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Automatic Irrigation and Worm Detection in Crop using Raspberry PI with OpenCV

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Abstract: *The Internet of Things (IoT) is a system of networked devices that can talk to one another and function on their own. Agriculture provides a wealth of indications for data analysis that help produce improved agricultural yields. Intelligent farming enhances information and communication thanks to the use of IoT devices in agriculture. For the best crop growth, it is important to consider a variety of parameters, including soil types, soil moisture, mineral nutrients, temperature, light, and oxygen. Now, a range of sensors can collect these parameters and transmit them to the cloud. A few of these criteria are taken into account in this study's data analysis in order to advise to the consumers better agricultural decisions using IoT. The Internet of Things (IoT) is a system of networked devices that can talk to one another and function on their own. Agriculture provides a wealth of indications for data analysis that help produce improved agricultural yields. Intelligent farming enhances information and communication thanks to the use of IoT devices in agriculture. For the best crop growth, it is important to consider a variety of parameters, including soil types, soil moisture, mineral nutrients, temperature, light, and oxygen. Now, a range of sensors can collect these parameters and transmit them to the cloud. A few of these criteria are taken into account in this study's data analysis in order to advise to the consumers better agricultural decisions using IoT.*

Keywords: Machine Learning, DTH 11, Raspberry-Pi, CNN(Convolutional Neural Network).

I. INTRODUCTION

1.1 Overview

Agriculture has traditionally been regarded as the main source of supplies for meeting the basic necessities of the population. It is recognised as both a necessary kind of employment and a significant industrial sector in India. In order to maintain a healthy diversity, farmers should practise traditional naked eye observation and produce healthy crops without using pesticides on their cultivation field or on the animals that eat those products. But in today's world, weather patterns are shifting swiftly in opposition to the availability of natural resources, which decreases food supply and increases security. Farmers frequently decide to leave the areas deserted because of the frequent attacks on animals caused by this problem. India is a country where the majority of people make their living from agriculture and related sectors. Agriculture is the main sector of the economy of this nation. The crops are destroyed by severe natural catastrophes like droughts and floods that occur in this country. The farmers experience severe financial losses as a result, which prompts many to take their own lives. Accurate agricultural output forecasts can help farmers and governmental organisations make the necessary preparations before harvest, including storing, selling, establishing a minimum support price, importing/exporting, etc.

1.2 Motivation

The continually expanding demand and dwindling supply of dietary staples make it
Imperative to swiftly enhance food production technologies.

- Due to water scarcity on the planet as a result of water limitations and land water scarcity, farmers use irrigation.

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- Irrigation is the science of artificially distributing water to land or soil so that plants can accept it, depending on the type of soil available.
- The main driving force is to shorten the surveying process's time requirement.

1.3 Worm Detection in Crop

Crop productivity is much sought after in agriculture. To raise or enhance productivity, it is vital to find worms quickly and to improve irrigation. In the past, sensors were used to measure the soil moisture in the field as it was being watered.

It looks to be erratic and varies, for instance, according on the top and inner layers of the soil. This problem is being avoided by using early worm detection and automated watering systems.

The essential procedures for worm identification in crops using CNN and sentiment analysis are as follows:

1. Data gathering: Compile photographic information about the crop, such as images of dry crops, insects, and damaged crops.
2. Pre-processing: This step involves transforming the incoming picture data into useful floating-point tensors that can be fed into convolutional neural networks.
3. Feature extraction: To extract features using deep learning, we consider the pre-trained network as an arbitrary feature extractor, allowing the input image to advance until it reaches a predetermined layer and halting there. We then use the outputs of that layer as our features. By doing this, we may still use the powerful, discriminative properties that the CNN has learnt.
4. Segmentation: Segmentation is the process of breaking up an image into groups of pixels that are each represented by a mask or labelled image.
5. Train a machine learning system, such as a CNN, to understand how the crop result and the features relate to one another.
6. Prediction: Based on the pre-processed visual data and the CNN findings, use the trained model to make predictions regarding crop status.
7. Evaluation: Assess the model's effectiveness using criteria like accuracy

1.4 Automatic Irrigation

Using IOT to power an irrigation system Our controller and processor are a Raspberry Pi 3. A sensor that gauges soil moisture delivers data to a Raspberry Pi 3 if the ground is dry. A Raspberry Pi 3 will process it before the motor turns on. Additionally, this activity data will be sent to the farmer mobile app.

