QUALITY AND PESTICIDES DETECTION IN FRUITS AND VEGETABLES

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Abstract: ***The existence of pesticides in fruits and vegetables has been a growing worry in all over the world. This work tries to solve the problem by customer side. The consumer should get to know whether the selected fruits and vegetables are safe to consume or not. The main aim of this work is to detect the amounts of pesticides on fruits and vegetables by calculating its normalized difference vegetation index using sensor. Here the work is done in two parts. The first part performs the identification of fruits and vegetables by using CNN. Here a set of image features such as color, shape, texture is trained using CNN for the identification of fruits and vegetables. In module 2, detect pesticides in fruits and vegetables by three ways calculating its NDVI, by using IR sensor and gas sensor then compare the result. The program in the Arduino gives for the output display. The detection information will be displayed on the screen. And the output graph is plotted.***

Keywords: Convolutional Neutral Network, Machine learning.

I. INTRODUCTION

A wide verity of pesticides is wont to increase the production, quality in agriculture sector. For human diet fruits and vegetables are the important part since they dispense essential nutrients that are mandatory for many of the reaction occurrence within the body. The continual uses of pesticides have results in many problems including the human health. so as to scale back the loss and maintain the standard of fruits and vegetables harvest pesticides were used. Today, the utilization of pesticides has increased significantly due to the growing population and therefore the demands this population. The high increase in community means more food must be produced and spreading of diseases is more like. Pesticide use in commercial agriculture has led to a rise in farm productivity, so why the farmers use the pesticides. Several reports suggest that prime levels of pesticides in food can cause the expansion of diseases like cancer, kidney and lung ailments. Children have developing organs, susceptible to catching infections and diseases. Residual amount of those chemicals is present on the food when it gets to the grocery. The importance of food quality has become a significant issue thanks to the widespread use of pesticides. once you consume a fruit, the pesticide residue goes into the body as they grind to a halt and may cause you to sick. The consumers should get to understand whether the chosen fruits and vegetables are safe to consume. to make sure the security of food for consumers and to guard consumer health, the monitoring of pesticide residues in food products must be pursued.

Our system can sense the fruit and indicate the level of pesticides substance in the fruit. It is user-friendly where the level of accuracy is very high. Fruits which seem fresh from outside can be decayed inside, so the inner quality of the fruits is assessed using IR sensor. The main aim of this work is to detect the amounts of pesticides on fruits and vegetables by calculating its normalized difference vegetation index using sensor. Here the work done in two modules, in module 1, identify the fruit. The system is trained by image dataset. When the fruit image is captured by the camera the system identifies the fruit using convolutional neutral network (CNN) algorithm. Fruits-360 dataset which is publicly available on GitHub and Kaggle for evolution purpose. During feature extraction, at this point the network will perform a number of convolutions and pooling operation during which the features are detected. Here the features extracted are color, texture and shape of a fruits. Features are extracted from the input image which is further converted into pixel values. Convolution is utilized for conversion of image into pixel value which preserves the relationship by learning image features. In module 2, pesticides in fruits and vegetables are detected in three ways by calculating its NDVI, by using IR sensor and gas sensor then compare the value. Firstly, calculate the NDVI for that capture the reflected light using LDR and send to Arduino where the signals are analyzed. secondly, by using IR sensor reflected and transmitted light is sends to Arduino and signal is analyzed. Finally, by using gas sensor pesticide is determined from threshold value, compare all the methods result and final output graph is plotted. Since the device is portable, it will enhance the efficiency of the food and safety authorities and ensure quality.

II. RELATED WORK

Quality Detection of Fresh Fruits and Vegetables: This paper developed a prototype to detecting quality of the fruit and to provide organic consumption levels. The system consists of hardware module to detect the quality of the fruit. This is done in three modes, they are, inner quality of the fruits is determined using ethylene gas sensor and IR sensor which determine the ethylene present in the fruit. Artificially ripened fruits are detected and finally detect the pesticide residue level in fruits is indicated. This whole paper revolves around sensor integration and application. [1] Automatic Fruit and Vegetable Detection and Disease Identification system: This paper developed the automatic vision technology. This system is to identify the fruit image and it will be labeled if the fruit is defected it will send as input for disease identification. Neutral Network method is used for image classification and identification of fruits and vegetables. The proposed work is composed of mainly three steps. In the first step the data is accumulated. In the next step, features are extracted and the machine is created. In the third step, the trained machine will find the fruit and label it. In the final step it will identify the disease related with the identified fruit. The driving objective

