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WILDLIFE OBSERVATION ROBOT USING IOT

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Abstract: Wild animals become more aggressive when wounded because they're scared and confused and may think you're trying to capitalize on their vulnerable state. They're more likely to lash out and bite or scratch you than to accept your help. To address this, our project proposes an alerting system using YOLOv3, a real- time object detection algorithm based on deep convolutional neural networks, to classify and monitor animals that are hurt in Zoo or forests. This algorithm enables efficient identification and tracking of animals, aiding safeguarding wildlife observers and ensuring the preservation of wildlife in their natural habitats.By this wildlife monitoring robotic car using IOT, wildlife observers may get up and personal with wild creatures. An ESP32 is used in this system. The system receives these orders using a Wi-Fi module. We can capture the images of the wildlife continuously. And able to detect the wildlife.We are using the MLX9061an infrared thermometer designed for non-contact temperature sensing to measure the temperature of the animals and an ultrasonic non-contact type of sensor used to measure a wildlife's distance.

Index Terms - Image Processing, YOLO Algorithm, Convolutional Neural Network, COCO, ESP,UNO,IDE.

INTRODUCTION

Even though they belong in the wild, animals occasionally venture into locations where they may run into people. Even though they can be stunning to look at from a distance, up close interactions can quickly become lethal. When wild animals are injured, they become more hostile because they are afraid and confused and may believe that you are taking advantage of their weakness. Instead of accepting your assistance, they are more likely to lash out and bite or scratch you. It's possible for sick or injured animals to stray onto your land. They might not know where they are and be in a condition of altered consciousness, or they might be seeking refuge. For example, animals suffering from rabies may exhibit signs of injury. When an animal appears in this state, it can be risky to approach them; it is recommended to leave wild animals alone or to the professionals. Handling wildlife requires education, practice, specialised equipment, and knowledge. Additionally, poaching and animal smuggling have become important threats to biodiversity in recent times, endangering most species. Numerous threatened species are in danger of going extinct. Automated equipment has becoming increasingly common for observing wildlife. Illegal wildlife trade is killing wildlife worldwide as poachers, traffickers, and highly organised criminal syndicates will stop at nothing to satisfy their profit-driven consumer base. Some of the most charismatic and lesser-known wildlife species in the world are experiencing historic reductions due to the trafficking and unsustainable trade in wildlife commodities like rosewood, tiger bone, pangolin scales, rhino horn, elephant ivory, and bear bile. Observing wildlife can yield a wealth of important information about the surrounding environment.The natural environment has been devastated more and more in recent years, making wildlife preservation and monitoring crucial. This project focuses on three key and fundamental application topics for relevant ecology and zoology research: behaviour recognition, habitat environment observation, and animal detection. We also introduce robotic cars on IOT for wildlife monitoring. With simply their Android phones and remotes, users can control this robot wirelessly. Additionally, the robot is equipped with a wireless camera that wirelessly streams video to the user's PC. So, by controlling this robotic vehicle from a safe distance, wildlife observers can securely capture up-close footage of wild creatures. The most exact and accurate temperature sensor is the infrared one, which allows us to take an animal's temperature without having to touch them. In order to run the robot at that distance without upsetting the animals, we can additionally record the distance values of the robot from the wildlife. Additionally, we are able to identify wildlife and count the number of wildlife animals in the surrounding area. For our project, we're utilizing the Python OpenCV and the YOLO model. The YOLO model is essentially an object detection model, but it also includes additional detections, such the Elephant Zebra Dog Cat Bear, which helps us identify some wildlife. The computer vision framework and library that we will be using to enable our YOLOv3 method is called OpenCV. Darknet Architecture is supported by OpenCV by default. A pre-trained model called Darknet Architecture can classify 80 distinct classes. Our current objective is to use OpenCV's Darknet (YOLOv3) to classify things using the Python programming language. YOLO is an algorithm for detecting objects. In addition to being faster and more accurate than earlier algorithms like R-CNN, the more modern YOLOv3 is also more potent than the basic YOLO and YOLOv2. The main justification is that the layers are implemented convolutionally, which means that instead of many scans required by conventional algorithms, only one scan of the image (or frame) is needed to produce a prediction. The ESP8266 Wi-Fi module and ESP32 Cam are also the foundation of this project. The ESP8266 Wi-Fi Module is linked to the MLX90614 non-contact infrared temperature sensor and the HC-SR04 ultrasonic sensor. The distance between a person and the MLX90614 temperature sensor is measured by an ultrasonic sensor. The MLX90614 is employed for taking the individual's temperature. The ESP8266 Wi-Fi Module transmits the person's measured temperature and distance to the Google Sheets or Google Spreadsheet if the individual is within the designated range. Additionally, it sets off the ESP32 Cam to take the picture and upload it to Google Drive simultaneously. This is an IOT-based, fully contactless temperature monitoring system.

