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AGRICULTURE HELPER CHATBOT FOR SMART AGRICULTURE USING ARTIFICIAL INTELLIGENCE

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ABSTRACT

In the year 2020, agriculture contributes about 19.9% of India's GDP and employed about 60% of the country's population which makes it important part of the country's economic growth. Till 2018, it was about 15.41% only but now it has been increased with the help of the latest technologies like IOT, AI, CHATBOT etc. The proposed system is a mobile apps which was developed to assist the farmers by two ways, the voice bot and the suggestion bot. To respond the farmer's queries in the multi-language, we have created an agricultural multi linguistic voice bot using Google translator, pysttsx3 and Google search engines. Also, we have the suggestion bot to give a versatile suggestion to the answer of farmer's query related to weather, crop, fertilizer, soil etc. Using this mobile apps, farmers will progress towards better farming practices and increase the agricultural production.

Agriculture is considered to be the backbone of India. There are many people who are involved in farming mostly belong to the lower class and are stuck in poverty. The emergence of middlemen in the Indian agricultural marketing sector can be traced back to as early as bartender system times. The interference of middlemen has led to poor lifestyle for the farmers since time immemorial. The development of a portal will serve as a way for the farmers to sell their products across the country. The portal helps the farmers in registering themselves easily and selling their produce.

Keywords: Conversational AI, NLP, Smart Agriculture, IoT**,** Farming.

I. INTRODUCTION

The agriculture sector scenario in India, providing support is a very challenging. The strength of small and marginal farmers and landless laboure is in millions - their knowledge on agro technology and farming is less, many live in remote areas. Traditionally government workers and field officers visit the fields and interact with farmers in villages and provide them training on best practices in farming and aspects of agriculture. In recent years, agriculture has seen a growth in usage of Information & Communication Technology (ICT).

II. METHODOLOGY

NLP is at the heart of conversational AI. Figure 1 depicts the high-level architecture components of of Conversational AI.

NLP Engine:

Natural Language Processing (NLP) engine makes use of artificial intelligence technology tobetter understand a sentence or phrase based onthe user input query. Chatbots are developed based on a rule-based engine that requires detailed queries to be provided which results in results being large and inefficient. NLP engine extracts data and returns actionable results that comprises of predictable intents, entities (both standard and custom) and user requests from expressions.

Bot Builder:

The Bot builder which is also indicated as the runtime of the dialogue, which is a Graphical User Interface (GUI) where the interaction flowcan be created by the user. This is the place where user would indicate the bot how to respond to user's input messages. A bot builder provides a distinctive user experience environment which accelerates the complete botdevelopment process.

Bot Logic:

It is Cloud platform, which is responsible for invoking and consuming OData services or APIsfrom the back-end

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database and system and exposing that information to conversational AI, the Bot logic can be written and exposed as a web API in any programming language of the developer's choice.

Bot Connector:

It is an adaptor that enables CAI to connect to many channels of communication, like messenger, webchat, slack, Microsoft teams, etc. Based on customer specifications, the Bot connector may be hosted on on-premises system also.

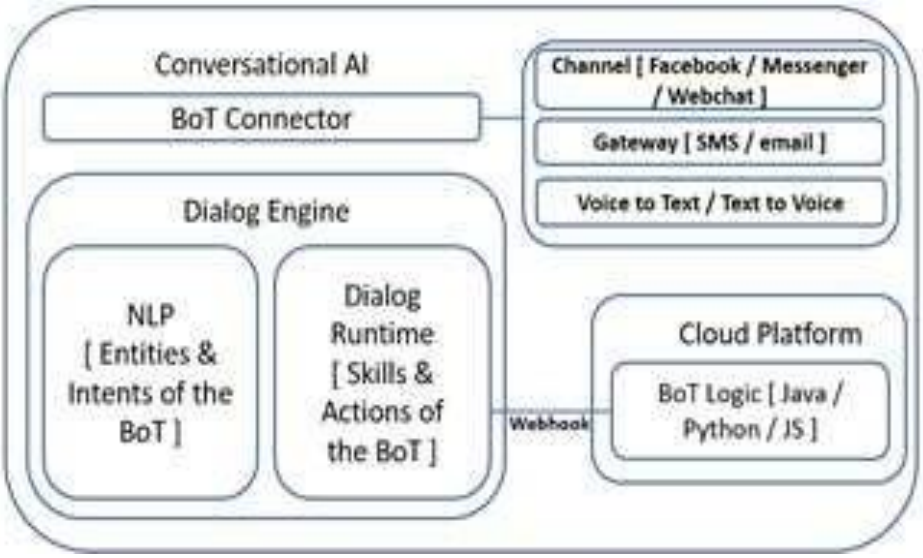

Figure 1: Conversational AI Bot building framework used to build Farmer's Friend chat bot

III. PROPOSED MODULES

The Agriculture Helper Chatbot serves as an intelligent virtual assistant specifically designed to provide valuable information, guidance, and support to farmers and agriculture professionals. Here are some key functions of the Agriculture Helper Chatbot:

1. **Information Retrieval:** The chatbot functions as a knowledge repository, providing farmers with access to a vast amount of agricultural information. Users can ask queries related to crop cultivation techniques, pest management, soil health, market trends, and more. The chatbot retrieves relevant information from its database and presents it to the user in a concise and understandable manner.

