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IOT-BASED SMART FARMLAND USING DEEP LEARNING

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ABSTRACT

The IoT based Smart farmland using deep learning is a system for tracking animals on agricultural land combines surveillance cameras, drones, an Arduino controller, IR sensors, and an LCD display to detect and tally the animal's presence. Upon detection, the system utilizes AI methods to categorize the animal type and send immediate SMS notifications to farmers through a GSM module. It incorporates an animal-repellant buzzer and a gate control mechanism. Through the use of transfer learning with CNN models, it accurately identifies four specific animal species: elephants, cows, goats, and pigs. Continuous updates and training with new data maintain its precision, serving the agricultural and wildlife protection domains. This technology significantly aids farmers in safeguarding their crops, offering crucial insights into intrusions and amplifying crop yield. Its primary purpose revolves around simplifying the identification of animals on agricultural land.

I. INTRODUCTION

Rapid population growth and ongoing economic expansion are leading to overexploitation of mineral resources, which is rapidly altering ecosystems in unexpected and dramatic ways. Mortal action has transformed the vast amount of land surface, altering the wildlife population, their habitat, and their behavior. The alarming decline and movement of animal species highlights the urgent need to address this crisis. Studying these animals is crucial because it gives scientists a deeper understanding to guide conservation efforts. By studying their behavior, ecology, and interactions, we can create more effective strategies to protect and maintain diverse, healthy, and resilient ecosystems that support both human and natural systems. In farming, one of the main social issues that are being in the present is the danger of the crops by the wild creatures. Wild beast intrusion has always been a persisting problem for the agronomist. Some of the creatures that act as trouble to the crops are monkeys, mammoths, cows, and others. These creatures may feed on crops and also they run around the field in the absence of a planter and therefore can beget damage to those crops. This may result in a significant loss in the yield and will beget fresh fiscal protection to the planter to deal with the fate of the damage. Every planter, while exercising his product, should also be apprehensive of the fact that creatures also live in the same place and they need to be secured from any probable suffering. This problem needs to be attended incontinently and an effective result must be created and fulfilled. Therefore, this design aims to address this problem which is caused by the planter. To assist farmers with technical challenges, the project provides technological solutions that combine wireless sensor networks (WSN) and the global system for mobile communication (GSM). The system utilizes a PIR sensor to detect animals approaching crop fields. Controlled by a microcontroller that works in conjunction with the sensor, the system has been tailored to identify four specific animal species: pigs, goats, cows, and elephants. The project's potential for agriculture is what makes it significant. An extensive and well-annotated dataset, comprising pictures of the target species, is first gathered. Careful data preprocessing is then done to improve the quality of the data. Convolutional Neural Networks (CNNs) are used to automatically identify pertinent features and classify objects accurately. The training and evaluation stages of the model guarantee that it can distinguish between the four animal species with accuracy. Post-processing methods such as non-maximum suppression are used to improve the precision of categorization. The model can be used in actual situations, such as agriculture after it has been trained.

II. EXISTING SYSTEM

1. In [1], the authors propose an irrigationsystem that aims to reduce water wastage and automate the irrigation process for large agricultural areas. The system determines the water requirements of the crops based on the atmospheric temperature, humidity, and soil moisture conditions. To achieve this, the system utilizes a machine learning technique. It collects data from various sensors that measure the environmental conditions, considers predefined threshold values,and performs further analysis. It cross-checks the obtained outcomes with theweatherforecast and makes a decision regarding whether water should be initiated or not. By incorporating machine learning and real-time data analysis, this smart irrigation system aims to optimize water usage by providing irrigation only when itis necessary based on the analyzed conditions. This approach can help reduce water wastage and automate the irrigation process for large agricultural areas.
2. In[5],the authors introduce the use of IoT(Internet of Things) for detecting physical data and transmitting it to the user. They emphasize methodologies that can be employed toaddress various issues,such as the detection of rodents and the identification of risks of crops. The authors describe the development of an IoT device using Python scripts, which can send notifications withoutthe need for human intervention. The IoT device mentioned in the paper likely comprises sensors or detectors that gather physicaldata related to the agricultural environment. This data can include information on rodent activity, temperature,humidity or other relevant parameters. The Python scripts developed for the IoT device enable the processing and analysis of the collected data. Based on the predefined criteria or algorithms, the device can identify and recognize rodents and potential risks to crops.When such events or conditions are detected, the IoT device automatically sendsnotifications or alerts to the user or farmer. By leveragingIoT technology and Python programming, the system described in the paper offers a solution for real-time monitoring and early detection of agricultural issues. The ability to send notifications without human intervention allows fortimely

response to potential threats or problems, improving the overall efficiency and effectiveness of agricultural operations

III. PROPOSED SYSTEM

Our project aims to safeguard crops from animal damage while ensuring the animals are diverted harmlessly. When animals enter the farm area, the PIR sensor detects their presence and signals the controller. A continuous recording camera captures the surroundings, and a deep learning model identifies the animal entry, playing suitable sounds via a buzzer to repel them. The microcontroller then sends automated notifications using GSM to inform the user. Additionally, our project introduces an Automatic Cattle Counting system using strategically placed IR sensors at the farm entrance/exit to detect cattle presence. These sensors monitor movement, updating the count when cattle enter or exit, allowing manual gate control via the central controller. This system combines real-time hardware connections through USB to TTL technology and sophisticated animal detection via deep learning, offering a versatile solution applicable to security, agriculture, and wildlife conservation. Using a Convolutional Neural Network (CNN), the system accurately detects animals, initiating responses through the USB to TTL interface upon detecting animals in images or video frames.

