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OPTIMAL GROWTH SENSOR AND FARM SECURITY ROBOT

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Abstract— **Automation is need of future and automation in farming is necessary as there is acute storage of fertile land and skilled farmer. Understanding the stages of plant growth is important to help farmers to optimize the yield. Vegetables and fruits are most important agricultural products. In order to obtain more value added products, a proper quality control is essentially required. Many studies show that quality of agricultural products may be reduced from many causes. One of the most important factor of such quality is plant diseases. This paper provides advances in various methods used to study plant growth and diseases using image processing.**

Index terms- **Plant diseases; plant growth; automation, image processing,**

I. INTRODUCTION

Agriculture is the backbone of India. In recent years the consumption of agricultural products due to increase in population. As we know India is the second largest populated country in the world demand for agricultural products is more. But the yields are not matching the required demands.

One of the main reasons for this is uncertainty in deciding the right time for harvesting. If the farmer harvests the crop too early, yield requirement will meet the market expectations. Also if the harvesting of crops is too late, produced will go bad because of overgrowth.

So selecting right time for harvesting is very crucial for getting maximum yield.

Plant diseases cause losses in abundance to both the quality and quantity of agricultural products. Economic losses and a threat to food security are complementary packages.

As plant diseases cause huge losses to the crop yield, its adverse effects are seen on agricultural products like fruit products, medicines.

II. OBJECTIVE

We propose and experimentally evaluate a software solution for automatic detection and classification of plant leaf diseases using a machine vision guided system.

III. MAJOR OUTCOMES EXPECTED

A. Real time crop monitoring:

Provides fast, automatic, cheap and accurate image processing based solutions.

B. Security:

System has a fencing sensor wherein intruder can be detected and alert the owner using buzzer and SMS on his cell phone.

IV. METHODOLOGY

A. Image processing applications in agriculture areas

a. Crop Management: Using pest management detection of insect has been done, wireless sensor network is used for irrigation and weed detection is used for crop assessment using remote sensing.

b. Identification of Nutrient deficiencies and plant content: Nutrient deficiencies and various content of plants have been identified from leaves and skin of product using image processing algorithms.

c. Fruits quality inspection, sorting and grading: To improve and maintain the quality of fruits and vegetables and for Classification of agricultural products, image processing and machine learning is used.

d. Crop and land estimation and Object tracking: Geographic information System (GIS), color and texture segmentation algorithms are used.

B. Plant Growth Detection

Color of a crop leaf gives the vital information about the crop. Color analysis is based on RGB and HSI color space.

a. RGB color space: This color space is commonly used and human eye can also perceive it. The color of any object is made from three primary colors these are Red, Green and Blue.

Other colors are made from primary colors that is, the mixture of 2 or more

primary color gives the full color spectrum. RGB color space based on the primary spectral components of red (R), green (G) and blue (B).

HSI Color Space: HSI that is hue (H), saturation (S) and intensity (I) gives the color description in terms that are practical for human interpretation. Hue, Saturation and Intensity of the color objects are perceived and described by human eye. Hue gives the measure of distinct color of the spectrum such as red, green, yellow etc. Saturation is a measure of the degree to which pure color is diluted by white light that is richness of pure color. Intensity is the brightness subjective descriptor and impossible to measure. The Intensity of HSI model decouples the intensity component from the color carrying information (hue and saturation) in a color image. HSI is the gives the best results and compared to RGB color system because in RGB color system provide three separate coordinates RED, GREEN and BLUE which is not efficient for color perception and image processing than compared to HSI mode. Whereas in HSI modal only hue (h) can give the color perception. As a result, HIS model is known as the most ideal tool for developing image processing algorithms.

c. Feature extraction: We are extracting the Red, Green and Blue color from the crop image. Firstly, we are calculating the percentage of green color in the image of crop. After calculating the percentage of green color present in the image in RGB color system, we are converting the RGB color system into HSI that is, Hue, and Saturation and Intensity for better prediction. RGB data is first converted into HSI data. With image representation in the HSI domain, the color analysis was based on primarily the Hue value. Hue is a color attribute that describes a pure color, whereas saturation gives a measure of the degree to which a pure color is diluted by white light and finally intensity gives the effectiveness of the color. The three dimensional RGB space is reduced to a one- dimensional H Space for color analysis. For a digitized color image, the Hue histogram represented the color components and the amount of that Hue in the image. So, by knowing this development phase of crop farmer can cultivate better yield.

