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Smart Irrigation and Crop Protection using Deep Learning

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***Abstract*— Farmers in India are threatened by animal damage, which results in lower yields. It is critical to safeguard crops against animal damage. To overcome the fore mentioned issues and achieve our goal, machines are used. The entry of the animals is detected using the deep learning model, and an alert is notified to the farmer. Depending on the requirements, the automatic irrigation system feeds or drains water. Water would be sprayed automatically in the event of a fire disaster. Smart irrigation and crop protection makes the protection in the agricultural field where it protects from various crop diseases and makes the crop from the protection to the disease. The crop in the field system makes the use of deep learning algorithms which makes the process of protection and detection. The crop protection process involves the operation with the system which detects ad prevents from the operation of the system from the crops where it makes the use of various operation. The smart irrigation process involves the operation of the system with the various operation where it makes the detection of the system with the deep learning algorithms and makes the detection technique in the system. The crop in the fields are affected with the various operation methods which makes the operation in the system with the use of Arduino with ESP8266 WiFi module. The various sensors used in the system makes the sensing unit in the external environment which makes the use of motor driver which controls the crop water irrigation control in the system. The motor is controlled with the relay unit where it is connected to the sprayer which sprays the water in the field evenly to the crops.**

***Index Terms*— Agriculture, Animals, Crop protection, Deep Learning, Farmers.**

I. INTRODUCTION

Today, extensive data on animal behavior and activity can be collected across a wider time and geographical range. Due to their accessibility and low-cost camera, to monitor and analyze wildlife. The study of wildlife, from camera-trap photographs, we may quickly gather information about an animal's appearance, which helps us understand its behavior and biometric characteristics as well as pertinent details about its surroundings and habitat. The recent acquisition of a sizable collection of camera-trap photos tests the abilities development of several methods for the automated analysis massive, including animal recognition, is urgently needed. In this paper, we present a CNN-based approach for identifying wildlife animals. Automated analysis of image sequences requires the segmentation of objects and their separation from the background depending on their motion. Several studies have focused on back end and front-end modelling for object recognition; nevertheless, complicated dynamic scene modelling

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presents difficulties. Natural scenes frequently have a lot going on, such as swaying trees, rippling water, moving shadows, fluctuating weather, rain, etc.
Diverse research efforts have occurred in recent years. As a result, researchers have been paying close attention to this topic in recent years. These methods produce regional proposal networks (RPNs) and the subsequent categorization of the region proposals. On the other hand, regression-based object detection techniques like SSD, YOLO, etc. These techniques likewise produce region proposal networks (RPNs), but classify these region proposals as they are being created. The location and recognition of objects have been successfully accomplished by all of the aforementioned processes.
In this research, a novel approach to decreasing human-animal conflicts is presented. It involves employing a camera system to continuously and automatically monitor risky regions. It is also an area of study that aims to "smarten up" computers. As machines' capabilities increase, mental capabilities that were once assumed to require intelligence are no longer included. Real-time object detection algorithms are used in this instance to identify objects with the aid of deep convolutional neural networks. It aids in locating instances of wild animal damage to crops. For this project, we need several cameras installed at agricultural regions, allowing us to see exactly who is entering each location. When an animal enters a farmer's field, our technology will be able to recognize it and send him a warning message. Farmers can now take steps to divert such animals from their crops with ease.

II. Literature Survey

The further more review of the literature section in the publication involves the deep learning algorithm improvement in the algorithm operation where it makes the design use of the system which makes the improvement in the efficiency of the system which makes the best use of the system with involvement of the system with the desired outcome which involves the operation of the system with the expected algorithm operation which makes the learning of the deep learning algorithm with the various input standards which makes the system in improvement of the efficiency. The system makes the use of the data with the given input and makes the use of the system with the Arduino and ESP8266 which provides the hardware action in the system. The deep learning system makes the use of work with the various conditions with the system which makes the use of working in various application of the operation.

A. Animal Detection for Road Safety

Blind spots cause problems for truck drivers. This paper proposes a model for detecting animals and alerting the driver. We are segregating the animals using machine learning—a deep learning algorithm and a large open-source dataset.The model's accuracy is 91%. The animal detection in the system makes the use of the system with the deep learning algorithm which makes the system to work efficiently.

B. Sensor Based Water Management for Agriculture

Using an array of sensors to assess the water quality and an LCD to display the determined value, monitoring urban waste water for agricultural use offers a smart option. The estimation of water quality parameters, such as pH, turbidity, BOD, and TDS, is the main goal of this paper.

C. IoT Based Water Quality Estimation And Monitoring

Rapid development has also had a negative influence on the sources of water used for agricultural, household, and industrial purposes. All of these resources have been damaged as a result of man's sheer avarice, that has resulted in illegal garbage and excessive levels of industrial effluents in excess of regulatory regulations. In this study, the author suggest an IoT-based system that makes it simple for individuals to keep an eye on the water quality delivered to their houses.

