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Detecting Intended Target Birds and Using Frightened Techniques in Crops to Preserve Yield

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ABSTRACT- An invention that is more appealing and practical for the general public is required as the world moves toward new trends and technology. The study uses AI and IoT technology to reduce crop damage caused by birds, a significant threat to crops. The automated system identifies and discourages specific bird species, reducing the cost of traditional deterrents. The system uses YOLO, a high-performance object detection model, to identify birds in real-time using a webcam feed. It then uses a ResNet100-based CNN for selective bird classification, minimizing disruption to wildlife. The system identifies a bird and triggers automated responses, providing real-time notifications via the Blynk platform. A buzzer on an ESP32 board scares birds, protecting crops. The ESP32 board manages the buzzer and communication with the Blynk server. The Paper utilizes AI and IoT to automate bird detection and deterrence, reducing human intervention and providing a cost-effective solution for farmers.

KEYWORDS- AI, IoT, YOLO, Blynk Server, CNN

I. INTRODUCTION

Birds can cause significant damage to farms and crops, leading to significant losses. Scarecrows and noisemakers are examples of traditional measures that frequently fail to repel these bothersome birds. A clever strategy that makes clever use of state-of-the-art technology has been put forth to address this problem [1] [6]. This creative bird deterrent technique makes use of cutting-edge instruments to identify particular bird species and implement strategies to efficiently prevent crop damage and maintain yields. The suggested solution makes use of cutting-edge technology, most notably the object detection model YOLO, which allows for precise identification of birds in webcam broadcasts. In addition, it uses a Convolutional Neural Network (CNN) based on ResNet100 to identify the species of the birds that are identified [3]. In addition to these sophisticated algorithms, the system has an Internet of Things (IoT) component that consists of a buzzer and an ESP32 board that are networked together to provide seamless operation. This device intends to revolutionize agricultural bird control practices by fusing advanced technology with strategic detection and deterrence strategies [4] [7]. It provides farmers with a proactive and effective way to protect their crops and lessen the financial burden of damages from birds. This novel methodology offers a viable way to deal with the enduring problem of bird damage in agricultural settings because of its all-encompassing approach and use of state-of-the-art instruments. The cutting-edge device automatically sounds an alarm to notify customers of any potential threat when it detects a dangerous bird, such a hawk that hunts prey or an armed crow, in the area [5][9][10]. This integrated system offers improved crop security by fusing cutting-edge technology with useful deterrent techniques. The ESP32 board, a crucial part of this defense system, is smoothly connected to a loud buzzer that is placed in a strategic manner to shock and deter birds that have been identified as possible threats [11][16][17]. This sophisticated system's ability to expand and adapt makes it stand out from the competition. It can be adjusted to efficiently function in a variety of conditions and meet changing agricultural needs. The project's architecture makes it simple for farmers to increase the effectiveness of their current bird deterrent tactics or scale up their protective measures as necessary [12]. This adaptability makes it possible to respond to changing crop management difficulties with ongoing advancements while also streamlining the deployment process. This state-of-the-art solution's main goals are to encourage environmentally friendly farming methods, improve operational effectiveness, and lessen the need for manual intervention and surveillance. The system seeks to transform traditional crop protection methods by utilizing technology, providing farmers with a more economical and environmentally friendly substitute. The system's effectiveness in actual agricultural settings is thoroughly assessed through stringent field testing and validation procedures to guarantee its dependability and performance under a variety of circumstances [13] [15].

A. *Final Stage*

- Determine the specific species of bird causing damage.
- Implement scare tactics that effectively discourage the targeted bird from feeding in the fields.
- Use scare tactics that are effective yet minimize disruption to non-target species and the environment.
- Continuously monitor the effectiveness of the scare tactics and adjust as needed.

II. LITERATURE SURVEY

This review might help to clarify the problems and analysis of the current framework as well as the recommended work. We make clear that this written evaluation uses the most recent and recommended utility layout. The utility has been operating correctly as of late, and its present association can provide insight into its current state. It is evident from the proposed framework that the goal of our new artworks is to offset the lingering negative effects [1] [15].

A. YOLOv3: An Incremental Improvement, by Redmon, J.,& Farhadi, A.

This study presents YOLOv3, a significant advancement in the You Only Look Once (YOLO) series for real-time object identification. It includes a more complex backbone network called Darknet-53, improving accuracy and performance. YOLOv3 is particularly effective in real-time detection and is used for initial bird detection.

B. Deep Residual Learning for Image Recognition, by He, K., Zhang, X., Ren, S., &Sun, J.

The paper introduces the ResNet architecture, a deep residual learning method for image classification tasks, and its application in a project for selective bird species classification, demonstrating its efficiency and accuracy.

C. Real-Time Bird Detection Using Convolutional Neural Networks, by Oliveira, R. A., Pinho, C., & Marques, T.

The study investigates the use of CNNs for real-time bird detection in environmental monitoring and conservation efforts, demonstrating high accuracy in identifying bird species.

