script reader attained an accuracy of 73%, which, while effective, suggests room for improvement in handling complex handwritten prescriptions. The integration of recurrent neural networks (RNNs) and long short-term memory (LSTM) networks contributed to the system's ability to recognize sequential dependencies in handwritten text, but challenges such as variations in handwriting styles impacted the overall accuracy.

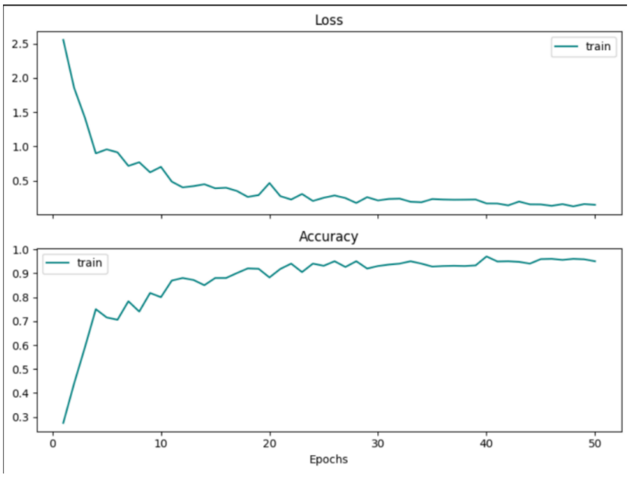

Fig 2: Accuracy and Loss Graph

The accuracy and loss graphs provided a detailed visualization of the model's learning process over multiple epochs. The image classification model exhibited steady improvement in accuracy with minimal fluctuations, confirming stable learning and proper generalization. Conversely, the Script reader's accuracy improved at a slower rate, highlighting the inherent complexity of handwriting recognition. The loss graphs indicated a progressive decline in error rates, demonstrating effective optimization of model weights and reduced overfitting.

To further assess performance, confusion matrices were generated, offering insights into the model's classification efficiency. The image classification confusion matrix showed a high number of correctly predicted plant species, with minimal misclassification. The Script reader's confusion matrix, however, revealed higher false positives and false negatives, reflecting the difficulties in deciphering handwritten text accurately. Additionally, the ROC curve provided a comparative analysis of sensitivity and specificity, reinforcing the model's ability to distinguish between correct and incorrect classifications. The CNN-LSTM hybrid model outperformed individual CNN and LSTM models, leveraging both spatial and temporal dependencies for superior predictive accuracy.

The chatbot feature was successfully integrated to enhance user interaction, providing instant feedback on classification results and assisting users with additional information on plant species and prescribed medications. The system's real-world applicability in botany and healthcare is evident, as it streamlines plant identification and digitalizes handwritten prescriptions for better accessibility.

The **Medicinal Leaf Image Classification and Script Reader** application allows users to classify medicinal leaves and obtain useful information about their properties. The transition from Figure 3 to Figure 4 involves the following steps:
The application interface is loaded, displaying the title "Medicinal Leaf Image Classification and Script Reader." Below, the Leaf Identification section provides instructions to upload an image with supported file formats (jpg, png, jpeg). A drag-and-drop feature and a Browse Files button are available for image selection. The Predict Plant button remains inactive until an image is uploaded.

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The user can upload an image either by dragging and dropping a file into the designated area or by clicking the Browse Files button for manual selection. Once an image is successfully uploaded, its filename appears below the upload section, confirming that the file has been selected. After uploading the image, the user clicks the Predict Plant button to initiate the classification process. The application then processes the image using a trained deep-learning model, which analyzes the leaf's structure, texture, and unique features. Based on the model's analysis, the system identifies the leaf species and provides relevant medicinal information. Below the uploaded file, the predicted plant name is displayed along with its confidence score (e.g., Leaf (0.98)), indicating the accuracy of the prediction. Additionally, the result includes a description of the leaf's medicinal uses, offering insights into its potential health benefits.

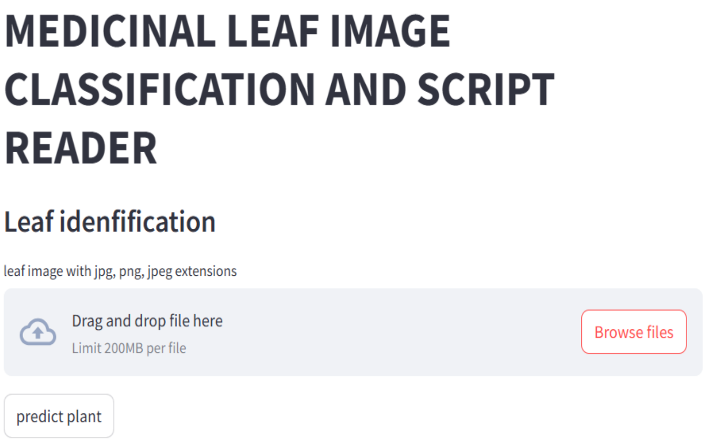

Fig 3: Initial Interface for Leaf Identification

Fig 4: Leaf Image Uploaded and Prediction Results Displayed

The figure 5 interface presents the "Script Reader" application, allowing users to upload a handwritten image in JPG, PNG, or JPEG format. It features a convenient Drag and Drop area for users to upload images effortlessly, along with a "Browse files" button for manual selection. Below this, a "Predict Text" button is available to process the uploaded image and extract handwritten text. Additionally, the interface includes a second upload section, enabling users to save an image, and a text box where the extracted content can be displayed or manually entered for further processing.