D. Animal Behavior Classification Using DeepLabCut

In this article, we present a technique for categorizing animal behaviours in films captured by a fixed-point camera. Animal detection and tracking are required in order to categorize animal behaviour. The traditional methods for identifying moving objects rely on backdrops and frame removal. Since indoor animals are vulnerable to sunlight and shadow, conventional approaches are not ideal for their detection. We provide a technique for following animals and categorizing their activity using DeepLab's skeletal data.

E. Water flow monitoring using IoT solutions

This publication presents cutting-edge water management strategies. To save costs, use cutting-edge technology tools like long-range, low-power networks and the Internet of Things. The findings show that effective management of natural resources, particularly those that are unrecoverable, is the essential foundation for the development of cities towards sustainability. Along with highlighting the benefits and drawbacks of potential technological solutions that are currently feasible, this work also raises potential applications in other fields, such as agriculture and water treatment.

The overall review of the system makes the use of the system with the needed development in the system which is needed to be overcome with the further improvement in the system. The design of the system makes the use of the device design and makes the more improvement in the design using the deep learning system. The hardware design is integrated with the deep learning and makes the use of design metrics with the use of various instruments with the system. The design system in the network makes the use of the deep algorithm which is optimized with the efficiency improvement in the system. The system makes the control of the control of hardware devices which helps in the make of the system with control of Arduino and ESP8266. The control of these hardware devices makes the use of the system with the integration of the control of sensor data and the system with the control of motor and sprayer system.

III. Problem Identification

The problem included in the system makes the identification of the crop disease with the deep learning algorithm. The algorithm makes the system of applying the sensory inputs to the system which makes the system with the control of processed inputs in the system. The main problem of the system makes the use of identification of the crop disease with the system which makes the identification and implementation of the system. The crops in the field are affected with the various diseases which makes the use of the system with the recovering of the crops from the various diseases. The main approach in the system design makes the use of the product with the use of application in the identification process where it makes the crops free from the diseases.

The problem identification in the system makes the use of DNN and analysing the incoming data with the sensory data's where it makes the system to work in the progress of the identification and protection of the crops. The crops protection makes the process of applying the sensory input with the system with the process of operating in the system and operation. The main task of the system makes the operation where it makes the identification and detection of the system.

The Incoming data In the system where it makes the process of operation in the system with the collection of data. The incoming data in the system which makes the operation which makes the operation in the detection of the system. The process makes the use of the identification and detection operation with the deep learning algorithms and makes the effective detection of the system. The system makes the deep learning algorithm which makes the operation with the incoming data and operation with the system. The crop protection is also included with the smart irrigation system where the entire system in the network makes the use of applying the process in the process. The smart irrigation also includes the spraying and supplying the water to the field which plays the additional operation in the crop protection operation.

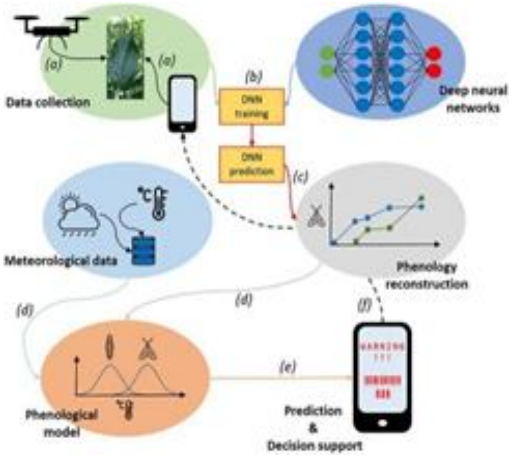

Fig. 3.1 Crop prediction Process

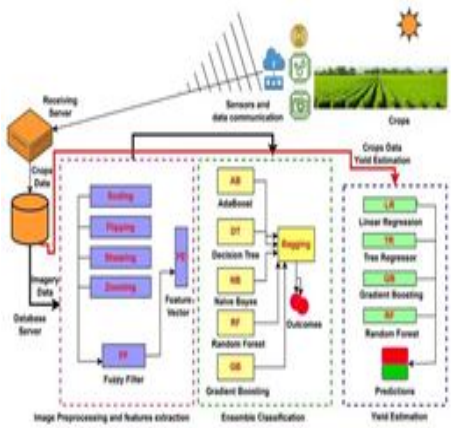

Fig. 3.2 Image processing

Fig. 3.1 involves the involvement of various filters where it extracts the data from the crop image where it sends the data to the deep learning algorithm. The algorithm further predicts the crop disease and makes the control of the system with the efficient irrigation to the system.