2. **Recommendations and Suggestions:** The chatbot offers recommendations and suggestions based on user queries and contextual information. It can provide guidance on crop selection, planting methods, irrigation techniques, fertilization schedules, pest control strategies, and other agricultural practices. The recommendations take into account factors such as location, crop preferences, and specific farming conditions.

3. **Diagnosis and Problem-Solving:** The chatbot assists in diagnosing crop diseases, pest infestations, and nutrient deficiencies. Farmers can describe the symptoms or upload images of affected crops, and the chatbot uses image recognition technology and machine learning algorithms to identify the problem. It then provides appropriate solutions and treatment recommendations.

4. **Weather Updates and Alerts:** The chatbot integrates with weather APIs to provide real-time weather updates, forecasts, and alerts. It helps farmers make informed decisions regarding irrigation, crop protection, and harvesting based on current and future weather conditions.

5. **Crop Management and Recommendations Module:**

Offers personalized recommendations for crop management practices, including planting, irrigation, fertilization, and pest control. Takes into account factors like soil type, climate, and crop type to suggest optimal practices.

6. **Market Prices and Trends Module:**

Provides real-time market prices for various crops and agricultural products. Analyzes market trends and offers insights to help farmers make informed decisions regarding their produce.

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7. Disease and Nutrient Deficiency Diagnosis Module:

Utilizes machine learning models to diagnose crop diseases and nutrient deficiencies based on user-provided symptoms or images. Recommends appropriate treatments and preventive measures.

8. Livestock Management and Care Module:

Offers guidance on raising and managing livestock, including feeding, breeding, health care, and disease management. Provides solutions to common livestock-related issues.

9. Government Policies and Subsidies Module:

Informs users about relevant government agricultural policies, subsidies, grants, and financial assistance available to farmers.

10. Farming Tips and Best Practices Module:

Provides a repository of farming tips, best practices, and success stories to help farmers improve productivity and efficiency.

11. FAQ and Troubleshooting Module:

Addresses frequently asked questions and provides troubleshooting solutions for common agricultural problems. Offers a knowledge base for users to find quick answers to their queries.

12. User Authentication and Data Security Module:

Implements user authentication to ensure secure access to sensitive data. Ensures data security and privacy for user interactions.

13. Chatbot Training and Feedback Module:

This module continuously trains the chatbot using user feedback and conversation history to improve responses and interactions. Allows users to provide feedback on the chatbot's performance. Each of these modules contributes to the overall functionality of the agriculture helper chatbot, enabling it to offer valuable insights, personalized recommendations, and timely assistance to farmers, thus enhancing their productivity and efficiency in agricultural practices.