LITERATURE SURVEY

Paper 1: T. Yue, "Deep Learning Based Image Semantic Feature Analysis and Image Classification Techniques and Models,"[1]. In this paper the author explains how the deep learning methods are widely used to extract and analyze the images how a solid foundation can be laid in the image classification techniques, it is based on the relationship between the big data and the artificial intelligence technology. This paper also outlines the process of generation and development of deep learning and elaborates the restricted Boltzmann

Machine Model and also the energy model. This paper also introduces the application principle and specific application scheme of the model and convolutional neural network model in the image classification field.

Paper 2: F. Wang, P. He, T. Zhang and D. Liang, “. Wildlife detection algorithm based on Inv-YOLOv5m,"[2]In this paper the author laid a detection model where firstly, the author focuses on the original feature extraction network which is replaced by the CBL module.second, the self-attention mechanism that is embedded in the feature extraction module to improve the feature extraction ability of the detection network. Finally,the evolution operation was introduced to the feature fusion module to improve the detection ability of each feature scale. By following these three stepsthe author enhanced YOLO V5 wildlife detection model which was more accurate and provides a new technical means for wildlife detection.

Paper 3: M. Gabriel, S. Cha, N. Y. B. Al-Nakash and D. Yun, “. Wildlife Detection and Recognition in Digital Images Using YOLOv3"[3]. This paper mainly concentrates upon the recent advances in the machine learning techniques that enable the convenient monitoring of wildlife and their living environments, this paper mainly deals with the deep learning methods which are used to detect and recognize the wildlife in digital images and report the experimental results which were conducted in a commodity workstation. They use the YOLO V3 and YOLO V3-tiny to detect and classify several classes of animals based on the digital images on 9051 which achieve the percentage of accuracy of 75 .2% and 68 .4% of precision.

Paper 4: M. Mangaleswaran and M. Azhagiri, "A Comparison of Different Learning Algorithms for Wildlife Detection and Classification in Animal Conservation Applications,"[4]. This paper mainly concentrates how to track animal movement patterns habitat use population demographics human and wildlife conflict vehicle and animal collisions snare and poaching occurrences and epidemics. This Paper also deals with the identification and categorization of animals from picture and video sequences depend depending on the image processing this provides a reliable method for detecting wildlife and divides into two categories animal and human conflict and also animal and vehicle collision. This article also discusses a variety of learning techniques to identify and categorize the wildlife when it enters a living area or an agricultural region or a roadway based on the camera trap and dataset.

Paper 5: D. Ma and J. Yang, "YOLO-Animal: An efficient wildlife detection network based on improved YOLOv5,"[5]. From this paper we get to know that how the rapid expansion of human civilization squeezes the living space of the wildlife and the biological species that are surrounded an alarm for the human.It also gives us the idea of how to understand the changes of the wild animals and other species in the specific area and formulates the effective restoration and protection measures by using the wildlife animal species recognition network based on the deep learning and improved YOLO V5 and YOLO-animal this model applies the artificial intelligence and computer vision and covers all aspects of human’s daily life and work. The YOLO V5algorithm can quickly and accurately deal with the problems of effective channel attention module the original YOLO V5S network structure is enhanced and the detection accuracy of small targets occurred and fuzzy targets is effectively improved.