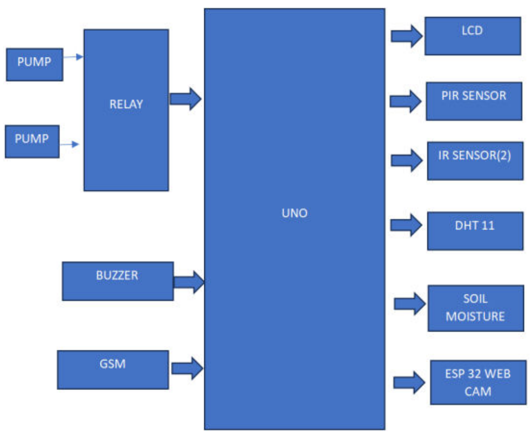
IV. LITERATURE SURVEY

Kumar, S., Chowdhary, G., Udutalapally, V., Das, D., & Mohanty, S. P. (2019, December). GCrop: Internet-of-Leaf-Things (IoLT) for monitoring the growth of crops in smart agriculture. In 2019 IEEE International Symposium on Smart Electronic Systems (iSES) (Formerly iNiS) (pp. 53-56). IEEE.

Proper growth of a plant is an important parameter for plant status, crop yield and its quality. Traditional methods of analysing the ideal growth and development of crop often are estimation and the farmer's intuition. This paper presents a smart solution, gCrop to monitor the growth and development of leafy crops and to update the status in real-time utilizing the IoT, image processing and machine learning technologies. Leaves are readily available and disposable component which could significantly help in analysing the health, environment and maturity of the crops. The gCrop system consists of a smart camera system which would identify the leaf as an object, calculate its dimensions and statistically analyse the measurements correlating with the species' age and maturity and predict the same as the 'ideal conditions'. A computer vision algorithm runs on the backbone of the Internet of Leaf Things (IoLT) based gCrop system to calculate the growth patterns of the leaves in real-time. The model shows a great potential with an accuracy of around 98% to predict the growth of the leaves. Thus, it is promisingly expected that this system will effectively contribute in strengthening the current farming practices by ensuring the quality of the crops and improving the production yield. With the foreseen increase in global population predicting to exceed nine billion by 2040, food production is a major challenge. Further effects of climate change, reduced water supplies in many regions, and the environmental impacts of intensive plant and livestock production are aggravating the situation. The Food and Agricultural

Organization of the UN (FAO) also states that producing more food with less natural resources is a challenge of the future. The usages of smart sensors and information and communication technology (ICT) in agricultural field are converging into smart farming, which includes the smart and precision farming. In productive agriculture system the growth monitoring of crop is a significant factor. It is often only the farmer's understanding, through trial and error and intuition that goes into the process. However, in precision agriculture to maximize the efficiency, a more stable and reliable system is required for measuring the growth of plants. The accurate measuring of growth status of plants will help to optimize the required fertilizer level, time of usages of fertilizer and further control the water and other environmental conditions. Leaves are a readily available and disposable component which could significantly help in analysing the growth, health, and maturity of the leafy crop to improve the yield [1]. Pre-existing traditional techniques include measuring the Leaf Plastochron Index (LPI) of the leaves and correlating the age and growth of the plant based on it's length [2]. The LPI is a logarithmic function with the length and index of the leaf from the bottom as it's parameters, and has been tested and proven fairly accurate in determining age in Lycopersicon Esculentum, a species of Tomato [2]. However, the present technique still relied on manual precise measurement of leaves dimension, and extensive labour, which is a problematic given that the size of work is enormous. Growth monitoring can be idealised the same way, where the system can detect the growth patterns of crop based on it's ideal factors and conditions such as fertilizer control, effects of water and temperature, etc. With algorithms efficient enough to replace the human eye and machines capable enough to compute information in milliseconds, it is a solution to a plethora of problems. The present work proposed a smart model, gCrop which provides a solution to this problem by analysing leaves with a smart IoLT (Internet of Leaf Things) system. The grow-log system consists of a smart camera system which would identify the leaf as an object, calculate its dimensions and statistically analyse the measurements correlating with the species' age and maturity and predict the same as the ideal condition. A computer vision algorithm running on the backbone of IoLT based gCrop system calculates the growth patterns of the leaves in real-time. The model shows a great potential in maintaining the quality of the crop and helps in improvement of yield.

Block diagram



V. CONCLUSION

The integrated system for monitoring animals in agricultural settings combines various technologies such as surveillance cameras, drones, Arduino controllers, IR sensors, and an LCD display. Upon detecting animal presence, the system employs AI methods to classify the type of animal and promptly notifies farmers via SMS using a GSM module. Additionally, it features an animal-repellant buzzer and gate control mechanism for added protection. Leveraging transfer learning with CNN models enables precise identification of elephants, cows, goats, and pigs. Regular updates and continual training with new data sustain its accuracy, benefiting agriculture and wildlife protection. This innovative technology significantly supports farmers in safeguarding their crops, providing vital insights into intrusions and ultimately boosting crop yield. Its primary focus lies in simplifying animal identification on agricultural land, offering a comprehensive solution to mitigate potential threats and protect agricultural resources.

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