IV. MODELING AND ANALYSIS

SYSTEM ARCHITECTURE

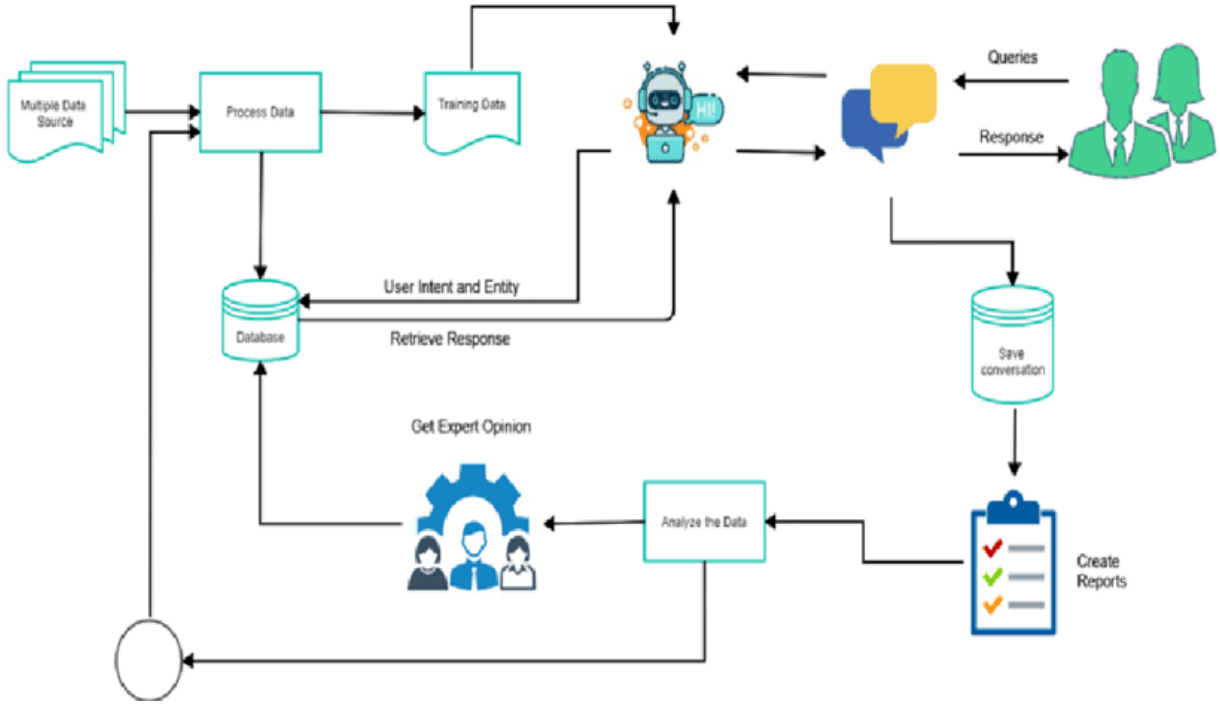

Figure 2: System Architrcture

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V. PROPOSED ALGORITHM

Convolutional neural network

CNN is a renowned deep learning model that handles data complexity during computation very well. Convolutional layers, dropout layer, activation layers, a flatten layer, and a pooling layer make up the CNN model. In CNN, the main layer is the convolutional layer, which extracts features, while the pooling layer reduces the size of these extracted features, the dropout layer reduces the overfitting, and the flatten layer transforms the data into an array.

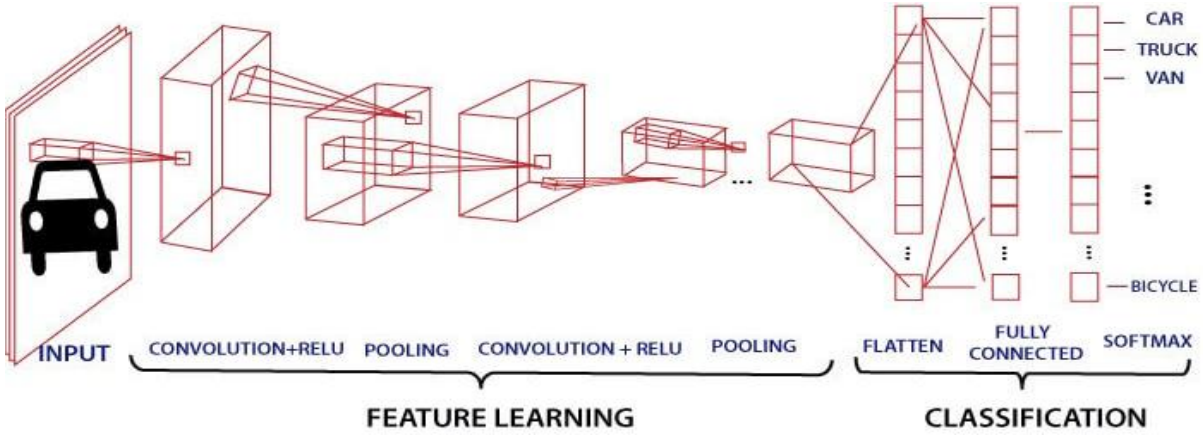

Figure 3: Convolutional Neural Network

Convolution Layer

Convolution layer is the first layer to extract features from an input image. By learning image features using a small square of input data, the convolutional layer preserves the relationship between pixels. It is a mathematical operation which takes two inputs such as image matrix and a kernel or filter.

Current TimeÂ 0:00

/

DurationÂ 18:10

Â

The dimension of the image matrix is **h×w×d**.

The dimension of the filter is $\mathbf{f_h \times f_w \times d}$.

The dimension of the output is $\mathbf{(h-f_h+1)\times(w-f_w+1)\times 1}$.

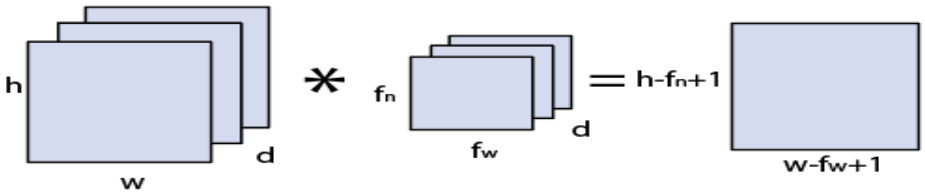

Image matrix multiplies kernl or filter matrix

Figure 4:

Let's start with consideration a 5*5 image whose pixel values are 0, 1, and filter matrix 3*3 as:

$$\begin{bmatrix} 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$$

5 × 5 — Image Matrix 3 × 3 — Filter Matrix

Figure 5:

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The convolution of 5*5 image matrix multiplies with 3*3 filter matrix is called "**Features Map**" and show as an output.

$$\begin{bmatrix} 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 4 & 3 & 4 \\ 2 & 4 & 3 \\ 2 & 3 & 4 \end{bmatrix}$$

Convolved Feature

Figure 6:

Convolution of an image with different filters can perform an operation such as blur, sharpen, and edge detection by applying filters.

