Greenshield: The Smart Farming System For Suicide Avoidance

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ABSTRACT

Introduces a ground-breaking plan that uses cutting-edge technologies to solve the urgent problem of farmer suicides. The method blends three necessary components for early prediction, creating a complete answer to the various problems that farmers encounter. First, To detect issues related to plant health, the system employs Convolutional Neural Networks (CNN. This helps farmers who greatly depend on their agricultural produce by acting as an early warning system of possible financial difficulties in addition to helping to maintain crop yield. Second, the project protects crops from unforeseen hazards provided by animals by using YOLOv5 for animal entrance detection. This function guarantees that farmers' livelihoods are protected and helps to mitigate financial losses for them. By incorporating these state-of-the-art techniques into a platform for real-time monitoring, The system's ultimate goal is to lower the startlingly high incidence of farmer suicides by proactively warning authorities and farmers about possible emergencies and providing them with the tools they need to act quickly and effectively .Moreover, this multi-feature strategy promotes agricultural sustainability in addition to addressing current problems. The platform for real-time monitoring gives farmers the ability to make well-informed decisions and act quickly in the face of new difficulties. This empowerment reduces the stress brought on by uncertainty in agriculture, which enhances general well-being. The initiative aims to improve farmers' lives by developing a comprehensive system that integrates animal invasions and technology-driven early detection of plant illnesses that frequently results in startlingly high farmer suicide rates.

Keyword : *-Convolutional Neural Network, YOLOV5*

1. INTRODUCTION

Our project emerges at the intersection of advanced technologies and the critical socio-economic issue of farmer suicides. With the agricultural sector being a cornerstone of many economies, the alarming rates of farmer suicides underscore the need for innovative solutions. This project endeavours to pioneer a transformative approach by integrating three key features into a unified system. The first facet involves leveraging Convolutional Neural Networks (CNN) for the early detection of leaf diseases, thereby addressing crucial plant health issues. By giving farmers a tool to quickly detect and treat crop diseases, the system aims to enhance overall agricultural productivity and, in turn, alleviate economic pressures on farmers.

The second part of the system is on applying YOLOv5 for animal entrance detection, protecting crops from unforeseen dangers presented by wildlife. Crop protection and agricultural sustainability are closely related, and the project's goal is to strengthen farmers' lives and reduce financial losses.

Essentially, the project's novel approach seeks to surpass traditional farming methods by converting them into a state-of-the-art, comprehensive system that tackles the various issues that farmers encounter. The initiative aims to change the agricultural landscape, promoting sustainability and resilience while greatly enhancing the well-being of farmers by combining early illness detection and preventing animal incursions.

1.1 Leaf Disease Detection

The development of Convolutional Neural Network (CNN) models is necessary to efficiently and precisely recognize crop diseases from leaf photographs. CNNs are excellent for picture categorization due to their capacity to automatically extract characteristics from raw pixel data. To improve characteristics and eliminate noise, the photos undergo preprocessing. To boost the dataset's diversity, this may entail using augmentation, normalization, and resizing approaches. In order to save farmers money and worry, the major objective is to assist them in identifying and treating plant health issues as soon as possible.

1.2 Animal Intrusion Detection

Use YOLOv5 to monitor agricultural areas in real time and detect animal incursions. Based on the required level of detection and the available processing resources, select the suitable YOLOv5 variation. The larger versions of YOLOv5 give more accuracy at the expense of more computing complexity. Apply the learned YOLOv5 model to photos or surveillance material in real-time or in batches for inference. To quickly identify and notify staff members of animal incursions, incorporate the model into any security systems or programs for monitoring that are already in existence.

1.3 Data Integration and Prediction

Combine the results of the modules for detecting animal entry and leaf disease into a single, cohesive system. Develop predictive algorithms that take into account these traits together with additional environmental and socioeconomic factors to assess the risk of farmer suicides. Consolidate the preprocessed data from multiple sources into a unified dataset. This can be achieved through techniques like data warehousing, data fusion, and data virtualization. Using the trained model or models, make predictions on new or unobserved data. This could mean classifying new occurrences, forecasting future patterns, or clustering data points.

