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AGRIGRASS: Precision Farming for Weed Detection & Control

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Abstract

Weed detection and control is done using image processing technique. Image processing is the process of capturing the image and storing it digitally. Image of weed is capture and algorithms like CNN and KNN are applied for the feature extraction and classification respectively. An RGB image is taken as a sample in order to demonstrate the difference between weed and the crop. This RGB image is further processed for detecting the weeds. After certain steps namely uploading image, applying CNN algorithm(for feature extraction) and KNN algorithm(for classification) we get the solution to prevent the development of weeds. During this process, weeds are separated from the crop that has been taken in the sample image.

Keywords— Image Processing, CNN [Convulutional Neural Networks], KNN [K Nearest Neighbor],Weed Detection, PCA [Principle Component Analysis].

I. INTRODUCTION

Agriculture is a milestone in the history of human civilization. Due to agriculture, the man settled at a particular place. Agriculture is one of the oldest and prime activities of human being. It has remained an important source of land. In spite of growing industrialization and urbanization in the world, nearly 50% working population still engaged in agriculture.

In developing countries, the agriculture sector has been a major source of employment and it has contributed to the national economy. The basic aim of agriculture is to raise stronger and more fruitful crops and plants and to help them for their growth by improving the soil and supplying the water. Agriculture is the backbone of the Indian economy. In India, about 64% of the total population is dependent on agriculture for their live food. Agriculture is the cultivation of animals, plants, and fungi for food, fiber, biofuel, medicinal plants and other products used to sustain and enhance human life.

Agriculture started thousands of years ago, but no one knows for sure how old it is. Farming is growing crops or keeping animals by people for food and raw materials.

Farming is one of the main occupations in India. India is the 2nd Largest producer of agricultural products in the world. Automatic weed identification and classification is to development of an automated computer vision or machine vision system with the use of image processing techniques. Farming is a part of agriculture. A farmer is a person who operates a farm and is engaged in agriculture, raising living organisms for food or raw materials. The term usually applies to people who do some combination of raising field crops, orchards, vineyards, poultry, or

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other livestock. Farmer is sometimes also called agriculture. There are various problems faced by a farmer in the field of farming. Soil erosion, seeds, weeds, irrigation, small and fragmented land-holdings and many more.

Weeds serve as an important source of genetic materials for crop improvement such as breeding for resistance to pests and diseases which are made possible by genetic materials provided by wild species of the crop plants. Weeds reduce farm and forest productivity, they invade crops, smother pastures and in some cases can harm livestock. They aggressively compete for water, nutrients, and sunlight, resulting in reduced crop yield and poor crop quality. Some weeds are a potential threat to the existing crop. This is one of the main reasons that weed detection in farms plays an important role in the agricultural field. Distinguishing between the good and bad weeds manually is a tedious task. The manual work of detecting weeds is very time-consuming. There are three types of weed namely Annual Weeds, Biennial Weeds and Perennial Weeds. Annual weeds germinate and spread by seed, having an average lifespan of one year. Biennial weeds develop from seed and complete their life cycle in two years. Perennial weeds produce long taproots in addition to seeds and it occurs every year.

Fig 1: Annual Weed

Annual weeds germinate and spread by seed, having an average lifespan of one year. It has two stages; Summer annual and Winter Annual. Summer annual weeds generate in spring and die in fall. Winter Annual weeds generate in fall and die in spring. Prevention of the Annual Weed is done by using herbicide.

Fig 2: Biennial Weed

Biennial weeds develop from seed and complete their life cycle in two years. It has two Stages: Rosette Stage and Bolt Stage.

Rosette stage is the germination of the biennial weed in the first year. Bolt stage is where a biennial weed develops into the flower and produces seeds this happens in the second year. Prevention: Biennial weeds can be cut down at the beginning of the Rosette Stage.

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Fig 3: Perennial Weed

Perennial weeds produce long taproots in addition to seeds and it occurs every year. There are two stages of perennial weeds. Those are Broadleaf and Narrow-leaf stage. The broadleaf is the stage where the weeds have wider leaves in addition to its roots. The narrow-leaf is the stage where weeds have longer leaves in addition to its roots. Prevention of the perennial weeds is done by using closed planting technique.

II. **RELATED WORK**

In the paper[1], Umamaheswari S et.all discussed the over issues of shortage of manpower and resources for agriculture, development of new crop diseases and weeds. There is an ever-growing demand for food to be met by agricultural producers. To reduce the environmental issues and address, the food security precision agriculture get involves. By developing a system to detect and locate the weed plants among the cultivated farm, crops based on the captured images of the farm by using image processing, which leads to automated weed detection system under tasks in precision agriculture. To enhance the performance of the above system using parallel processing is used in real-time. The parallel image processing is the process where the multiple features are identified at the same time.