IV. Proposed Methodology

Our proposed system presents a system for segmenting animals from photos. If the level is too high, the moisture will be drained out, and if it is too low, water will be supplied. The gas sensor is used to detect the existence of flames and to extinguish the fire using sprinklers. In the second stage, these concepts were separated into backgrounds and foregrounds. AlexNet extracts feature vectors from each image. The proposed problem in the method involves the working of the system with the system. The protection of the crops from the animals involves the working with algorithms, sensors and control actuators. The entire system works with the operation of the system with the sensory input data and provides the feedback to the algorithm which makes the control of the actuators in the system. The main algorithm plays the major role is that YOLO v3 which makes the effective usage of the system with the system of processing and provides the protection to the crops in the field. The algorithm also helps in the control of the field which makes the smart irrigation with effective usage of the water where the algorithm decides the water irrigation time duration.

A. Algorithm used for Animal Detection

AI projects use object grouping frameworks to identify subjects of interest that are explicit objects in a class. The frameworks group objects in images into bunches where objects with comparable qualities are grouped together, while others are ignored unless otherwise specified. The elements learned by the convolutional layers are sent to a classifier, which predicts the identification, as is typical for object finders. Nonetheless, it maintains accuracy. It allows the model to see the entire picture while testing so that the global settings in the picture can educate the forecasts. YOLO and other CNN "score" locations based on their resemblance to predefined classes.In YOLO, the expectation relies on a layer that makes use of 11 convolutions and is implemented using a convolutional layer. Because YOLO's prediction uses 11 convolutions and the size of the expectation map is equal to the size of the element map before it, the acronym stands for "you only look once." CNN has a programme called YOLO that is designed to locate objects in real time. CNN's are classifier-based systems that can recognize patterns in images when they are input as organized types of information (view the picture underneath). YOLO has the advantage of being a lot faster than other networks.

The YOLO v3 algorithm makes the use of the system which helps the process in the operation of the task while segments the input image with the prediction scale as 1, 2 and 3. The mechanism used in the system which makes the process of convolution process with the upscaling and concatenation in the system. The system which makes the prediction process with the 3 layer of scale which makes the process of applying in the technique. The algorithm makes the system with the efficient detection of the animals with the environment and makes the control of the hardware system which makes the use of the system. The process involves the development of the system with the design of the algorithm which makes the use of detection and provides the protection to the crops with the animals. The system makes the control of motor and sprayer with the algorithm output system.

