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Monitoring The Movements of Wild Animals and Alert System Using Deep Learning Algorithm

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I. ABSTRACT:

In agricultural fields and forest areas, where a great deal of resources are lost and human lives are in danger, human-animal conflict is a major problem. As a result, people suffer, losing their homes, cars, crops, and sometimes even their lives. Thus, in order to prevent the entry of wild animals, this area needs to be routinely monitored. We have attempted to provide a document related to this topic so that the system that would monitor the field can be built. This device uses a machine learning system to identify the trespassing animal after first taking a picture of it through a camera. This study presents a model that classifies animals in photos using a CNN-based approach and notifies the user with a message.

II. INTRODUCTION

Wild animals, including tigers, elephants, deer, and leopards, that cross roads in wooded regions are frequently the cause of traffic accidents. Over the past few decades, there has been a notable rise in human-animal collisions that have an impact on wildlife, property, and human safety. Human-animal conflict arises from encroachment, poaching, urbanization, and animal introduction into neighbouring settlements. With over 3,000 animal fatalities on Indian roads in 2022 alone, traffic fatalities have posed a serious danger to wildlife populations. The goal of this research is to develop an animal detection system that notifies cars in advance of possible animal collisions.

The study focuses on monitoring and analyzing wildlife using natural-scene animal detection via camera-trap networks. Animal detection is hampered by high levels of congestion in image sequences, which results in low detection rates and high false discovery rates. To build an animal detection algorithm, the researchers leverage Deep Convolutional Neural Network (DCNN) features and a camera-trap database, including recommendations for potential animals.

Utilizing ultrasonic sensors at field corners, the model employs a camera mounted on an E-vehicle embedded with a Node MCU microcontroller to detect incursions and take pictures of the intruders. The effectiveness of the buried cable sensor system to identify deer and other animals in actual settings is also assessed.

The proposed CNN-based algorithm is trained to detect animal movement in both daylight and nighttime vision using motion sensors such as PIR sensors and IP cameras. The algorithm may be used to identify animals on highways in a variety of scenarios and reaches an accuracy of approximately 82.5% in animaldetection.

To sum up, this project intends to solve the rising issue of human-animal incidents on roadways by developing an animal detection system that warns drivers of possible animal crashes.

III. LITERATURE REVIEW

The goal of monitoring wild animal movements and putting in place a deep learning algorithm-based alert system is to improve conservation efforts, collect important data for ecological studies, and stop or lessen the frequency of incidents involving humans and wildlife. These devices are intended specifically to target wild creatures that have the potential to kill, injure, or damage human property. Before they cross the road, these wild creatures are detected by this system.

In the past, signs alerting people to possible animal crossings have been used to prevent animal-vehicle collisions. In some instances, barriers or wildlife warning reflectors have been put in place to prevent wildlife from approaching the road. A number of wildlife crossing structures have been integrated with wildlife fencing in a few carefully chosen locations. However, the majority of the time, the quantity and width of these crossing structures are constrained, primarily due to their comparatively high cost.

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IV. SYSTEM REPRESENTATION

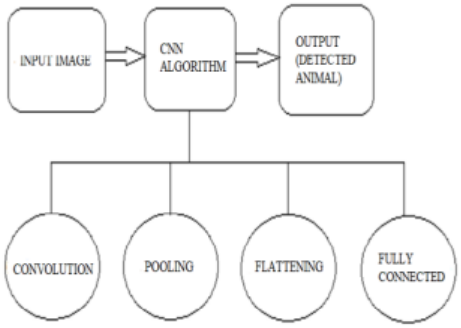

Fig 1-Flow Chart

The system continuously monitors the video feeds and motion sensor inputs in real-time, analyzing the data for potential intrusions.The intrusion detection algorithm processes the video analytics data and motion sensor inputs to identify and classify potential intrusions accurately.When an intrusion is detected, the system generates an email alert containing details about the intrusion, including time stamp, location, and supporting visual evidence (images or video clips).The email alerting system sends the generated email notifications to designated recipients, such as security personnel, property owners, or authorized individuals, who can take appropriate actions upon receiving the alerts.

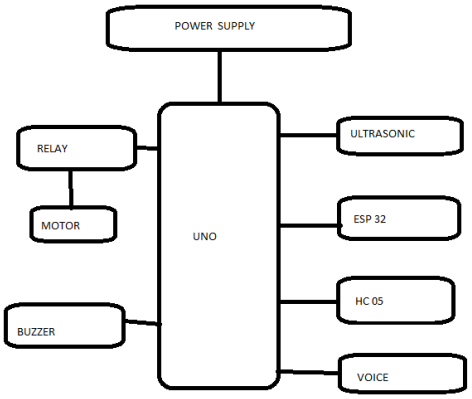

Fig 2 - BlockDiagram

V. COMPONENTS DESCRIPTION

A. Arduino

A series of microcontroller boards called Arduino is intended for use in electronic design, prototyping, and experimentation. The ATmega microcontroller, which combines the CPU, RAM, Flash memory, and input/output pins on a single chip to form a whole computer, is the foundation of this device. Arduinos are useful for many things, including robots, electronic musical instruments, and even tweeting houseplants. Through USB, an Arduino can be connected to a computer and programmed in C/C++ using the Arduino IDE. It does not require a keyboard or screen to operate, either with or without the Arduino.