In the paper[2], R. Anirudh Reddy et.all proposed about the detection of weed which is now done with the new technology called "Image processing". In earlier days, weed detection was done manually and the process was fully dependent on the manpower. The farmers used to look after every crop and then separate the crops and weed manually. Out of 100%, there was a chance of almost 30-40% where the farmers failed in the process of weed detection. In this paper, the authors have used two main algorithms namely Support Vector Machine(SVM) and Bayesian Classifier Algorithm. The motive of this paper is that it reduces the manpower and increases the accuracy of detection by using various steps like image acquisition, colour detection, edge detection, thresholding feature extraction and then finally detecting weeds from crops which takes place.

In the paper[3], Ajinkya Paikekari et.all helped this particular project to give base idea I.e Image processing ,the image processing is the process of making an image suitable to the digital word by applying various methods like edge detection, colour segmentation, Filtering by using this process the time will get reduce of finding weed manually in crop field or far-m. The farmer will get the benefits and also there will be a new technique for agriculture occupation in India.

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In the paper[4], Shubham Lavania et.all mainly focuses on the detection of weed and crop from the image captured in the maize field. Here discrimination among crops and weeds is made using Otsu's method and PCA (Principle Component Analysis) methods. The image is captured in RGB image format and then Otsu's method is applied to it. Thresholding is applied and then given image is converted into a binary image. In this way 1 is assigned to excessive green colour and crop and weed both are combined and separated. Then PCA (Principle Component Analysis) and double Otsu's methods are applied to separate the weed from a crop which is here maize crop. It is easier to distinguish between crop and weed. In the high-density area, it is easier to distinguish weed in that crop row area of the farm. Instantaneous detection of different types of plants can be done using these Otsu's and PCA (Principle Component Analysis) methods. This can be applied to various agriculture fields. PCA (Principle Component Analysis) has low processing time. So it is easier to detect weed present in crop field instantaneously.

In the paper[5], Sachin khirade et.all proposed the identification of diseases related to plant by using an image processing technique. Here basic steps are mentioned image processing technique to identify the disease of the plant and it is as follows: Image acquisition, image pre-processing, image segmentation, feature extraction. Image segmentation is carried out on the different processes such as Segmentation using Boundary and spot detection algorithm: The RGB image is converted into the HIS model for segmenting. Boundary detection and spot detection helps to find the infected part of the leaf as discussed, The K-means clustering is used for classification of an object based on a set of features into K number of classes. The classification of an object is done by minimizing the sum of the squares of the distance between the object and the corresponding cluster, Otsu Threshold Algorithm: Thresholding creates binary images from grey-level images by setting all pixels below some threshold to zero and all pixels above that threshold to one. Feature extraction is done by a colour co-occurrence method: In this method, both colour and texture are taken into account to get unique features for that image. For that, the RGB image is converted into the HSI translation.

In the paper[6], Peeyush Soni et.all discussed about the use of LARS [Low Altitude Remote Sensing] system is mounted on a drone to figure out the land which is occupied by weeds. Crop growth and weed infestation in a soybean field were monitored by processing low altitude remote sensing (LARS) images taken from crane-mounted and unmanned radio-controlled helicopter-mounted platforms. Images were taken for comparison between true colour (R–G–B) and colour-infrared (NIR) digital cameras acquired at different heights above ground. All LARS images were processed to estimate vegetation indices for distinguishing stages of crop growth. This paper includes an analysis of a large number of area of the farm and provides images of weeds. Hence it will be easier to understand what scale weed is growing on the farm.

In the paper[7] Anup Vibhute et. all mainly focuses on the applications of image processing. Here applications of image processing for identifying crops and classifying them are stated. Using edge detection, colour detection, shape detection of crops and weed is done to identify them. Algorithms like PCA, K-means, K-NN, ANN can be used for classification purposes. For food, grading is also one of the applications of image processing. Image processing is an effective tool that can be applied for the agriculture domain with great accuracy for the analysis of geometric parameters.

In the paper[8] George E. Mayer discussed about the machine vision for identification of the plant. Characters of the plant are analyzed. Then a binary image of a given image is created Then according to shape and texture features, plant species are classified. Also, an artificial neural network (ANN),

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used for distinguishing weeds from the plant. Fuzzy set theory (FST) is used for plant classification. Older photographic plant image data bases can be used as references for new unknown digital plant images.

In the paper[9] Camilo A. Pulido Rojas et. all exposed a comparative analysis of weed classification strategies based on area and texture features over images of crops. Due to the random behaviour of weed growth and relation with crop size during early ages, it is appropriate to use area and colour features for weed classification. Weed identification solutions focus on providing a basis for weed removal applications. These patterns serve as a basis for training K-nearest Neighbor and Support Vector Machine(SVM) classifiers. The algorithm based on SVM presented the best performance with a specificity index of around 90%. For the selective treatment of weed, the system should be in real-time.