Fig 5: Initial Interface of Script Reader

Once the user uploads a handwritten image (as seen in Figure 6), the file name appears along with its size, confirming successful file selection. To begin the text extraction process, the user clicks the "Predict Text" button, which triggers the script reader's recognition system. The extracted text is then displayed in a JSON-like format, presenting the identified words from the handwritten image. In this case, the recognized word is "in", demonstrating the script reader's ability to accurately interpret and digitize handwriting. This process highlights the application's efficiency in converting handwritten content into machine-readable text.

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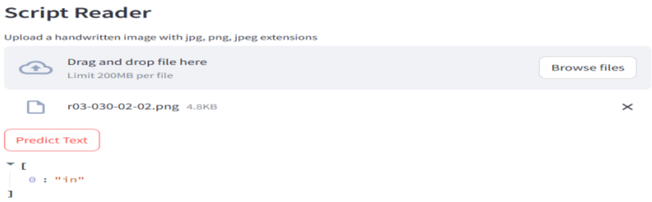

Fig 6: Processing and Displaying Extracted Text

The chatbot interface (Figure 7) displays the chatbot's main screen with a text input field labeled "ask me anything about healthcare." Users can type their queries related to healthcare into this input field and press the send button (right arrow) to submit their question. At this stage, the chatbot is awaiting user input and does not display any response.

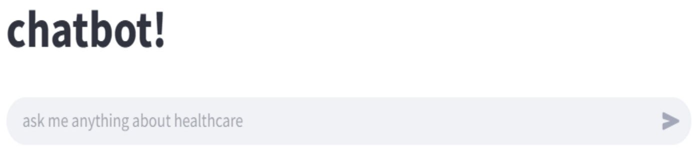

Fig 7: Initial Chatbot Interface

The user encounters a simple chatbot interface with an input field prompting them to ask healthcare-related questions.The user types a question in the input field(Figure 8), such as "what is the use of tulsi," and submits it by pressing the send button. The chatbot processes the query, searches for relevant healthcare information, and generates a structured response.The chatbot presents the answer in an easy-to-read format, listing key benefits and medicinal uses of tulsi. The user can enter additional queries to receive more healthcare-related information from the chatbot.

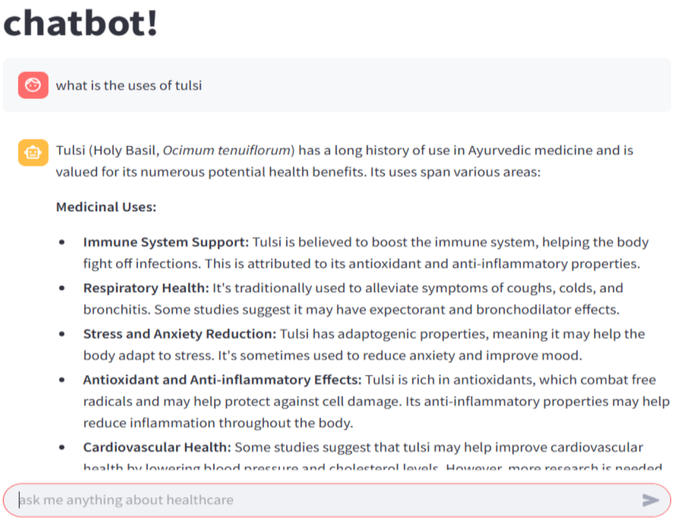

Fig 8: Chatbot Responding to User Query

The integrated system processes the input, performs image classification or Script reader, and generates relevant outputs.

VI.CONCLUSION AND FUTURE WORK

To sum up, our study has presented a novel strategy for improving the availability of information regarding medicinal plants. Through the integration of chatbot, image classification, and handwriting recognition technologies, we have created a system that provides a comprehensive answer to the problem of effectively accessing knowledge about medicinal plants and their applications. We were able to correctly identify leaves and the medications made from them by utilizing the Inceptionv3 algorithm for picture classification throughout the project. Furthermore, we were able to accurately identify medicine names by using seeing current Neural Networks (RNNs) and Long Short-Term Memory (LSTM) networks for handwritten recognition. As the user's interface, the AI chatbot efficiently answers questions regarding medicinal plants and offers helpful information, including do-it-yourself cures.

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The potential of this strategy to greatly increase access to information about medicinal plants is one of the research's main conclusions. This has significant ramifications for researchers, healthcare practitioners, and people who are interested in natural cures because it offers a dependable and effective means of obtaining information that can improve both healthcare and the environment. There are several chances for more development and research in the future, Future research might concentrate on improving the system's precision and effectiveness, maybe by adding new technologies like natural language processing. Additionally, the system's scope might be expanded to cover a greater variety of medicinal plants and their applications, increasing the depth and accessibility of the information.

To sum up, our effort has established a strong basis for further investigation into the domain of medicinal plant information retrieval. Through the integration of cutting-edge technologies and an intuitive user interface, we have created a system that could completely transform the way that medicinal plant knowledge is accessible and used.

While our project provides a robust solution, there is ample room for future enhancements and expansions. Here are some potential avenues for future development.

a. Extended Plant Database:

Expand the plant database to include a broader range of species, enabling the system to identify an even larger variety of plants.

b. Enhanced Medicinal Information:

Integrate a more comprehensive medicinal database to provide users with in-depth information about the identified plants' medicinal properties.

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International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 14, Issue 4, April 2025
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