Paper 6: R. Shanthakumari, C. Nalini, S. Vinothkumar, B. Govindaraj, S. Dharani and S. Chindhana, "Image Detection and Recognition of different species of animals using Deep Learning,"[6]. This paper focuses on the deep learning methods for solving computer vision difficulties and how the deep learning models are efficient in solving complex real-world issues how to train the network slowly which takes time and money for certain real-world situations that are difficult to handle with deep learning.It finds ways to collect the data rapidly so that it can be used in the real time applications, it also focuses on the recent advances on the camera-based technologies as well as acoustic and seismic measures on how all of them can be used to detect animals. This paper uses the Yolo V5 model to detect several types of animals in the forest which are applied on the images and the real time camera feeds and recorded videos this model can recognize horses, sheep, cows, elephants, bears, zebras and giraffes etc. but can only detect birth the advances of the Yolo V5 network is also focused in this paper and reduces the deployment cost of the identification model.

Paper 7: A. Sathesh, K. Vishnu, A. Yuvaneshwar, V. Vellaisamy and K. Gowthami, "Image Processing based Protection of Crops from wild animals using Intelligent Surveillance,"[7]. The author mainly focuses on the traditional methods on how to monitor the wildlife in the production of crops and also the need for specialized reduction of animals. This paper provides us the method which includes the segmentation of the image and the object detection process in this model the predefined images of some animals are stored in the image processor and when the animal is intruding into the land the camera fixed at various places will capture it and send to the processor for processing. The feature extraction and matching of the predefined image will be done through the YOLO based regression algorithm after the processing of the image the alarm will be produced and the SMS will be sent to the owner of the land.

Paper 8: G. Bandari, P. L. Nirmala Devi and P. Srividya, "Wild Animal Detection using a Machine Learning Approach and Alerting using LoRa Communication,"[8]. In this paper an algorithm is demonstrated to identify the wild animals, this system categorizes the wild animals based on their images. Animal monitoring theft prevention and animal vehicle accident prevention can be aided by this method it also applies the deep learning techniques when an animal is detected the alert will be sent to the devices through the Lo-ra communication because the standard communications like the Wi-fi or the GSM technologies may not be available in the remote areas. The computer vision using the python is utilized for the image processing for the faster processing the raspberry pi development borders used and the live streaming is processed to detect a wild animal Wild animal is detected an alert is sent to the user through the Lo-ra communication,

Paper 9: V. Palanisamy and N. Ratnarajah, "Detection of Wildlife Animals using Deep Learning Approaches: A Systematic Review,"[9] The author wants to tell us how the researchers use the camera traps that are activated when an animal enters the field allowing them to collect millions of images of the animals without disturbing them. This method also uses the machine learning mainly the convolutional networks which examines the major deep learning ideas which are relevant to the deduction and recognition of wildlife animals this provides us a model which recognize the animals in the camera trap images it also uses the deep learning techniques for automated animal recognition and for the segmentation of the captured image the detection of the wildlife in the captured image and the comparison of the approaches.

Paper 10: M. Kumari, A. Kumar and R. Singhal, "Design and Analysis of IoT-Based Intelligent Robot for RealTime Monitoring and Control,"[10]. Through this paper the author puts forward her surveillance robot that can be used in the domestic areas and other places this robot is controlled manually and they can also be made automatic based on the requirements. This paper also focuses on the design and implementation of mobile

Robot for obstacle detection and avoidance in real time basis this paper also provides with the methodology of the remote-control system.

Paper 11: P. Rai and M. Rehman, "ESP32 Based Smart Surveillance System,"[11]. In this paper the author has proposed the hardware and software implementation of smart surveillance system using the ESP32 the implementation to acquire a continuous video and transmit the video using the Wi-Fi and display it over the computer it also focuses on how the ESP32 camera module works with different automations.