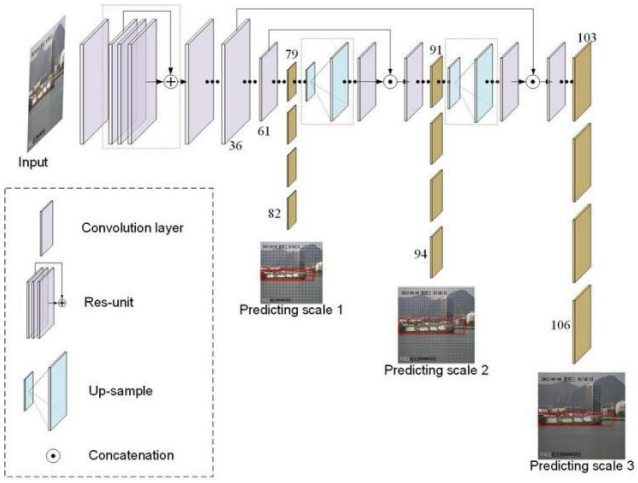

Fig. 4.1 YOLO V3 Architecture

B. Block Diagram

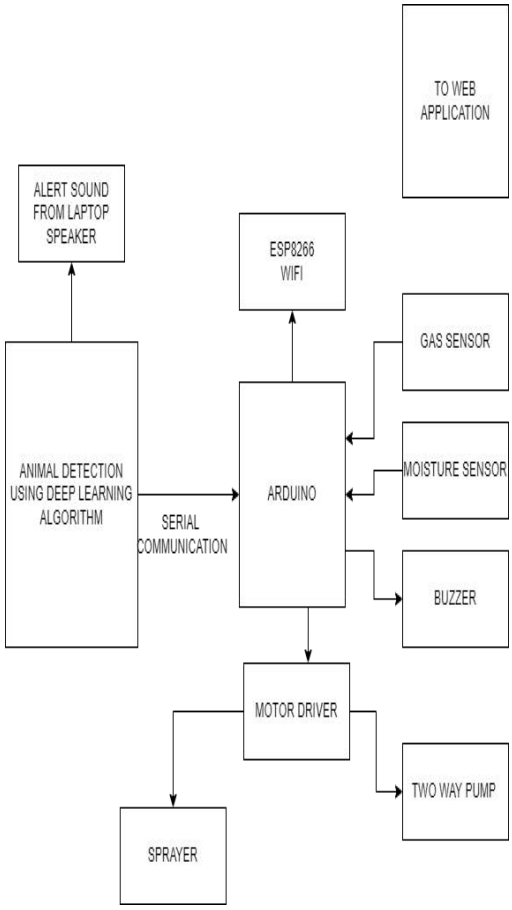

Fig 4.2 Block Diagram

The block diagram explains the design of the system with the Arduino and esp8266 which makes the control of various sensors. The YOLO V3 algorithm which provides the animal detection and sensing with the provided crop field which detects the presence of animal and gives the data in the form of serial communication. The Arduino receives the data and makes the data transmission to IOT through ESP8266 and controls the motor driver unit. The data received from the sensor provides the data in the form of analog and digital where it makes the sensing of the all the received input to the Arduino Atmega328p 8 bit micro-controller. The motor driver is the motor control module where it makes the control of the motor and sprayer system the digital signal which provides the irrigation to the crops. The entire system is displayed in the web page system. The system controls the entire network with the ESP8266 WiFi module.

C. Hardware Implementation

The animal entering the field is detected by the deep learning algorithm fed into the Arduino. The gas sensor detects a fire in the field and alerts the farmer, while the soil moisture sensor irrigates the crop as needed. The detection range of these sensors causes the DC pumps to operate. The hardware implementation consist of four geared motors which has been controlled by using the motor driver. The hardware unit is designed as a vehicle where it should be readily available to make the crop protection from the animals and should provide the smart irrigation.

The hardware device consist of the network where it makes the system with the desired operation. The entire monitoring and output is processed using the web page and ESP8266. The ESP8266 is responsible for the display of the output data in the web page. The processed data is transferred from the Arduino atmega328p micro-controller to the ESP8266. The control system makes the entire device operation with the system where it makes the system to work in the operation of the irrigation field.

The hardware system designed to work with the power supply of entire system with the 5V supply. The 5V voltage supply makes the use of the system with the entire control operation for the Arduino micro-controller. The ESP8266 is designed to work with the 3.3V power supply where it makes the voltage regulator with AMS1117 regulator. The controller operates with the 3.3v as the high output voltage. The communication with the Arduino and ESP8266 will have a voltage shifting circuit where it has the shifting of the voltage from the 3.3v and 5V operation in signal transmission.

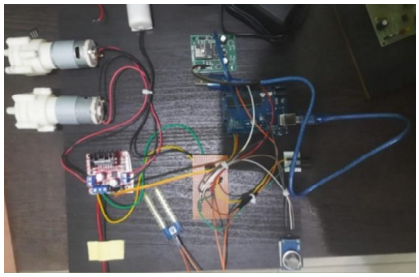

Fig 4.3 Hardware Implementation

V. OUTPUT

The soil moisture sensor and gas sensor water the crop and guard it against farm fire while the deep learning algorithm fed into the Arduino recognizes the animal entering the field. These sensors' detecting range causes the DC pumps to operate. The farmer receives a signal from the system when an alert is detected, together with information on the identity of the animal that was detected, the soil moisture level, and the value of the gas sensor. The output is viewed in the system where it makes the entire system control where it makes the operation in the system where it provides the output in the web page where it controls the entire system where it makes the control of the irrigation and pump control operation with the web-page. The animal detection is viewed with the help of YOLO v3 algorithm. The web-page consist of the data as soil moisture level, humidity and Co2 gas level in the atmosphere.

A. Testing and Result

The farmer receives a message that includes information such as the date, time, soil moisture level, and, if an animal has been spotted, the animal's identity. The web-page provides the entire information about the entire operation of the system. The system makes the operation where it makes the operation with the YOLO V3 algorithm. The web-page makes the end output of the system where it makes the system with the date and the sensor’s data.

The simplified web-page makes the use of the system with the output providing with the entire system where it makes the data retrieval operation from the ESP8266.

Fig 5.1 Web-page Output

VI. CONCLUSION AND FUTURE SCOPE

This project is advantageous and successful for the water supply needed for agricultural production. The suggested technique uses computer vision to find the animals. Our suggested approach has a 98.8% average accuracy rate for detecting and identifying animals in photos, making it both affordable and extremely successful. Farmers may find an IoT-based smart water monitoring system to be of great assistance. Water is pumped to the field for improved crop cultivation depending on certain values for all the parameters, including humidity, moisture, and

temperature. but with enough training data, it can be simply expanded to recognize additional animal types. The crop protection from the animal is ensured with the operation and makes the crop free from animal's attack. The YOLO v3 helps in the animal detection where it provides the operation of the system with the detection and protection to the crops. The future scope implementation of the crops protection involves with the implementation of the system with the YOLO v8 algorithm. The YOLO v8 algorithm makes the use of the system with the working operation of the system with the necessary operation to the system. The improvement in the algorithm makes the operation of the system with the animal detection very precise and will have improvement in the smart irrigation in the crop system.

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