1.4 Alert System

Establish a real-time alarm system that, in the event that possible dangers are identified, alerts farmers and pertinent authorities in order to facilitate prompt assistance and response. Establish warning thresholds based on the number of animals discovered, their proximity to sensitive locations, or specific species of interest. Adapt these criteria to the monitoring site's requirements and the degree of sensitivity. Provide notifications, emails, or text messages as soon as the detecting module detects animal entry above the predetermined criteria. Provide an intuitive user interface so that farmers can communicate with the system.

2. System Design

The overall system design is shown via the system design. The design of the system is covered in great detail in this section.

Image Acquisition

The term "image acquisition" describes the procedure of gathering visual data, usually via a camera or sensor, and transforming it into a digital format so that a computer can interpret and evaluate it. Numerous fields, such as computer vision, medical imaging, remote sensing, and more, depend on this process. Systems for capturing images can be as basic as the cameras on smartphones or as sophisticated as those employed in industrial or scientific settings. The type of sensor, optics, illumination, and imaging system calibration are some of the variables that affect the quality and dependability of the obtained images.

Image Pre-processing

Noise reduction and normalization against pixel location or brightness variations are two aspects of image pre-processing. A variety of methods are combined into image preprocessing with the goal of making digital images better before they are subjected to additional processing or analysis. These methods are used to deal with problems including noise, changes in illumination, distortions, and other artifacts that may impair the precision and efficiency of later algorithms.

- Color Normalization
- Histogram Normalization

Feature Extraction

Choosing the feature The most crucial component in a pattern classification challenge is the vector. After pre-processing, the facial image is used to extract the key features. The scale, position translation, and changes in illumination level are among the fundamental issues with image classification.The process of identifying and eliminating important characteristics or features from images that can be used to represent and explain the content of the images is known as feature extraction in the context of image processing and computer vision. In order to minimize the dimensionality of the feature space and eliminate superfluous or irrelevant characteristics, feature extraction is sometimes followed by feature selection or dimensionality reduction techniques. This can increase the efficacy and efficiency of following analysis or classification activities.

2.1 Pooling Layer

The pooling layers section would reduce the number of parameters when the photographs were too large. Spatial pooling, sometimes referred to as down sampling or subsampling, reduces the dimensionality of each map without sacrificing important information.
There are various forms of spatial pooling.

- Max Pooling
- Average Pooling
- Sum Pooling

Max Pooling - The largest element is taken from the updated feature map using max pooling. Taking the largest element would be an other way to compute the average pooling. The total of all the feature map pieces is known as sum pooling.

Average Pooling -Convolutional neural networks (CNNs) frequently employ average pooling, along with max pooling, as a down sampling technique to minimize the spatial dimensions of feature maps while maintaining crucial information.

Sum Pooling -While sum pooling is not as popular as max and average pooling, it relies on the same idea of down sampling feature maps in CNNs (convolutional neural networks). Instead of calculating the maximum or average value within each region, sum pooling computes the sum of all the values within each pooling region. The stride selection and pooling size dictate how much down sampling the process does.