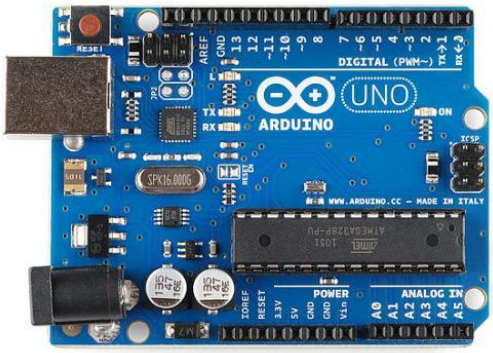

Fig 3- Arduino

B. Controller (ATMEGA328)

Our system's controller is its central component. The following characteristics of this controller are: Features include 23 programmable I/O lines, two 8-bit timers and counters, 32Kbytes of read-while-write programmable flash, an operating voltage range of 1.8–5.5V, a temperature range of -40°C to 105°C, and three flexible timers and counters. The ATmega328 integrated circuit has 28 pins in its pin layout. Three 8-bit bi-directional I/O ports (Port B, Port C, and Port D) with built-in pull-up resistors are available.

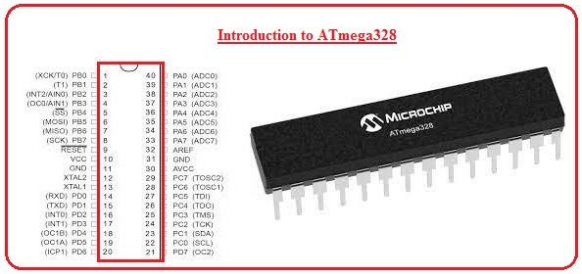

Fig 4-ATmega328

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C. Web cam

A webcam is a video camera which is designed to record or stream to a computer or computer network. They are primarily used in video telephony, live streaming and social media, and security. Webcams can be built-in computer hardware or peripheral devices, and are commonly connected to a device using USB or wireless protocols.

Fig 5 - web cam

D. LCD (Liquid Cristal Display)

A thin, flat display made of color or monochrome pixels arranged in front of a light source is called a liquid crystal display (LCD). Microcontroller devices frequently use these displays—such as 16X1, 16X2, and 20X2 displays—to output visual data. Designed around the LCD NT-C1611 module, LCD displays are low-cost, user-friendly, and capable of producing readouts utilizing a 5x7 dots plus cursor setup. The display needs a +5V supply in addition to 10 I/O lines for an 8-bit data bus and 6 additional supply lines for a 4-bit bus.

Fig 6 - LCD

E. LED (LightEmitting Diode)

A light-emitting diode (LED) is a semiconductor light source. LEDs are used as indicator lamps in many devices, and are increasingly used for lighting. Introduced as a practicalelectronic component in 1962, early LEDs emitted low-intensity red light, but modern versions are available across the visible, ultraviolet and infrared wavelengths, with very high brightness. The internal structure and parts of a led are shown below

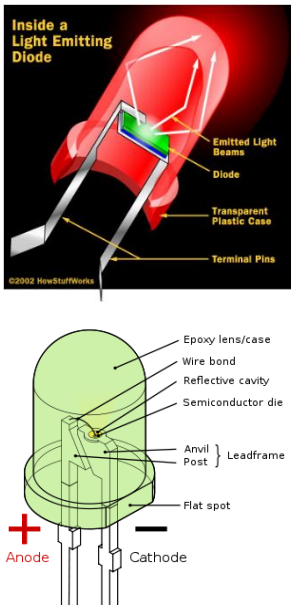

Fig 7– LED

F. Bluetooth

The HC-06 Bluetooth module is a slave module that is intended to communicate wirelessly over serial connections, receiving data from PCs or cellphones that are master Bluetooth devices. It uses the RXD and TXD pins for data transport and does not require the source code of any particular Arduino chip. While the TXD pin is connected to the RX pin via a voltage divider circuit, the RXD pin is connected directly to the RX pin on the Arduino. Modifications to the module's default parameters, such as the password, baud rate, signal strength, and module name, are possible using the AT commands mode.

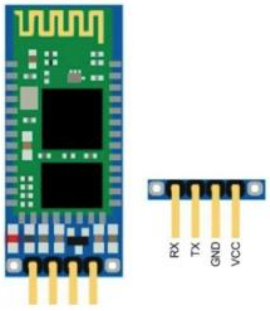

Fig 8– Bluetooth

G. Ultra Sonic Sensor

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The "ECHO" Ultrasonic Distance Sensor by Rhydolabz is a fantastic device that offers detection ranging from very close (2 cm) to far away (4 m). The sensor offers very accurate non-contact distance measurements ranging from 2 cm to 4 meters that are precise and stable. It is a useful sensor for mapping and measuring distance because of its small size, longer range, and simplicity of use. One I/O pin can be used for both triggering and measurement when the board is interfaced with microcontrollers. The ultrasonic wave is transmitted by the sensor, which then generates an output pulse in response to the time it takes for the burst echo to return to the sensor. It is simple to compute the distance to the target by measuring the echo pulse width.