of this work is to upgrade the esteem of fruit quality discovery.[2] Color Identification Technology: This paper uses color identification technology to find pesticides in fruits and vegetables. The system consists of Acetyl pesticide testing, applying Raspberry pi 3B and network cam for color identification method. The solution is prepared from acetylcholine, acetylcholinesterase and yellow color reagent. The solution is bright yellow, lower blue value (225,225,0) in the non-appearance of pesticide. In the appearance of pesticide, solution becomes light yellow with higher blue value (225,225,200). The constitutive area of blue value over time is used for converting pesticide residue concentration. The proposed system is cost effective and requires less testing time.[3] Fruit Quality Detection Using OpenCV/Python: This work use a vision based technology for fruit quality detection. This paper identify disease in tomato based on the color, the color of the fruit indicates its maturity and the presence of defects.it is done in three steps, firstly acquiring the image of the tomato it is done by camera and collect the rishika 225 tomatoes database and these images as input images in this system. Next, detect the disease by its color. This will enable the technology to be applied in many products.[4]

III. PROPOSED SYSTEM

This work is used for both fruits or vegetables identification and pesticides detection in them. The system includes two modules.

Module 1 is for the detection of fruits and vegetables. Here a fruit recognition frame work utilizing CNN is proposed. The proposed strategy utilizes profound learning methods for the grouping. The work uses the fruits size, color and texture to recognize each picture. For training and testing, all the input images were selected from the 360 dataset which is publicly available on GitHub and Kaggle. The dataset contains 90,380 different fruits and vegetables images of 131 categories. A white paper is placed back of the fruits as a background. Due to the inconsistency in the lighting a flood fill type algorithm was evolve which extract the fruit from the background. After removing the background all the fruits were scaled down to 100×100 pixels of standard RGB fruit images. Different varieties of the same fruits and vegetables are stored as belonging to different classes. From each class, feature extraction of every images should be done. The feature extraction process was done by three layers of CNN namely convolutional layer, Pooling layer and rectified linear unit layer (ReLU). The convolution layer (CONV) uses filters that bring about convolution operations as it is scour the input with respect to its dimensions. ReLu layer will apply an elementwise as shown in figure 1.[5]

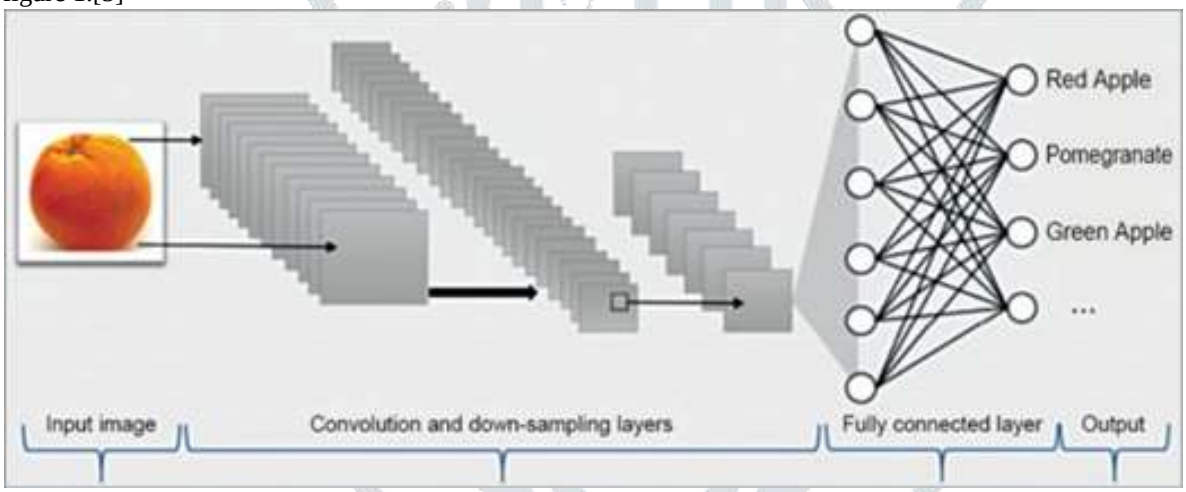

Figure 1 process in CNN

After the involvement of these three layers, all the images in the dataset would get resized to same measurements and same filter. A CNN model including all these images will be created and get saved. Then as an input the webcam would capture an image of the fruit or vegetable that was used for the experiment. As explained earlier the feature extraction of the input takes place and the resultant image would get compared with the CNN model that was already created and saved. Hence the fruit or vegetable used get identified. Output of CNN modules identify the fruits apple, banana, orange and lemon as shown in the figure 2.[6]

