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Disease Detection Application for Crops using Augmented Reality and Artificial Intelligence

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Abstract - *Day by day the world is transforming with the help of technology. In every field, there is automation for the work done. 'Agriculture' is also one of the most important part for the use of technology. As food belongs to our basic needs, therefore the way of farming should be changed and improved. Plant diseases are a major threat to farmers, the environment and the global economy. These adverse effects can be avoided by early disease detection, surveillance of crops. Most diseases of plants are diagnosed by agricultural experts by examining external symptoms. However, farmers have limited access to agricultural experts. Nowadays, 'Artificial Intelligence' (AI) is one of the emerging technologies. So, with the help of AI, we can change the way of farming. With an innovative application of Augmented Reality, the system intends to aid the rural farmer in the identification of the bugs and pest management. The system uses Augmented Reality for aiding the farmers in insect identification and pest management. This smart identification system would suggest the farmers appropriate pesticides and treatments for the bugs. The aim of creating this application is to improve the quality of plants and fruits with the help of AI. Using technology, we can look for solutions, which can be used for the betterment of crops and for increasing the production of food. With the help of AI will compare the Leaves and Fruits of the plant with their ideal condition for the given period of time and give suggestions about the various fertilizers, pesticides and some important ingredients required to that specific plant for its improvement.*

***Key Words*: Android, Google cloud, Agriculture, Augmented Reality**

1. INTRODUCTION

Agriculture is the main occupation of the people in the rural part of India. Crops worth Rs.50,000 crore are lost due to pest and disease attacks every year therefore pesticide consumption is low in India, according to a study. "This huge crop loss could be attributed to low pesticide consumption in India," said the joint study by industry body Yes Bank and Assocham. Pesticide usage in India is less than two percent of global consumption and is confined to one-fourth of the total arable land of about 180 million hectares. For populated countries like India, it is even more imperative to increase the productivity of crops, fruits and vegetables. Not only productivity, but the quality of products also needs to stay high for better public health. However, both productivity and quality of food get hampered by factors such as the spread of diseases that could have been prevented with early diagnosis. Many of these diseases are infectious leading to the total loss of crop yield. Given the vast spread of agricultural lands, low education levels of farmers coupled with limited awareness and lack of access to plant pathologists, human-assisted disease diagnosis is not effective and cannot keep up with the exorbitant requirements. Due to the tremendous growth in population, there is a high increase in the food requirement. The quality of the food produced must be good and the productivity must also be good. 52 percent of India's population depends on farming as their first profession.

Many other countries have started using advanced technologies for the cultivation of crops. There is no organization among farmers that can get this information. In this modern era, we are imposing a method to provide missing essential information to the farmers and the whole farming sector. The quality of the crop is responsible for the high production and yield of the crop. The quality of the crop can be improved if the crop is disease-free and healthy. By using advanced technologies, the diseases of the crops can be detected and the proper remedies can be done to save them from getting destroyed. The crops require daily attention if they're to be saved from the pests or insects. Pests tend to destroy the crops if the proper prevention method is not used to destroy them. If the crops are destroyed by the pests, it can affect the production of the crops which can cause loss to the farmer.

1.1 Problem Statement

Insects and Pests destroy the crop's life which in turn results in lower production of the crops. To answer the questions of 'How can the crop be kept safe?' we can use this advanced technology to get the remedies. It can be done by simply scanning the crop against the camera and the disease of the crop will be as the output.

1.2 Related Work

Literature survey is one of the most important part in any kind of research. Before start developing their is a need to study the previous papers of our domain which we are working and on the basis of study we can predict the drawback and start working with the new solutions.

Agriculture has the largest contribution in the GDP in India. But still the farmer's don't get worth price of the crops. It is mostly happens due to improper irrigation or inappropriate crops selection or also sometimes the crop yield is less than that of expected. By analyzing the soil and atmosphere at particular region best crop in order to have more yield from crop and the net crop yield can be predicted. This prediction will help the farmers to choose appropriate crops for their farm according to the soil type, humidity, temperature, water level, spacing depth, soil PH, season, fertilizer and months. This prediction can be carried out using the Random Forest classification machine learning algorithm.

The traditional methods used by the Indian farmers are a very slow, undependable and large amount of crops are damaged in the field due to bacterial attack and lack of information resources about the infection on the crop. Annually, such loss exceeds 40 percent in total. The main goal is to provide a feasible solution for finding problems and to enhance the productivity of the agriculture sector in India. The main awareness of this work is focused on Indian farmers because it addresses the key problems of getting the market status of different products in the agricultural field, weather information and also provides multiple language support. This will effectively help farmers to sell their products in the global market and earn a remarkable profit. At the same time, it's a big challenge of getting information about weather situation, kind of fertilization need to use the based type of crop. Due to lack of communication to farmers production was not good, also government sanctioning various schemes, benefits towards agriculture sectors and farmers towards their wealth. There is much scope to maintain the information of all these and analyze properly and communicate with farmers of India. This kind of analysis can be done with modern technologies such as big data analytical tools. A real monitor system needed to communicate with farmers, from time to time with the support of the mobile-based application.

2. PROPOSED SYSTEM

There are many peoples who are farmers. So, instead of creating the application for any other field, we all decided to create something for the development of farming. There are many problems faced by the farmers.

In some of the areas there is draught since last so many years, at somewhere farmers are facing problem of insects. These small insects make big impact on the crop's improvement. So, due to these problems' farmers doing suicide or some are finding for another profession. But, without food there is no life. So, farmers are one of the most important part of everyone's day to day life cycle. Farming is the main occupation of the people in rural areas. Despite the environmental factors being vital for the healthy growth of the crop, preventing the crop from the insects or pests is also a main challenge responsible for the growth. By using the advanced technologies in Information Technology, we can contribute in the agriculture sector for the wellbeing of the farmers.