Detecting Temperature and Humidity The farmer's app receives instantaneous temperature and humidity readings from the Raspberry Pi 3's DHT11 sensor. monitoring for rain Using a rain sensor, Raspberry Pi can identify whether it is raining or not. So, based on the value, we can either tell the farmer or choose not to start the engine. It is connected to an irrigation system and acts as a water-saving device. discovery of a worm sickness The Raspberry Pi 4 uses the input image from the test dataset to compare it to the trained dataset using CNN. This will show whether the leaf is defective or not.

1.5 CNN (Convolution Neural Network)

Like any other neural network, a CNN goes through a series of filters to produce an output that can be tagged and categorised. In this example, the input is an image. A CNN's specificity comes from its filtering layers, which include at least one convolution layer. They allow it to analyse images that are more complicated than a standard neural network can. CNNs are used in image analysis for a variety of tasks, including object categorization and detection, particularly in the field of radiography, as well as Facebook's automatic tagging algorithms. For simple, well-centered pictures like handwritten digits, the latter is best suited. Applications for image and video recognition using convolutional neural networks. CNN is primarily used for image analysis applications including object segmentation and picture recognition.

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II. CNN MODEL CODE

Convolutional neural networks with a focus on image and video recognition applications. CNN is mostly utilised for image analysis applications like segmentation, object detection, and picture recognition.

Convolutional Neural Networks have four different kinds of layers:

1. Convolutional Layer: Each input neuron in a conventional neural network is connected to the following hidden layer. Only a small portion of the input layer neurons in CNN are connected to the hidden layer of neurons.
2. Pooling Layer: The pooling layer is used to make the feature map less dimensional. Inside the CNN's hidden layer, there will be numerous activation and pooling layers.
3. Flatten: The data is flattened into a 1-dimensional array before being entered into the following layer. We flatten the convolutional layer output to produce a solitary, lengthy feature vector.
4. Fully Connected Layer: The network's final few tiers are made up of Fully Connected tiers. The output from the last pooling or convolutional layer is passed into the fully connected layer, where it is flattened before being applied.

2.1 CNN Implementation Steps

Step 1: Convolution Operation(Filter image)
Step 1(b): ReLU Layer
Step 2: Pooling (used max pooling function)
Step 3: Flattening (Covert Matrix into 1D Array)
Step 4(a):Full Connection.
Step 4(b): Dense()
Step 4(c): Optimizer()
Step 4(d) : compile()