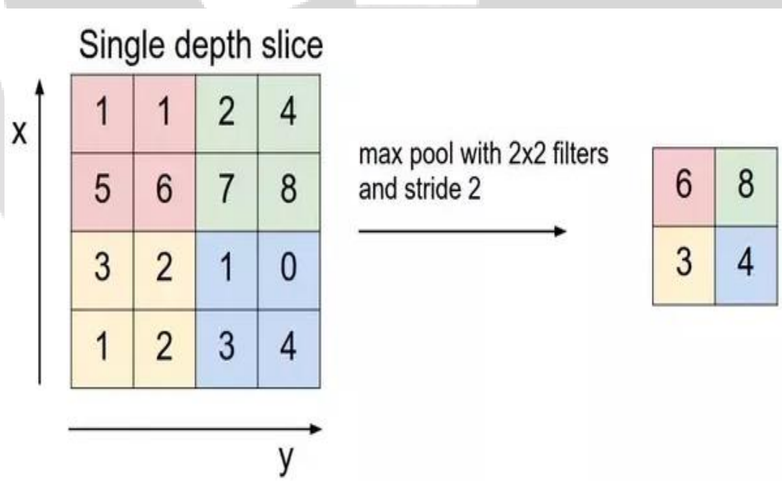

Fig -1 : Max Pooling

2.3 Data Flow Diagram:

By offering a graphical representation of the data flow through the system, a data flow diagram (DFD) represents the process features of an information system. Another use for DFDs is data processing (structured design) visualization. Models of data flow are used to illustrate how data moves through different stages of processing. The data is converted at each level before proceeding to the next.

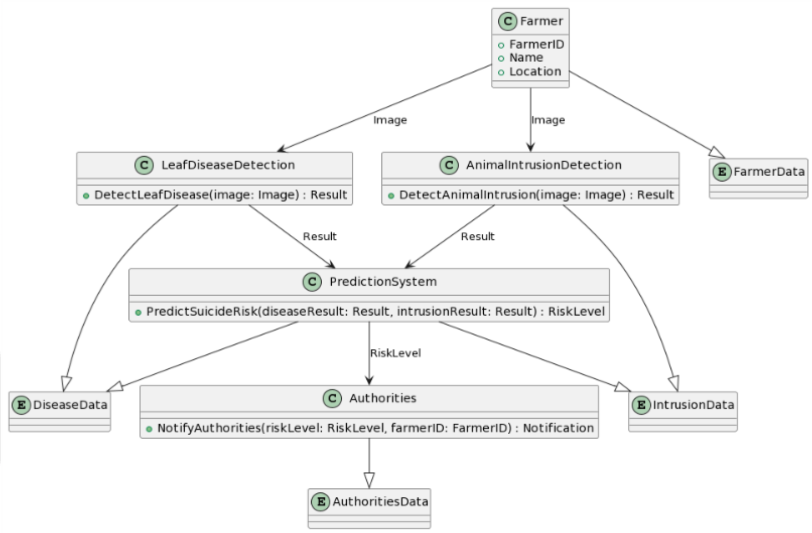

Fig -2: Data Flow Diagram

The operations or modifications that are carried out on data inside the system are represented by processes. They are shown as rectangles with labels that explain what is being done. Tasks like data manipulation, computations, and decision-making are examples of processes.

3. Implementation

YOLO

There is a detailed discussion of the algorithm used to discover and classify disaster areas. For both detection and classification, the YOLO object detection technique is employed. Yolo workflow is covered in detail here, step by step.

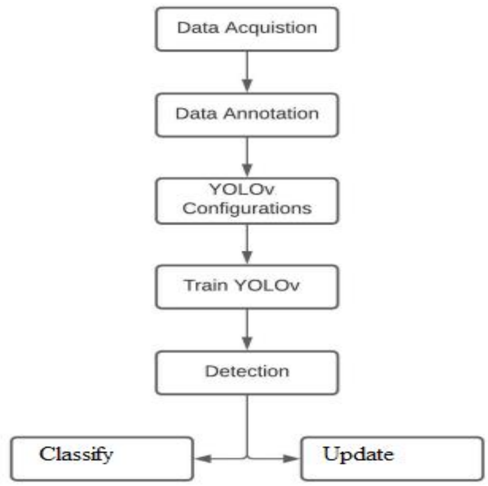

Fig -3 : WORK Flow of YOLO

In many different applications where real-time object identification is crucial, including robotics, autonomous cars, surveillance systems, and more, YOLO is frequently employed. Its ability to provide prompt and accurate detections makes it a preferred choice for many computer vision jobs.