In the paper[10] S. Rathika et.all proposed the importance of remote sensing. It plays an important role in crop classification, crop monitoring, and yield assessment. For sustainable agricultural management, all the factors which are influencing the agricultural sector need to be analyzed temporarily. Remote sensing data can greatly contribute to the monitoring of the earth's surface features by providing timely, cost-efficient and repetitive information about the earth's surface. Precision weed management technique helps in carrying out better weed management practices. To effectively utilize the information on crops for improvement of the economy there is a need to develop state or district level information systems.

III. GAP ANALYSIS

Based on the literature review conducted to date, the following gaps in the knowledge base for weed prediction have been identified. Earlier, there was no advanced system available for weed detection in different crop fields. Due to this reason , there was difficulty in identifying weeds in different crop fields. Weeds are not classified on specific criteria. The criteria for classification discussed in papers are not on the level of the harmfulness of weed. Following this, the solutions specified are based on the common basis of weed. Solutions are not specified for particular weed.

IV. PROPOSED SYSTEM

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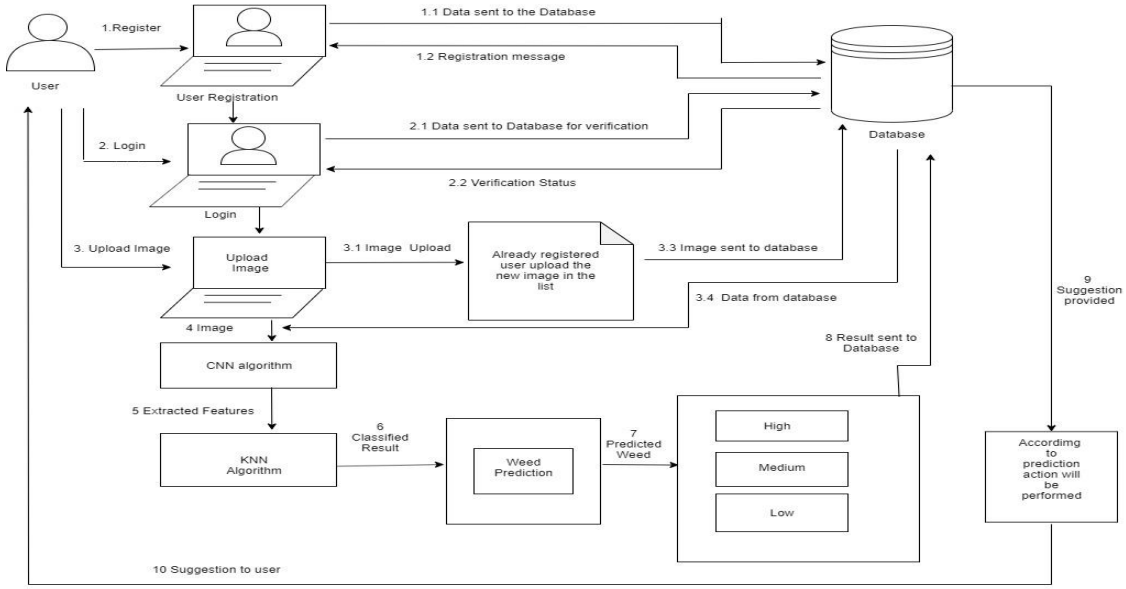

Fig. 4: System Architecture

The figure shows the System Architecture of the proposed system. The user has to register in the existing system by entering username and password. The data is then sent to the database and then registration message is sent to the user. After the registration process, the user will log in into the existing system by entering username and password. The data is sent to the database for the verification purpose. When the verification process is completed, the user will be successfully logged in into the system. The user will get the notification to upload the image. After the image is successfully uploaded, the CNN algorithm is applied and the feature extraction takes place. In this particular system, two main algorithms are used namely CNN and KNN. CNN stands for Convolutional Neural Network which plays the role of feature extraction. Features such as colour, shape, size of a particular weed are extracted.

KNN stands for K-Nearest Neighbor. It plays the roles of classification. The weeds are classified on the amount of poison present in it. They are classified as High, Medium and Low amount of poison present in the weed. After the weed prediction is done, suitable solutions are provided from the database to the user.

V. CONCLUSIONS

Weed on farms causes the problem to a farmer. Using this particular web based application, weed detection becomes easier also solution according to the weed type is provided to the user. After the detection of weeds, suitable solutions are provided which reduces the manual work of a farmer using an image processing technique. Hence it becomes easier for a farmer to take preventive measures on weed.

VI. FUTURE SCOPE

The proposed system will include consideration of the agriculture field only. In future research, we recommend to consider more agriculture technique and to make the system suitable for farmers. The proposed system will store the solution provided to specific weed which can be used in the

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future if the same kind of weed occurs. This system will give a precise solution to weeds which tends to grow in a large number of area.

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