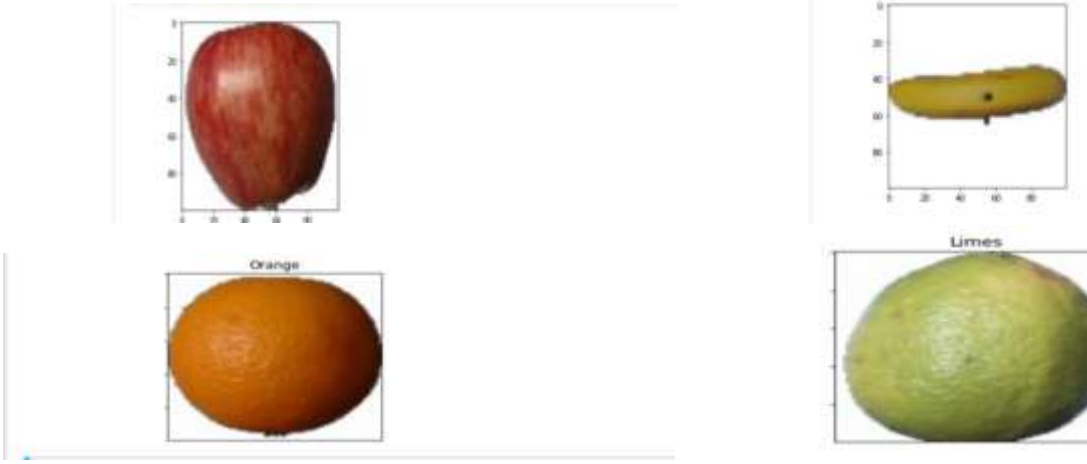

Figure 2 output of CNN module identify the fruits

Module 2 is for the detection of pesticides in fruits or vegetables. In this project three ways are used for the detection of pesticides. Firstly, the NDVI method. The light from LED is made to incident on fruit and the reflected rays from the fruit is received by LDR. The output from LDR is transmitted to Arduino. The ADC in Arduino converts the analog values to digital values. This process got repeated 30 times in order to check accuracy (for eliminating errors). After completing this 30 times, an array containing the values would be generated and average of the whole values get displayed on the screen. A graph corresponding to the values obtained by the repeated process also get generated.

Second way is using the IR sensors. An IR sensor has 2 parts, the transmitter and the receiver. The transmitter can transmit light rays of wavelength up to 960 nm. The rays from transmitter are made to incident on fruit and the reflected rays from the fruit is received by receiver. An IR receiver can receive rays of wavelength from 400-1000 nm. The output from IR receiver is transmitted to Arduino. This process got repeated 30 times in order to check accuracy (for eliminating errors). Here signal analyzation takes place. After completing this 30 times, an array containing the output values of Arduino would be generated and average of the whole values get displayed on the screen. A graph corresponding to the values obtained by the repeated process also get generated.

Last method is by using the gas sensor. One of the legs of sensor should be grounded, other would be connected to the Arduino and next is positive. The more chemicals in the fruit, the more there is in the air. This pesticide content gives a good indication for if a fruit or vegetable is safe or not. The sensor would be already assigned by a threshold value. If the value obtained in the experiment become more than threshold value then the fruit contains pesticides otherwise not. As that of the previous methods here also the process got repeated 30 times and a graph would get generated. The repeated process also got generated. Compare all three sensors result and graph plotted as shown in the figure 3.

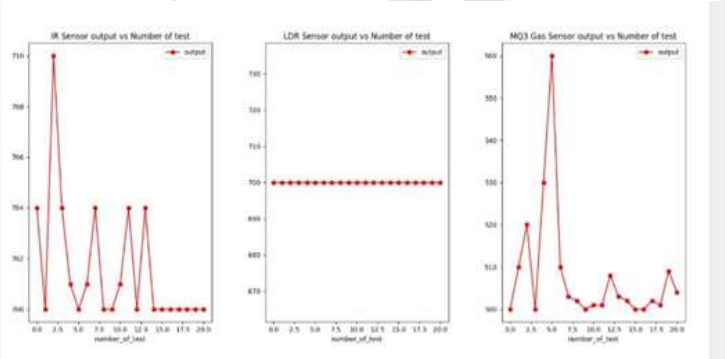

Figure 3 graph plotted by three sensors

IV. CONCLUSION

The methodology consists of the quality and pesticides detection of fruits and vegetables. The proposed work is composed of mainly two modules, module one it detect the fruit using image processing and the network used here is CNN. The images are used for train CNN, total of 360 fruits images is used for training. Input for the CNN is capture by camera and classification is done. In module 2, pesticides detection in fruits and vegetables by three ways calculating its NDVI, by using IR sensor and gas sensor then compare the result. The detection information will be displayed on the screen. And the output graph is plotted. Out of these method gas sensor give more accuracy to detect the pesticide on the surface of fruits and vegetables as shown above. Since the device is portable, it will enhance the efficiency of the food and safety authorities and ensure quality.

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