3.1 System Architecture

The conceptual model that outlines a system's behaviour, structure, and other aspects is called a system architecture. A system's formal description and representation, arranged to facilitate inference about its structures, is called an architecture description.

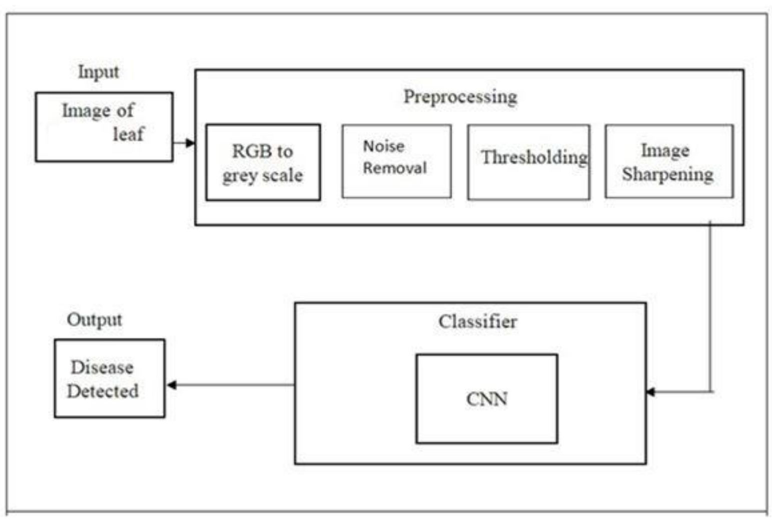

Fig -4: System Architecture

The suggested method's system architecture is depicted in the image. As we can see, the leaf disease detection system receives the leaf picture input, preprocesses it, and then extracts its features. The final component of CNN, the SoftMax classifier, receives the extracted features. To determine the threshold value based on the input image, the input image is pre-processed and converted to a greyscale image. Further image sharpening is done based on the threshold value, and then additional processing is done.

The following steps are included in the suggested method for disease detection.

1. Convert RGB to greyscale
2. Elimination of Noise
3. Limiting
4. Clarification of Images
5. Classification and Feature Extraction

3.2 Pre-processing Module

The picture that is acquired by the camera can be utilized as an input image to identify an illness or stored as a dataset for training. The image is captured and saved in a format that is supported by the device. Pre-processing is required for all photos in order to improve image processing performance. Photos that are taken are stored in the RGB format. The collected images have extremely high dimensionality and pixel values. Just as matrices are images, so too are mathematical operations on matrices done on images. Thus, we create a grayscale image from an RGB image. The preprocessed image is then obtained by performing Noise Removal, Thresholding, and Image Sharpening as the last steps.

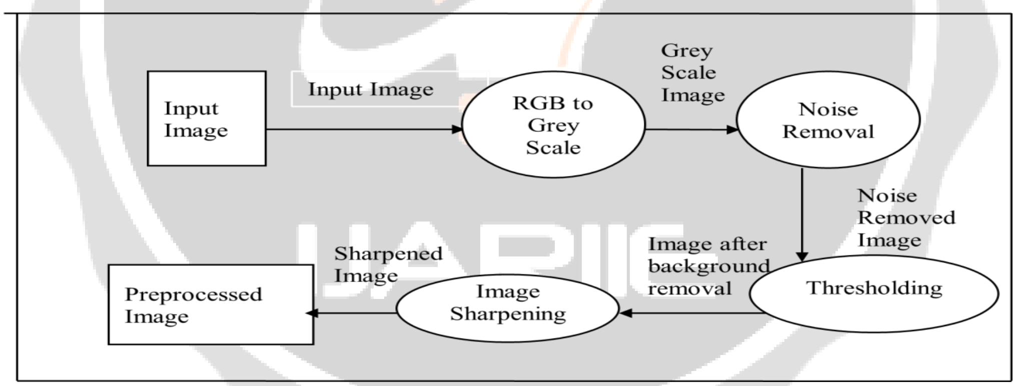

Fig -5 : Diagram for pre-processing module.