Strides

Stride is the number of pixels which are shift over the input matrix. When the stride is equaled to 1, then we move the filters to 1 pixel at a time and similarly, if the stride is equaled to 2, then we move the filters to 2 pixels at a time. The following figure shows that the convolution would work with a stride of 2.

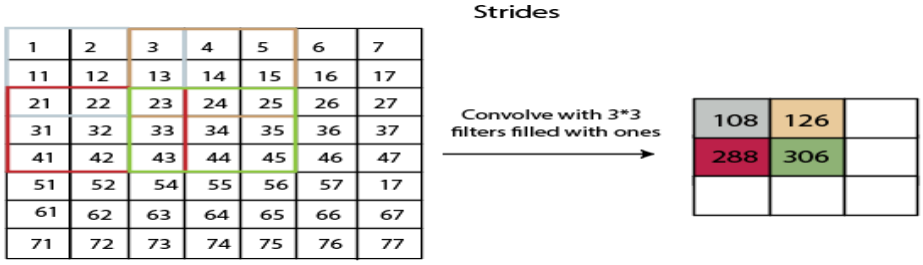

Figure 7:

Padding

Padding plays a crucial role in building the convolutional neural network. If the image will get shrink and if we will take a neural network with 100's of layers on it, it will give us a small image after filtered in the end.

If we take a three by three filter on top of a grayscale image and do the convolving then what will happen?

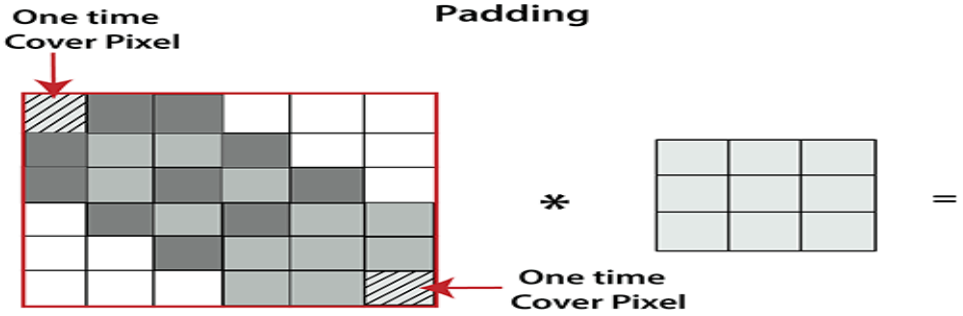

Figure 8:

It is clear from the above picture that the pixel in the corner will only get covers one time, but the middle pixel will get covered more than once. It means that we have more information on that middle pixel, so there are two downsides:

- Shrinking outputs
- Losing information on the corner of the image.

To overcome this, we have introduced padding to an image. **"Padding is an additional layer which can add to the border of an image."**

Pooling Layer

Pooling layer plays an important role in pre-processing of an image. Pooling layer reduces the number of parameters when the images are too large. Pooling is "**downscaling**" of the image obtained from the previous layers. It can be compared to shrinking an image to reduce its pixel density. Spatial pooling is also called down

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sampling or subsampling, which reduces the dimensionality of each map but retains the important information. There are the following types of spatial pooling:

Max Pooling

Max pooling is a **sample-based discretization process**. Its main objective is to downscale an input representation, reducing its dimensionality and allowing for the assumption to be made about features contained in the sub-region binned.

Max pooling is done by applying a max filter to non-overlapping sub-regions of the initial representation.

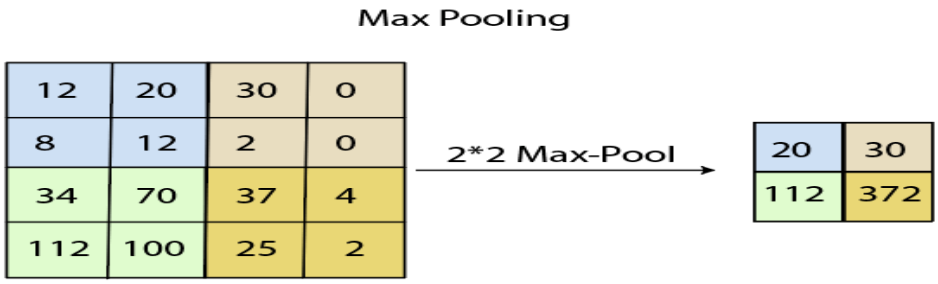

Figure 9:

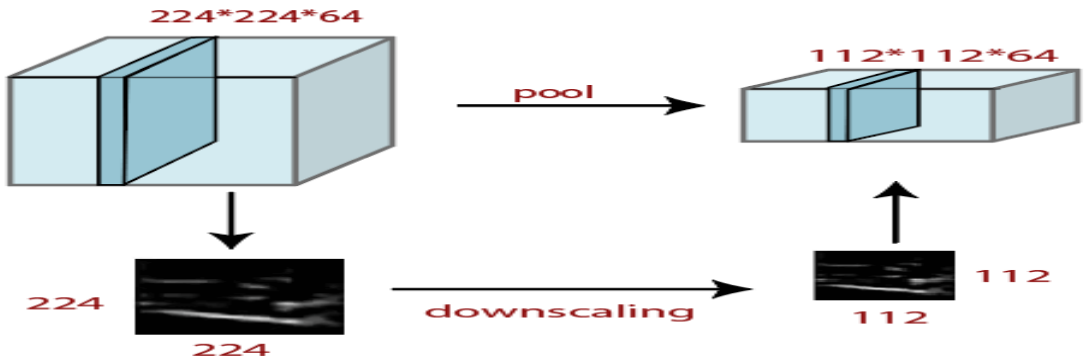

Figure 10:

Average Pooling

Down-scaling will perform through average pooling by dividing the input into rectangular pooling regions and computing the average values of each region.

Syntax

layer = averagePooling2dLayer(poolSize)

layer = averagePooling2dLayer(poolSize, Name, Value)

Sum Pooling

The sub-region for **sum pooling** or **mean pooling** are set exactly the same as for **max-pooling** but instead of using the max function we use sum or mean.

Fully Connected Layer

The fully connected layer is a layer in which the input from the other layers will be flattened into a vector and sent. It will transform the output into the desired number of classes by the network.

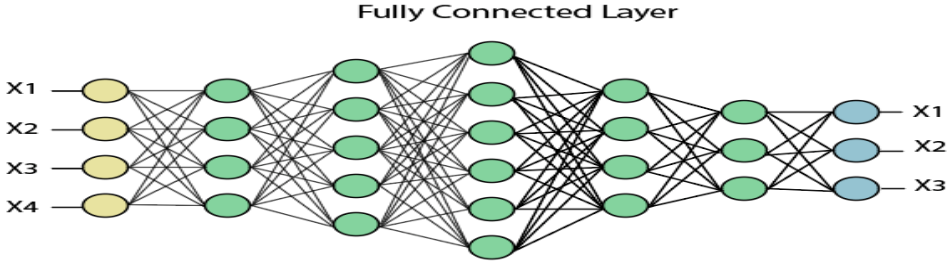

Figure 11:

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In the above diagram, the feature map matrix will be converted into the vector such as **x1, x2, x3... xn** with the help of fully connected layers. We will combine features to create a model and apply the activation function such as **softmax** or **sigmoid** to classify the outputs as a car, dog, truck, etc.

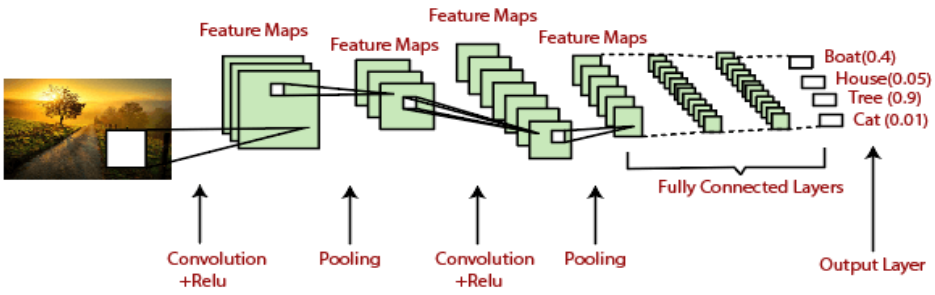

Figure 12:

VI. RESULTS AND DISCUSSION

To run project double click on 'runServer.bat' file to start python DJANGO web server similar to below screen