D. IoT-Based Agricultural Monitoring and Early Warning System, by Chlingaryan, A.,Sukkarieh, S., & Whelan, B.

This paper explores the use of IoT technologies in agricultural monitoring systems, highlighting their benefits in real-time data collection and automated responses, and their role in enhancing agricultural productivity and sustainability.

E. A Review of Bird Deterrence Techniques in Agriculture, by Tracey, J. P., Bomford, M., Hart, Q., Saunders, G., & Sinclair, R.

The review examines traditional and modern bird deterrence techniques in agriculture, highlighting their limitations and the need for dynamic, intelligent solutions, emphasizing the need for real-time detection and automated deterrence mechanisms. [1] [5].

III. RELATED WORKS

We have cross-validated a number of ML classification techniques in order to construct the model. Nonetheless, we will now talk about the highly accurate techniques we utilized to fit the model.

ML: Machine learning is an artificial intelligence (AI) service that allows systems to learn from experience and knowledge without the need for human participation, all while appearing to be pre-programmed. The creation of computer programmes with the ability to use statistical data and manipulate it for study or self-education is the focus of machine learning [1].

A. YOLO v3

"You Only Look Once" (YOLO) is an acronym for the phrase. This algorithm (in real-time) can identify and locate various objects in a picture. YOLO treats object detection as a regression issue and outputs the class probabilities of the recognized photographs. The YOLO approach uses convolutional neural networks (CNN) to recognize objects in real time. As the name implies, the method just requires a single forward propagation through a neural network in order to detect objects [1]. This suggests that the complete image is forecasted using a single algorithm run. Multiple bounding boxes and class probabilities are simultaneously forecasted using the CNN. With a COCO test-dev mAP of 57.9%, this instantaneous object identification algorithm analyzes images at a rate of 30 frames per second. The primary characteristics of YOLOv3 are its speed and accuracy shown in Figure 1, which can be readily traded off by adjusting the model's size, negating the need for any kind of retraining [2].

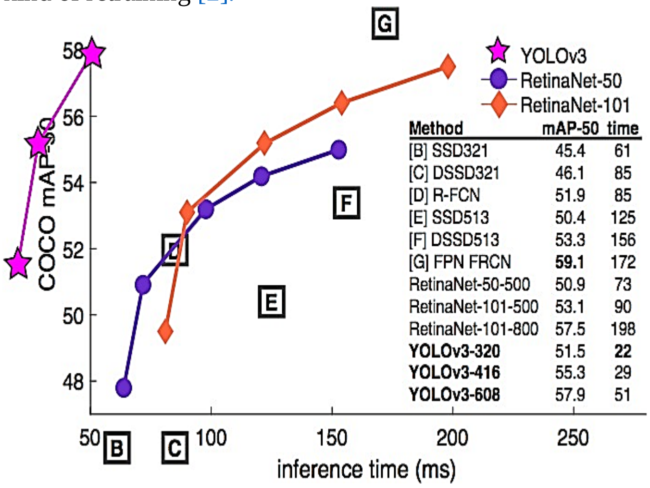

Figure 1: YOLOv3 comparison

B. Packages

NumPy: NumPy is a versatile package for handling arrays. It offers tools for manipulating these arrays as well as a high-performance multidimensional array object. This is the core Python module for scientific computing [2]. NumPy can also be applied as a productive multi-dimensional generic data container. Numpy can create any data-types, which makes it possible for NumPy to quickly and easily connect with a large range of databases [2] [4].

OpenCV: Open Source Computer Vision, It is one of the instruments for image processing and computer vision that is most frequently employed. It is employed in many different applications, including object disclosure, motion object tracking, face detection, and video capture. It currently has a significant impact on real-time functioning, which is critical to modern systems. It may be used to process photos and videos in order to recognize persons, objects, and even handwritten text written by humans [5].

gTTS: A extremely user-friendly tool called gTTS turns typed text into audio that can be saved as an mp3 file. Many languages, including English, Hindi, Tamil, French, German, and many more, are supported by the gTTS API. There are two audio speeds available for the speech delivery: slow and fast. Nevertheless, the voice of the generated audio cannot be altered as of the most recent version [3] [18] [19].

C. IR Sensors

An electronic sensor that senses and reacts to infrared radiation in the surroundings is called an infrared (IR) sensor. Expert in the field William Herschel accidentally discovered infrared radiation in 1800. When he compared the temperatures of each hue of mild, he found that the temperature slightly above the red mild—which is separated by a crystal—became the greatest. The infrared spectrum is much invisible to the unaided eye due to its longer frequency than visible light, yet it is still within a similar electromagnetic range. Any source of warmth, or anything with a temperature within roughly five kelvin ranges, emits infrared radiation [2].

D. IoT

The Internet of Things (IoT) allows people to live better lives, work more creatively, and manage their affairs. In addition to providing smart devices for automating homes, IoT is crucial for businesses. IoT gives authorities an ongoing view of how their systems function, providing insights into everything from system performance to storage network and coordination responsibilities shown in Figure 2. Effective art in the industries is no longer a very good substitute for human labor when serving meals in hotels and restaurants [4] [5].