3.3 State Chart Diagram for Proposed System

A state chart diagram is another term for a state diagram. It is the most often used of the five UML diagrams and is used to illustrate the system's dynamic nature. An object's various states throughout its life are depicted in a state chart. The state chart diagram, which consists of a finite number of states, describes the functionality of each module in the system. In this graph, each state is represented by a node and a directed edge, which illustrate the temporal evolution of the states. Each state name must be unique. When something is created, it enters its beginning state, and when it enters its ultimate state, it is said to have died. The starting state is represented by a solid circle, while the ending state is shown by a bull's-eye symbol.

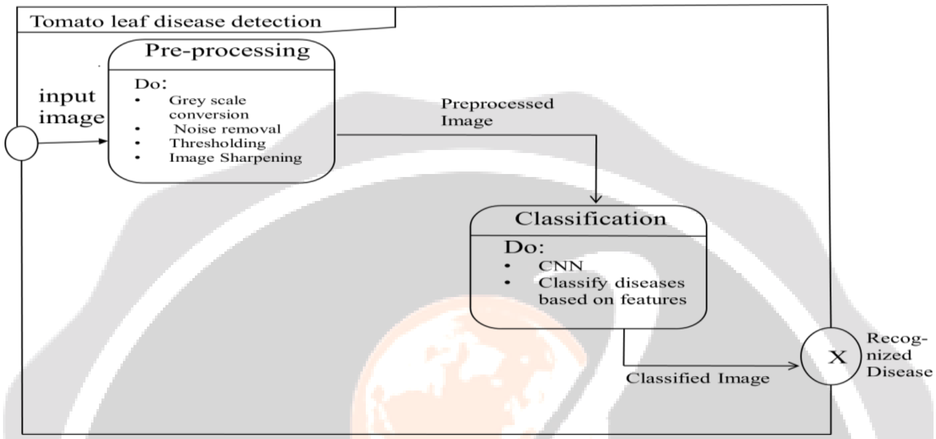

Fig -6 : State Chart Diagram of model using CNN**.**

The process is shown in the figure, beginning with the solid circle, as follows: reading the picture in the first step while utilizing the leaf as input; pre-processing to convert RGB to gray scale in the second state; noise removal; thresholding; and, finally, image sharpening. Classification takes place in the third state. The disease-recognized ID was displayed in the last state.