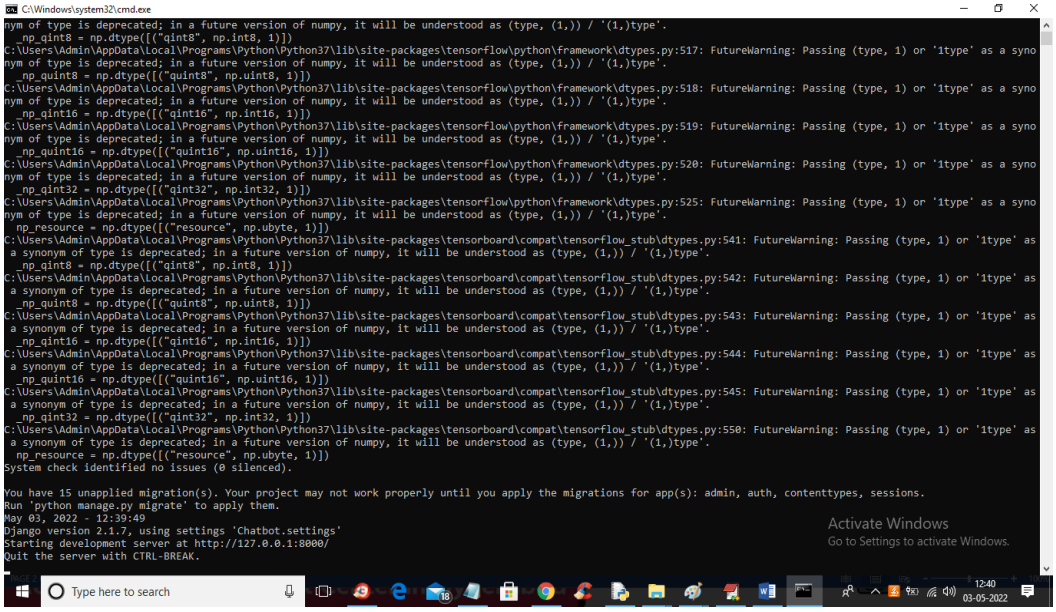

Figure: 13. Run DJANGO Server

In above screen DJANGO server started and now open browser and enter URL as 'http://127.0.0.1:8000/index.html' and press enter key to get below screen

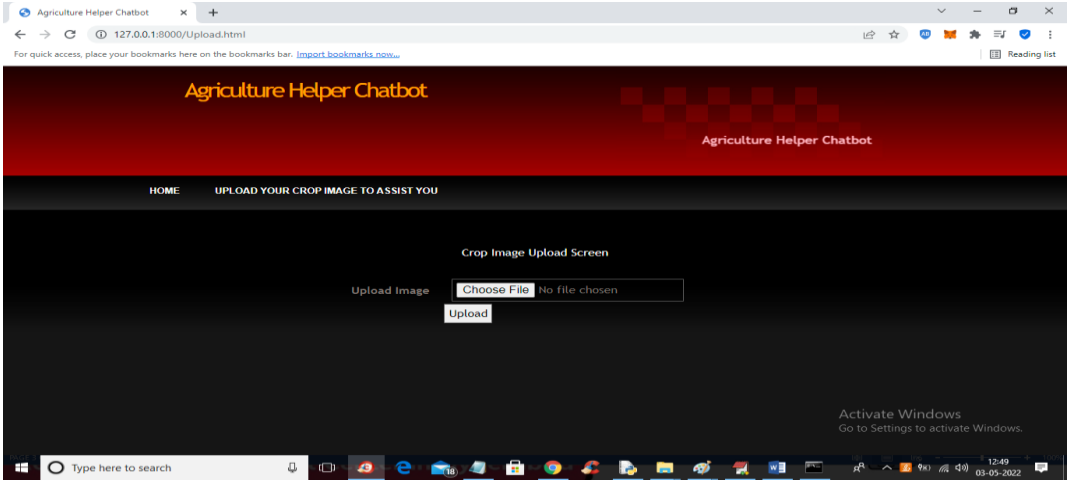

Figure: 14. Upload Your Crop Image to Assist You

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In above screen click on 'Upload Your Crop Image to Assist You' button to upload crop disease image like below screen

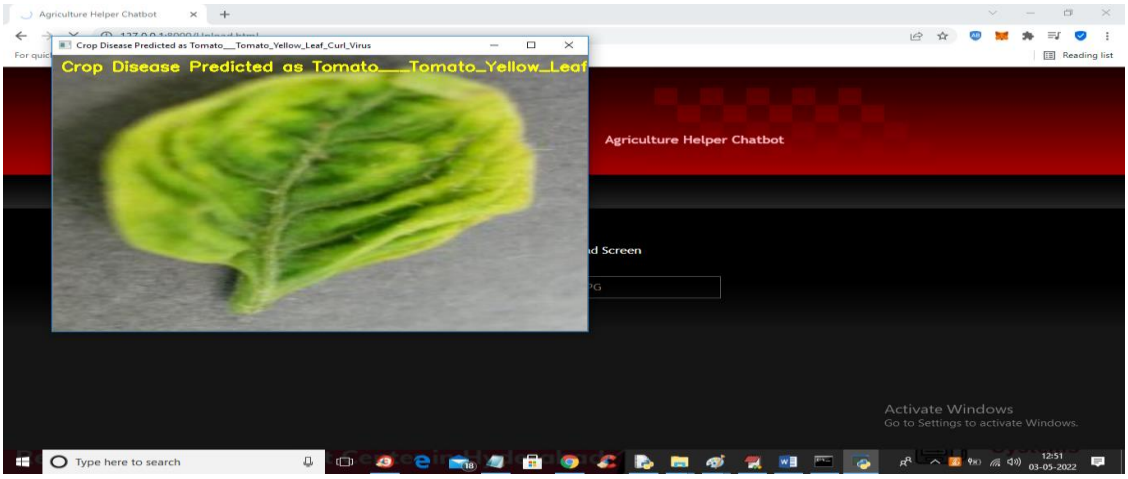

Figure: 15. crop disease prediction

In above screen in yellow colour text we can see crop disease predicted as 'Tomato Yellow Leaf curl' disease and now close above image to get possible remedies from chat bot