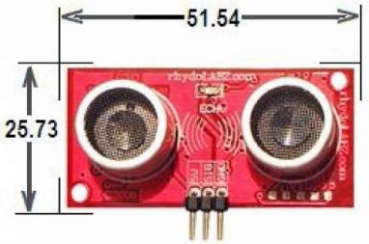

Fig 9– Ultra Sonic Sensor

H. ESP32 – Cam

Based on ESP32, the ESP32-CAM is a compact camera module with minimal power consumption. It includes an inbuilt TF card slot and an OV2640 camera.
Intelligent Internet of Things applications like WiFi picture uploading, QR identification, wireless video monitoring, and more can make extensive use of the ESP32-CAM.

Fig 10– ESP32 - Cam

I. Buzzers

Buzzers are signaling devices used in various applications, including panel mount, household goods, medical devices, and sirens. BeStar offers a range of configurations, including piezo transducers, electro-magnetic buzzers, and self-drive units. They are available in various mounting methods and are suitable for various applications. BeStar has been chosen by major companies for their reliable performance.

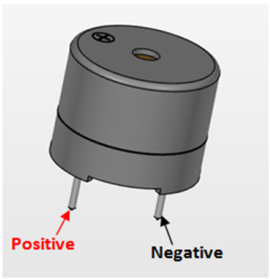

Fig 11– Buzzer

J. L293D Motor Driver IC

The L293D motor driver IC is a versatile component for driving DC motors, suitable for various applications like electric cars, robots, and home automation. It offers bidirectional control, protection features, and compatibility with various power sources and control systems. With a current capacity of up to 600mA per channel, it can operate in a wide voltage range of 4.5V to 36V, making it suitable for power supplies and batteries.

Fig 12–L293D motor driver IC

VI. OPERATIVE BENEFITS

A subsystem of artificial intelligence known as "machine learning" allows computers to learn on their own without needing to be programmed. The development of computer programs that can access data and use it to learn for themselves is the main goal of machine learning. To make better decisions in the future, the learning process begins with the interpretation of data, such as examples, prior models, or recommendations. The main goal is to enable computers to learn on their own without human intervention or help, so that they can rectify their own errors as a result of this learning. Convolutional neural networks (CNNs), a subset of deep neural networks, are typically used to analyze visual pictures.

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Deep neural networks are a collection of algorithms that have set new standards for accuracy for a number of crucial tasks. CNNs use relatively less preparation as compared to other image classification techniques. One of convolutional neural networks' main advantages is their freedom from prior knowledge and human involvement in feature construction (CNN). They are useful in a number of fields, including medical image processing, recommendation systems, image classification, and image and video recognition. Analyzing untamed animals in their native habitat is a crucial ecological task. Owing to the massive expansion in the number of people on Earth and the pursuit of economic development, the Earth's ecosystems are undergoing rapid, inventive, and substantial changes as a result of overuse of natural resources. Human activity has altered a growing area of the land surface, changing the natural population, habitat, and behavior. Even more dangerously, a large number of wild creatures have vanished from the planet, and a large number of species have been transported to new areas where they can disrupt both human and natural resources

VII. RESULTS

The proposedmonitoring the movements of wild animals and an alert system using a deep learning algorithm enhances to improve conservation efforts, collect important data for ecological studies, and stop or lessen the frequency of incidents involving humans and wildlife. It ensures to solve the rising issue of human-animal incidents on roadways by developing an animal detection system that warns drivers of possible animal crashes.

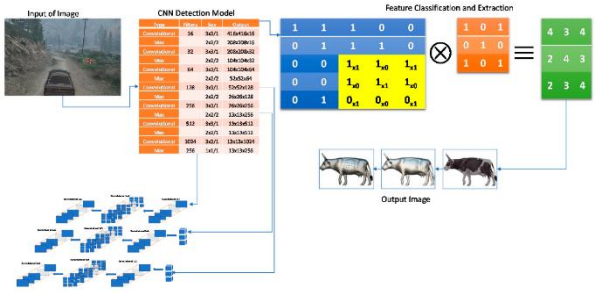

Figure 13-Prototype of monitoring the movements of wild animals and an alert system using a deep learning algorithm.

(image source : https://www.mdpi.com/2079-9292/10/24/3079)

VIII. CONCLUSION

A CNN framework for object detection has been built into this paper. In contrast to conventional methods in this domain, the suggested methodology combines CNN and a prototype detection network into a unified network. A technology that has gained popularity recently is the detection of vehicles and wild animals in vital forest regions. Animals may hunt people, or humans may be assaulted by animals when people use the forest routes. This method's main benefit is that it can identify the source of the problem and detect it. This can be prevented by using a mobile application to notify the drivers of the vehicles.

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