C. Disease detection

a. Image acquisition: Firstly, the RGB color images are captured using a digital camera with required resolution for good quality. The construction of an image database is clearly dependent on the application. The image database itself is responsible for the better efficiency of the classifier which decides the robustness of the algorithm.

b. Image Preprocessing and Segmentation: In preprocessing step to improve image data that removes background, noise and also suppress undesired distortions. It enhances image features for processing and analysis. The input RGB color image is converted into other color spaces such as HIS and CIELAB. Because RGB is color dependent space model but HSI and CIELAB are color independent space model and this are also derived from human perception. In segmentation step to find out the infected region. Segmentation mostly can be done by k-mean clustering, edge detection algorithm.

c. Feature Extraction: After segmentation the infected region various features are extracted to describe the infected region. Color, texture and shape based features are normally used for region description. Color features are important to sense image environment, recognize objects and convey information. Texture is one of the most important feature which can be used to classify and recognize objects. It is a powerful regional descriptor that helps in the image retrieval process. Contrast, Homogeneity, Dissimilarity, Energy and Entropy features are intended to describe texture. Shape is one of the primitive features for image content description.

d. Classification: It is final stage in disease detection. It is identifying a rule according to selected features and assigning each disease to any one the predetermined classes. The Artificial Neural Network and Support Vector Machine are mostly used as classifier.

V. HARDWARE IMPLEMENTATION

The entire system is divided into three different sections viz. Robot Side, Remote Side, Field side The robot and field section makes use of AT89s52 microcontroller whereas remote section makes use of AT89c2051 microcontroller.

A. Remote Side:

Movement of the robot is controlled by keypad present at the remote. Input commands from the keypad are transmitted using RF transmitter.

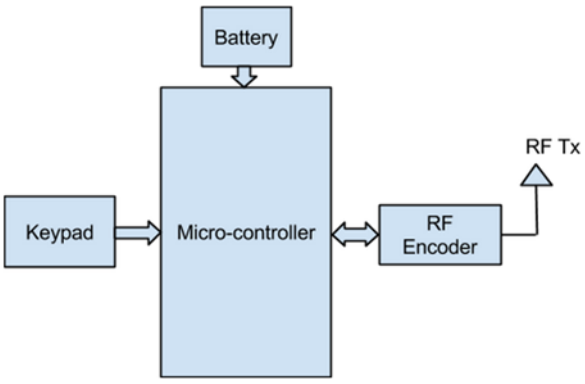

Fig. 1 Remote Side Block Diagram

B. Robot Side:

RF decoder decodes the input commands received from the RF transmitter. Based on the input commands the motor connected to the motor driver IC controls the movement of robot and camera captures the image of leaf and send it to PC for image processing.

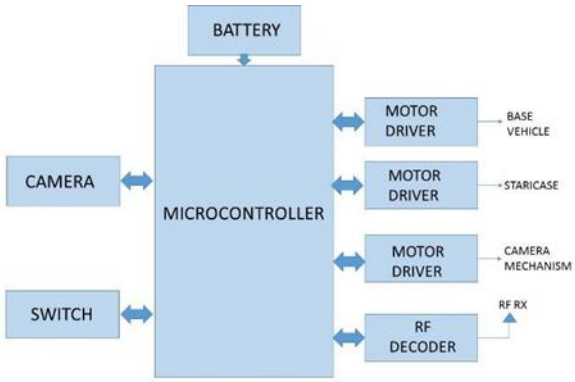

Fig. 2 Robot Side Block Diagram

C. Field side:

Field consist of PIR sensor for detection of intruder. Alerts are provided to the farmer using buzzer and SMS