METHODOLOGY

We have designed a robot that uses an RF module to monitor wildlife, and we can convert the car using a remote control that can be used up to 500 meters away. This robot car was designed to be noise-free so as not to annoy any wildlife. Life. The robot can be moved by an observer standing a great distance away. The ESP32 camera module, which we utilized for our project, records wildlife photographs every 20 seconds and uploads them to Google Drive. It can also be used for live streaming and animal detection. Figure 3 demonstrates how live streaming is carried out as well as how our project's YOLO module and Python are able to identify wildlife and count the number of animals that are in the area. The video feed is continuously updated as the remote-control car is being driven, allowing us to move the robot without endangering or bothering the animals. Our project uses the MLX90614 infrared temperature sensor, which has a high degree of accuracy. The temperature values are continuously measured over a 20-second interval to provide us with accurate animal temperature readings. The distance is also continuously measured so that we can operate our robot based on how far away the wildlife is. Both the temperature and the distance are sent directly to Google Sheets. This makes possible in order to make it easier for him to take care of the animal and administer medicine, the Observer can record the morning and evening temperatures.This allows him to monitor the temperature values and treat the wild animal. In this project, the Yolo V3 module and Python provide accurate animal detection. The ESP32 camera module has a maximum resolution of 600 x 800 pixels and is a 2MP camera. The software can be optimized to produce images with a higher resolution. The image quality of the ESP32 cam has superior frame rate of up to 60 Hz, with a default of 10 frames per second. This allows us to get higher quality images at a lower cost. The buzzer that warns endangered wildlife and the servo motors that drive them are both controlled by the Arduino. The circuit schematic for attaching the ESP826 module to the MLX 90614 and connecting the RF module to the motors is shown in figure 1. The goal of the YOLO V3 is to identify and locate different items in the visual input so that machines can read and comprehend their environment. Its technique is well-known in computer vision applications and it can deliver accurate and quick object recognition. To identify the wildlife in the movie, it uses the lead feature of a deep convolutional neural network. Yolo V3's prediction uses 1×1 convolutions. this indicates that the protection map's dimensions match those of the feature map exactly. We use the YOLO object detection model, a sort of convolutional neural network (CNN) that is a deep neural network for real-time object detection. This model is used to identify wildlife that has limited possibilities available to it. Using the numpy libraries for Python to work with matrices, linear algebra, and the Fourier transform to convert the video image to many pixels, analyze, and compare it with the YOLO V3 model.We also use Open CV, a library for computer vision and image processing. It plays a significant part in real-time operations, which is crucial to our project since it can process photos and videos and recognize objects in crisis. The Open CV card verification value is what we use in our project, CV2. Python code makes it simple to comprehend how the model functions. Since the object detection models YOLO V3 and CV 2 are the top image processing and object detecting models on the market, the Open CV and YOLO models are the best models that our project can use to work more precisely and accurately.

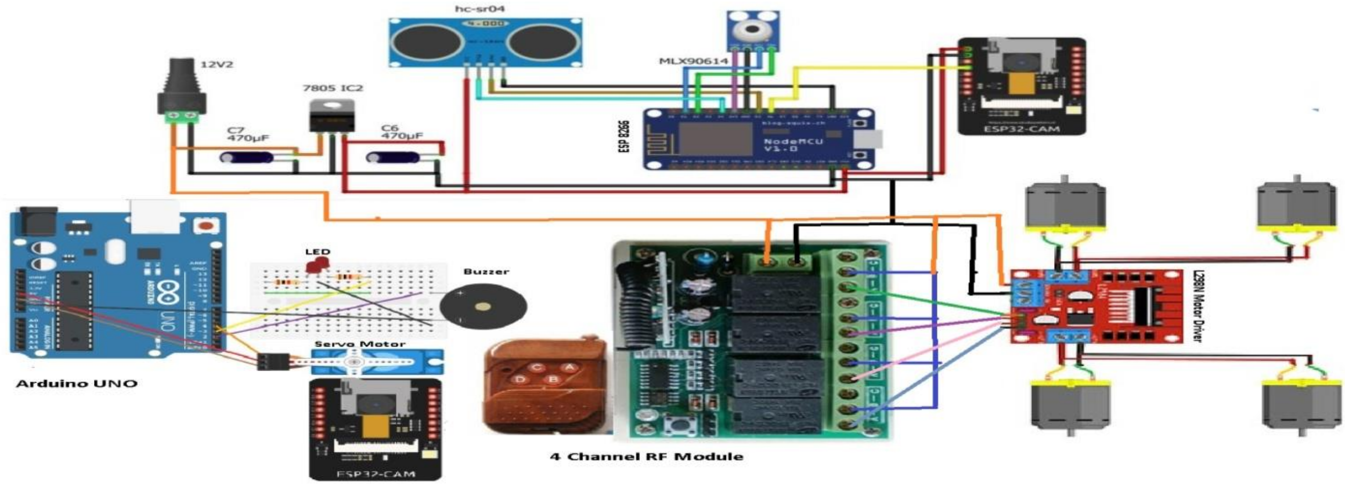

Figure 1: Circuit diagram

HARDWARE AND SOFTWARE USED

The cocoa data set, an Arduino UNO, an MLX90614 sensor, an ultrasonic sensor, two 470 uF capacitors, eight diodes, an ESP8266 Wi-Fi module, and an LN293D motor driver Gear motors, ESP32 camera, motor drivers, Dc motors (4), buzzer, robot chase, Arduino USB cable, The Arduino IDE, Python programming, and a voltage regulator (IC 7805) are the hardware and software utilized in this system