III. OUTPUT

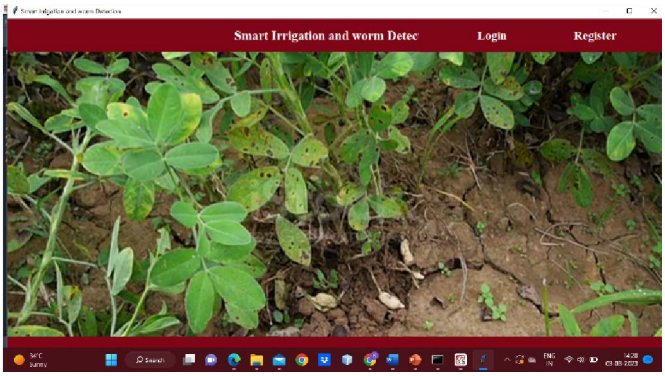

Fig1. GUI Main Page

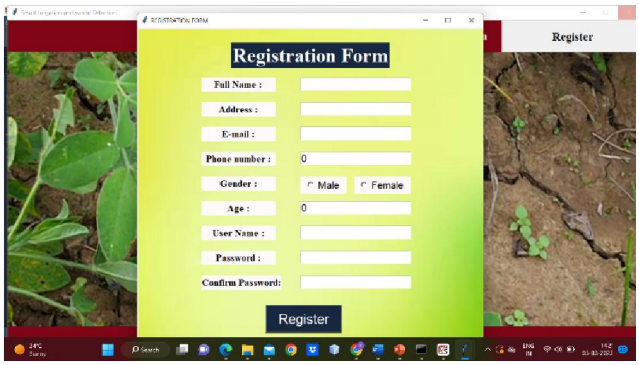

Fig2. Registration Page

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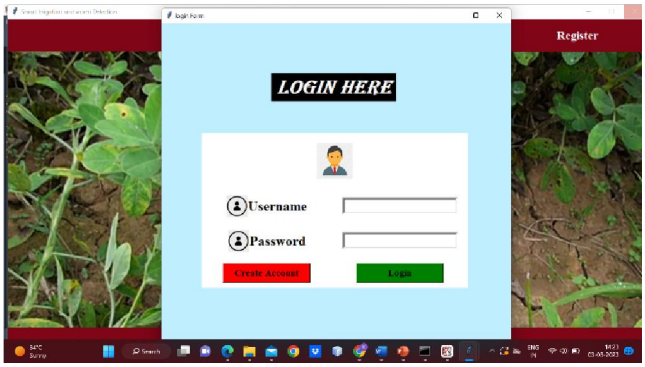

Fig3. Login Page

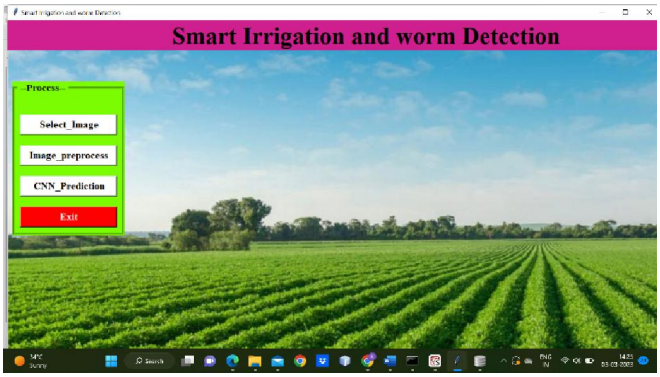

Fig4. Train Output

Fig5.1. Test Output

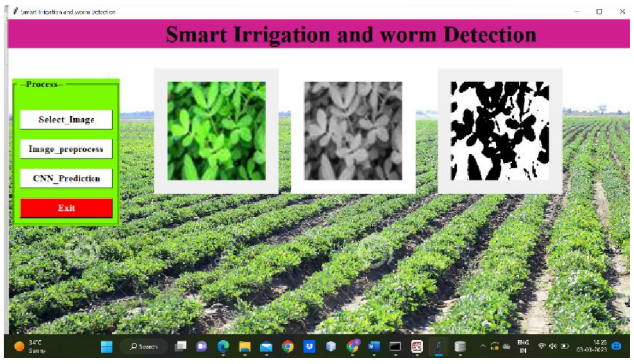

Fig 5.2 Test Output

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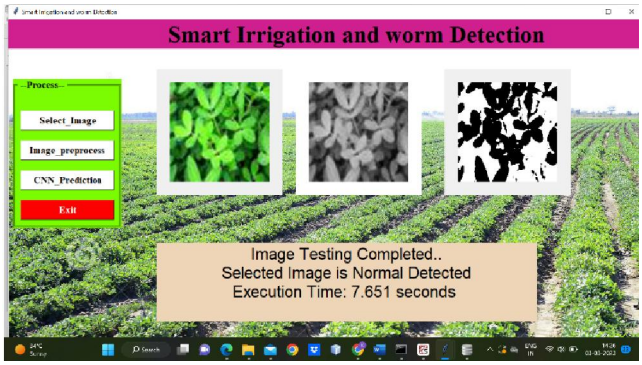

Fig 5.3 Test Output

IV. CONCLUSION

Agriculture contributes to the economy of our country. However, this falls short in terms of making use of modern machine learning technology. Therefore, our farmers should be familiar with all of the most recent machine learning technology and other cutting-edge techniques. These techniques help to increase agricultural productivity. This field was constructed using a Raspberry Pi 4 and numerous sensors. The system is a smart irrigation solution based on IOT and AI that fully automates irrigation by using the moisture content of the soil and the crops' moisture requirements. The major benefits are its efficiency and economic feasibility.

V. ACKNOWLEDGMENT

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VI. REFERENCES

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