4 RESULT AND CONCLUSION

Results

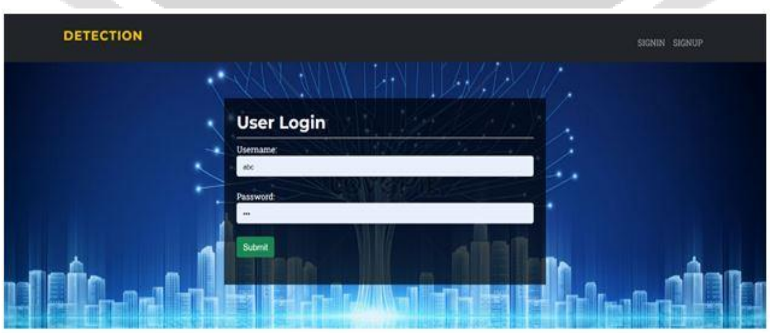

Fig -7 : Login Page

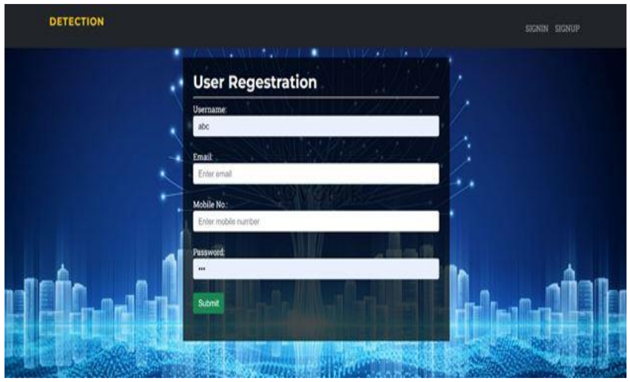

Fig -8 : User Registration

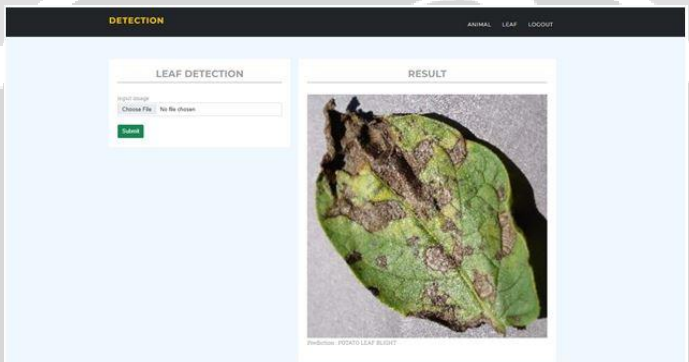

Fig -9 : Detection of Leaf which has disease

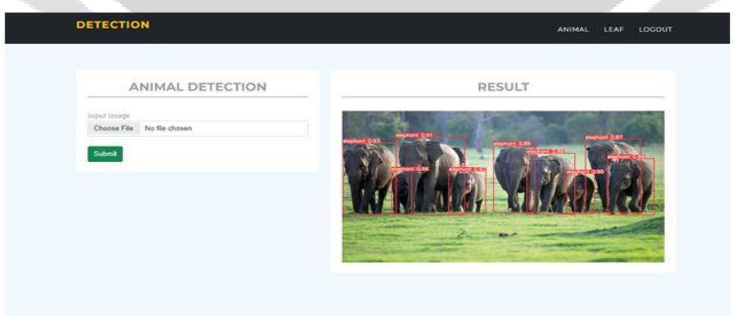

Fig -10 : Detection of Animal

CONLUSION

To sum up, the Greenshield project—"The Smart Farming System for Suicide Avoidance"—integrates state-of-the-art technologies to tackle pressing issues that farmers encounter. The system's capacity to monitor and protect agricultural assets is improved by the integration .Using YOLOv5 for animal incursion detection and Convolutional Neural Networks (CNN) for leaf disease detection. The system enhances the general welfare of the farming community by promptly notifying farmers and notifying authorities in high-risk situations. The study highlights the value of proactive monitoring and intervention in averting unfavorable circumstances that could cause farmers' misery in addition to showcasing the possibilities of cutting-edge technologies in agriculture.

Additionally, the concept aligns with the overarching goal of leveraging AI and machine learning for social good. By combining disease identification with intrusion monitoring, a comprehensive strategy to reduce stressors for farmers can be implemented, fostering the development of a more resilient and sustainable farming environment. As technology continues to have a significant influence on a variety of industries, this project offers a moving illustration of how technology may be used to solve practical problems, ultimately improving farmer welfare and creating a more safe and fruitful agricultural environment. By combining disease identification with intrusion monitoring, a comprehensive strategy to reduce stressors for farmers can be implemented, fostering the development of a more resilient and sustainable farming environment.

It's critical to recognize that technology cannot resolve the many problems pertaining to mental health in farming communities on its own. Greenshield ought to be incorporated into more extensive initiatives to address systemic flaws and increase public understanding of mental health concerns and give people access to resources and services for mental health. To sum up, Greenshield is a potential development in the use of technology to aid in the prevention of suicide in the agricultural sector. Through the integration of innovation, empathy, and community involvement, Greenshield holds the potential to save lives and advance the welfare of farmers across the globe.

6. REFERENCES

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