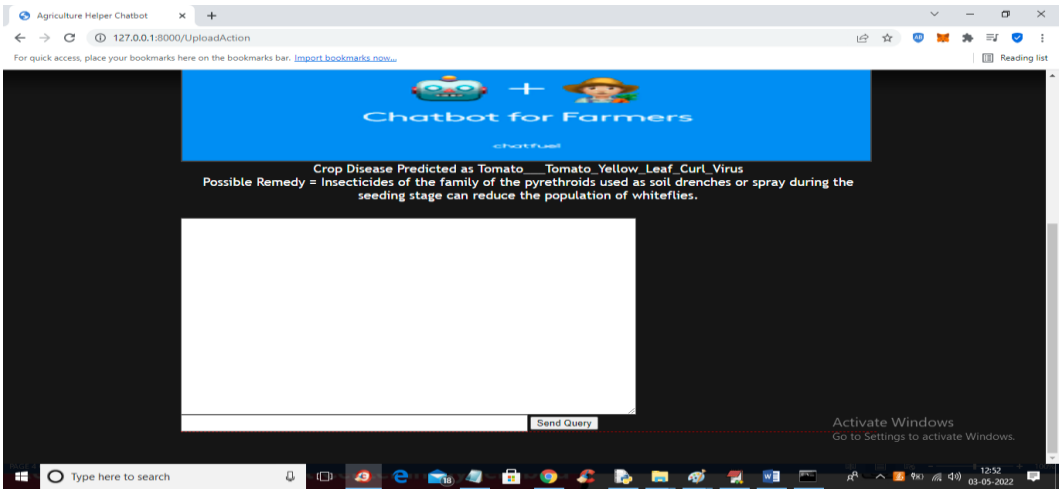

Figure: 16. post queries to Chatbot

In above screen in white colour text we can see crop disease name and then displaying possible REMEDIES and now user can post queries to Chatbot by entering query in text field

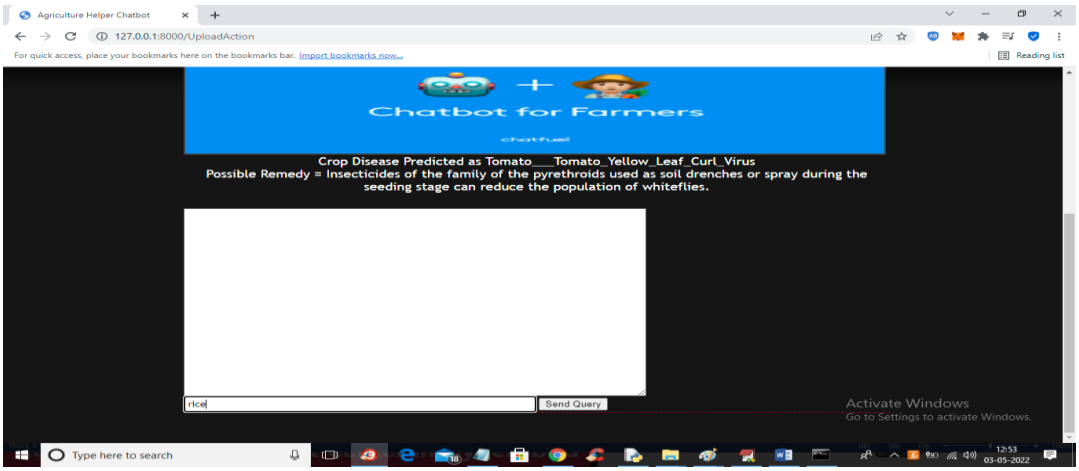

Figure: 17. Rice details and then click on 'Send Query'

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In above screen I entered query as 'rice' to know information on rice details and then click on 'Send Query' button to get below output