E. Mini Breadboard

One portable, reusable tool for creating electronic circuit prototypes is a tiny breadboard. By putting cables and electronic components into its network of interconnected sockets shown in Figure 3, you can use it to design and test circuits without using solder. Its compact size makes it perfect for experiments and small-scale applications.

F. Microcontroller

A microcontroller is a small integrated circuit that is made up of an input/output peripheral, memory, and a CPU all on one chip. It uses the execution of preprogrammed instructions to control and manage electrical systems and devices. Microcontrollers are widely used in toys, appliances, and car systems, among other commonplace electronics.

IV. EXISTING SYSTEM

Adaptability, efficiency, and sustainability are issues with traditional bird deterrent tactics, such as visual, aural, and physical deterrents. Known for frightening birds with their human-like figures, scarecrows eventually become immovable and need to be replaced with more sophisticated models that have moving parts or are moved occasionally, Auditory deterrents like gas cannons, pyrotechnics, and recorded distress calls scare birds away, but they can cause habituation, as birds become accustomed to the sounds and return. Visual deterrents like reflective tapes, predator decoys, and laser lights disrupt birds' perception of natural predators, but their effectiveness diminishes over time as birds learn they're not real threats. Netting and physical barriers prevent birds from accessing crops, but are costly, require regular checks, and impede farm operations, making them a permanent solution. Chemical repellents, applied to crops, deter birds but require frequent reapplication, can be costly, and may cause environmental and non-target species concerns. Conventional bird deterrence systems have limitations such as habituation, limited coverage, high costs, environmental impact, and labor intensiveness. These methods require constant repositioning, high maintenance, and can be costly, especially in large agricultural areas, and can negatively impact non-target species and human health.

V. PROPOSED SYSTEM

The IoT-based system uses advanced AI models to detect and scare selective birds in agriculture fields, providing a sustainable and effective solution for crop protection [1]. YOLO Object Detection uses a webcam feed for real-time bird detection, known for its high speed and accuracy, making it ideal for continuous monitoring. ResNet100-based CNN classifies birds into harmful and harmless species, ensuring targeted deterrence and minimizing disturbance to non-threatening wildlife [2], [5]. Real-time monitoring of agricultural fields is provided through a webcam, enabling live feed detection and classification. The Blynk platform sends instant notifications to users when a harmful bird is detected, which can be customized for mobile apps or emails [6], [8]. The ESP32 board uses a buzzer to emit sounds to scare away harmful birds, with control algorithms ensuring only harmful species are activated. The ESP32 board manages the buzzer and communicates with the Blynk server, ensuring reliable and low-latency responses in IoT integration [11], [15].

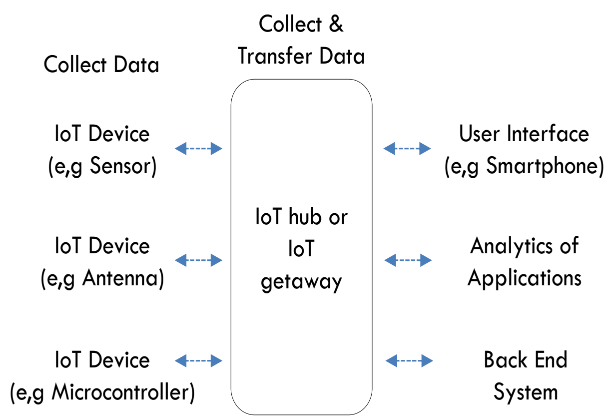

Figure 2: Workflow of IoT System.

Advantages of the Proposed System:

- Advanced AI models and IoT technologies enhance bird detection and deterrence, reducing habituation by selectively activating deterrence mechanisms based on real-time detection of harmful species.
- Real-time alerts and monitoring enhance user awareness and control over the deterrence process, allowing prompt response to potential threats in the field.
- Selective deterrence distinguishes harmful bird species, focusing only on threatening ones, thereby minimizing disturbance to other wildlife and promoting ecological balance.
- The system is designed for scalability and flexibility, adapting to different agricultural field sizes and can be easily customized to include additional sensors or deterrence methods.

Figure 3: Connected Wires

VI. CONCLUSION

The use of IoT devices in agriculture for selective bird detection and scaring has revolutionized crop protection. This innovative technology uses YOLO object detection and ResNet100-based CNN classification to target harmful birds, promoting ecological balance. IoT technologies like ESP32 board and Blynk platform enable seamless communication, automated responses, real-time alerts, and deterrence mechanisms, reducing labor costs and allowing farmers to focus on other management aspects. The detecting the intended target bird and using frightened techniques in crops to preserve yield uses AI and IoT to address traditional bird deterrence methods. It offers a cost-effective, environmentally friendly alternative to traditional methods, reducing economic losses and promoting sustainable farming practices, ultimately improving agricultural productivity.

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