Augmented reality

Augmented reality is the blending of interactive digital elements like dazzling visual overlays, buzzy haptic feedback, or other sensory projections into our real world environments. A technology that superimposes a computer-generated image on a user's view of the real world, thus providing a composite view. AR increases interaction and engagement and provides a great user experience to the farmer. Also AR increases the perceived value of product. The system used AR to provide easy and rich application interface to the user.

Google Cloud

A Google cloud is a platform designed by Google to provide cloud services to the users. It has layered infrastructure and delivers multithreaded security detecting and responding threats. It is an intelligent monitoring and control platform having real-time visibility on who can access our data. Also having better privacy and transparency.

Tensor Flow

Tensor Flow is the object detection and machine learning tool used for image classification and its processing. Tensor Flow is free. It is an open-source library for data flow and differentiable programming across its range and it is developed by Google. It is developed by Google itself for their internal use.

The above diagram shows the system architecture of our Life improvement of crops project. The system uses AR Core, vision API, Tensor Flow, and android modules. For the backend purpose, AR Core, vision API, Tensor Flow and for the front end, an android development kit used in system.

Android

The system used android for the front end purpose. Using android, system get the graphical interface of the application. It is the OS developed by Google and it is based on the modified version of the Linux kernel and other open-source software which is developed primarily for touchscreen mobile devices such as smartphones and tablets. In the android studio, there is need to install Sceneform, plugins to show the GUI in augmented reality. The current version of Sceneform is 1.9.0. A JSON response is needed from the vision API in the android studio for the correct object detection.

The system need POJO for every response which contains information about leaves of crops, insects and fruits and also the data for the fertilizer which have to use on those insects

System Flow

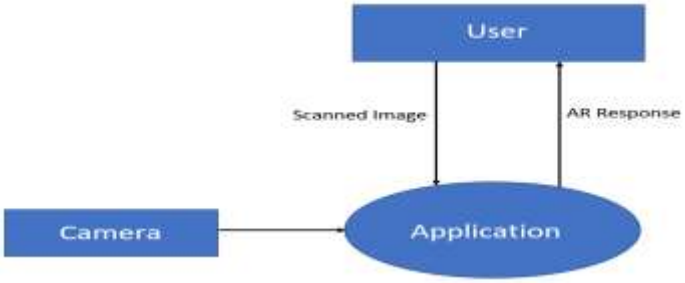

Fig -1: Data flow diagram for the user

System Architecture

Fig -2: System Architecture

The system uses AR Core, vision API, Tensor Flow, and android modules. For the backend purpose system uses AR Core, vision API, Tensor Flow and for the frontend, android development kit used.

Data Training

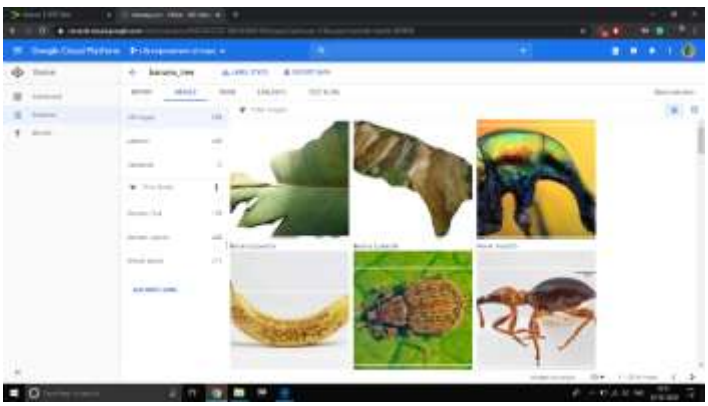

Fig -3: Data training and image processing

In the training of data, initially, 600 images of different crops, their leaves, fruits, and different insects are trained in the Google cloud data training platform.

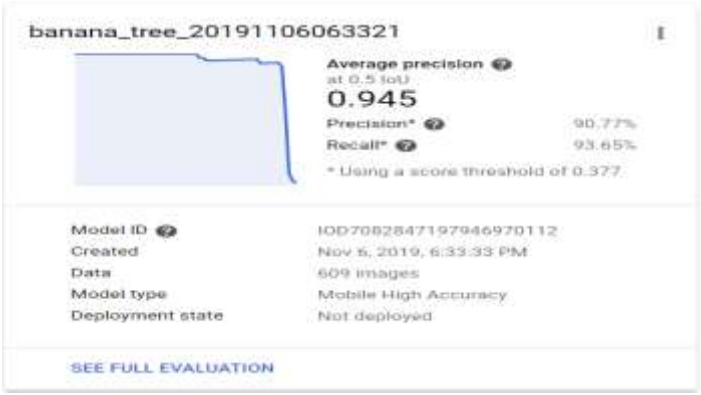

Fig -4: The average precision and recall for Banana Tree

The average precision got for the banana tree dataset is 90.77% and the recall percentage is about 93.65%.

3. RESULT

The system is combination of AR and AI which gives a better visual experience and suggestions to the farmer regarding the crop diseases and improvement.

4. CONCLUSION

The paper proposes a system which is an android application uses augmented reality. This system will help the farmers to have an idea about the crop diseases and their treatment suggestions. Based upon the predictions of the application the farmer can make decisions regarding their crop issues. The system used to detect various infections on fruits, leaves, and insects. This application can be developed as per the user requirement and provides a good user interface experience.

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