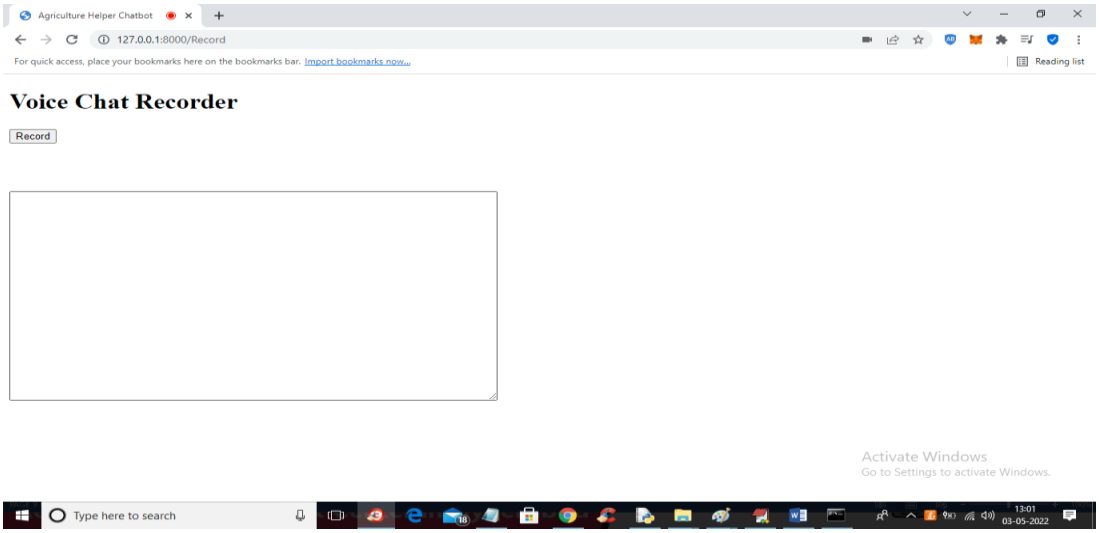

Figure: 18. 'Record' voice

In above screen now you can 'Record' voice and send to Chatbot

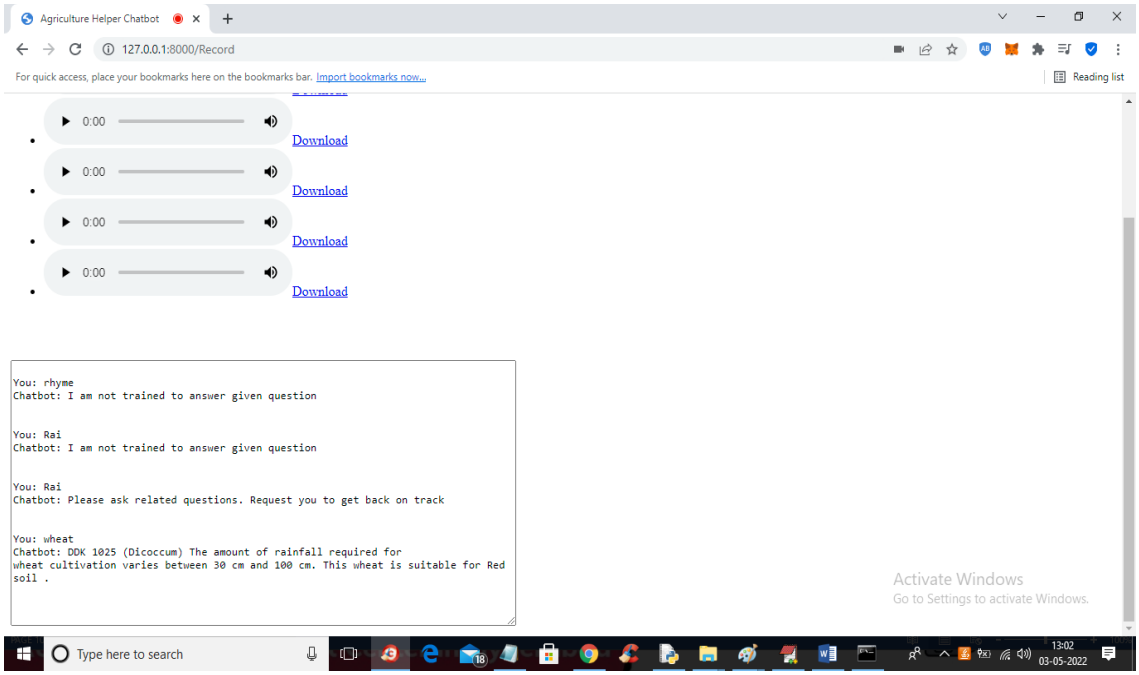

Figure: 19. Chatbot replied 'Not Trained'

In above screen I tried for voice command as 'rice' but it was not cleared voice so Chatbot replied 'Not Trained' and then I said voice command as 'wheat' to get suitable condition for sowing wheat. Similarly you can ask any question.

VII. CONCLUSION

Finally, I conclude that farmer's assist voice Bot system will help farmer communities by answering queries related to agriculture. Via this app, the farmer will be able to access the agricultural information as well as localized information including weather forecasts, best crop for plantation and fertilizer. This system will allow farmers of different regions who speak different languages to ask questions at any time. The voice bot will respond to the queries of the farmer in their regional language and also suggest the crop, fertilizer based on weather and soil which allow the modern farming technology to reach a larger number of farmers. As the future

work, we have planned to identify the diseases in crops and their remedies [3][4]. Further, we can also suggest the best plant and the harvest time based on the market price, climate and soil [2].

VIII. FUTURE SCOPE

The future scope of an agriculture helper chatbot powered by Artificial Intelligence is promising and transformative. Such a chatbot can revolutionize smart agriculture by providing real-time insights and recommendations to farmers. With AI's ability to analyze vast amounts of data from sensors, drones, and other sources, the chatbot can offer precise guidance on planting, irrigation, pest control, and harvesting. It could also predict weather patterns and market trends, aiding farmers in making informed decisions. As technology advances, integrating machine learning and image recognition could enhance the chatbot's capability to identify plant diseases and nutrient deficiencies. By fostering sustainable practices and optimizing resource usage, this AI-powered chatbot has the potential to significantly increase crop yield, reduce environmental impact, and contribute to food security on a global scale.

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