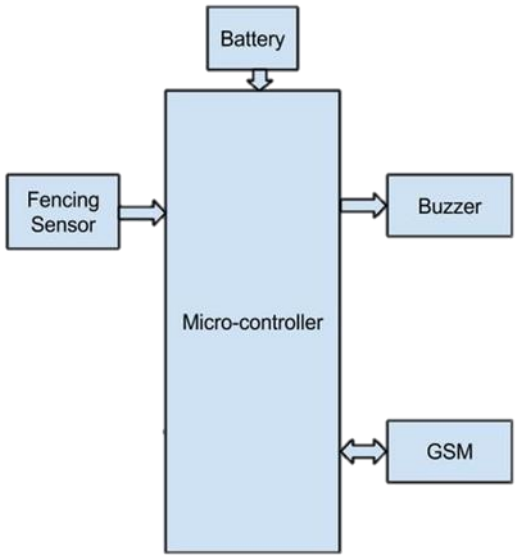

Fig. 3 Field Side Block Diagram

VI. SOFTWARE IMPLEMENTATION

In Digital image processing images are captured, transmitted, and processed in digital form. Digital image processing is one of division in electronic area where image being modified to pixels, stored in a digital storage and processed by computer. In effect, it reduces cost increasing computational speed, and flexibility. The core task of digital image processing is storing images and enhances them to the new information structures, so as to provide a better basis for obtaining and analysis of related activities. In addition, digital image processing leads to enhancement of image features interest and therefore useful information about the scene from enhanced image could be computed. Digital image processing, extract information of an image for processing and analysis task. After taking the digital image from the digital camera, the system transferred to a computer for processing and storage by using different processes such as image capturing, image digitization, noise filtering and feature identification.

VII. PRACTICAL IMPLICATIONS

Images of the plants leaf are captured by the camera. After capturing the image Red, Green, and Blue colors are extracted from crop's image. Percentage of green color in image is calculated in RGB color system. This RGB color system is converted into HSI color system. With the help of Hue, Saturation, and Intensity plants growth can be detected and farmer can cultivate better yields.

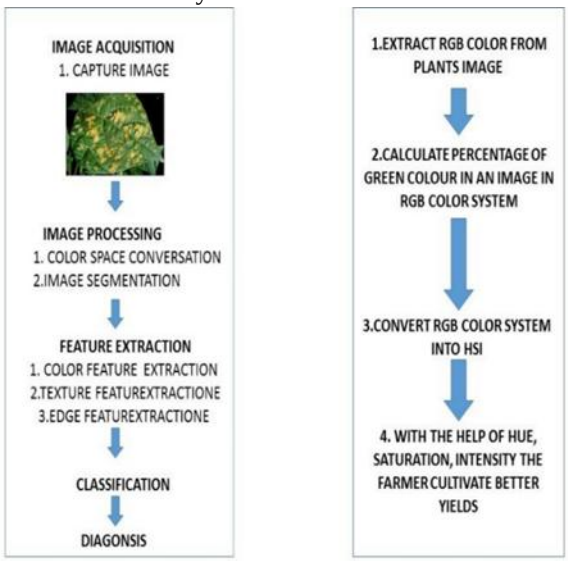

Fig. 4 Flow of Practical Implications

Plant disease have turned into a dilemma as it can cause significant reduction in both quality and quantity of agricultural products relying on pure naked-eye observation of experts to detect such diseases can be prohibitively expensive, especially in developing countries. Providing fast, automatic, cheap and accurate image processing based solutions for that task can be of great realistic significance. The proposed system is a combination of robotics and image processing - a step towards automation. The robotic system is used for real time crop monitoring and image acquisition controlled by the laptop.

In addition, the robot can trace a path automatically after giving a path manually to it. PIR sensor will detect the intruder and secure the farm.

VIII. VCONCLUSION

Thus, Image Processing based approach is proposed and useful for plant growth as well as well plant disease detection. It is an effective tool for estimating perfect time for harvesting.

As a result of proper harvesting the yields are matching the market demands.

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