DESCRIPTION OF WORK CARRIED OUT

Software installation: We installed the Arduino IDE, ESP32 board support package for Arduino IDE, the ESP8266 board package for the Arduino IDE,the python 3.6 .1 version, YoloV3 was imported to python, The CV Library was import imported to the python code.

Hardware Connections: Connect the 5V and GND pins of the ESP32 Camera module to the 5V and GND pins of the regulated 5V power supply. This 5V regulated power supply is based on the 7805 Voltage regulator.

connect D6 of the ESP8266 to the IO13 on the ESP32 Cam module. The IO13 pin look at the D6 pin as the push button or a digital sensor.

The VCC and GND pins of the MLX90614 non-contact infrared temperature sensor is connected to 3.3V and GND pins on the ESP8266. Whereas the SCL and SDA pins of the MLX90614 are connected to the ESP8266 D1 and D2 pins. D1 is the SCL and D2 is the SDA.

Connect the VCC and GND pins of the Ultrasonic Sensor to the 5V and GND. Connect the Trigger and Echo Pins to D4 and D5 respectively.

Programming: Configure GPIO pins as inputs or outputs, use pull-up and pull-down resistors to stabilize input readings, read and write digital pins.add the open CV library and the Numpy libraries to the python code.

APPLICATIONS

The primary use of a project is to monitor the early fauna of the zoo in order to protect it from visitors who may harm it. In addition, it can be used to monitor animals in the woods, identify forest fires, stop animal poaching, keep an eye on household pets, and keep an eye out for any unexpected wildlife incursions into our homes.

RESULTS AND DISCUSSION

We were able to develop our robot which was able to move silently towards the wildlife. We were able to control it from the distance of 400 meters and we could able to live stream using the ESP32 camera, we could also be able to detect the wildlife and certain objects due to using of the Yolo V3 object detection module. We were able to send the data to the Google sheets using the ESP8266 module. we used the 12-volt battery to supply power for all the components and also a power bank to power up the ESP32 module and the ESP8266 module and also the Arduino IDE. The figure 2 below shows the final output of our project, figure 3 shows the live streaming of the ESP32 camera and detection of the wildlife.

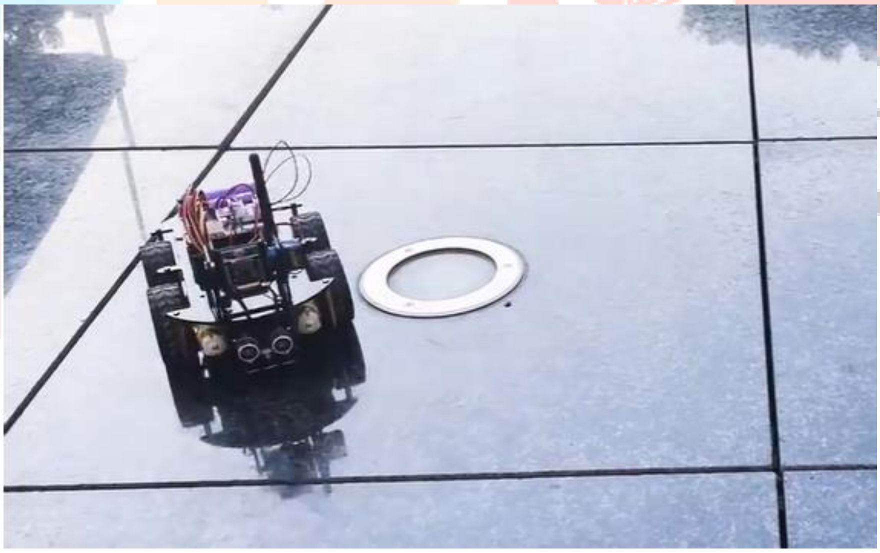

Figure 2: Complete Setup

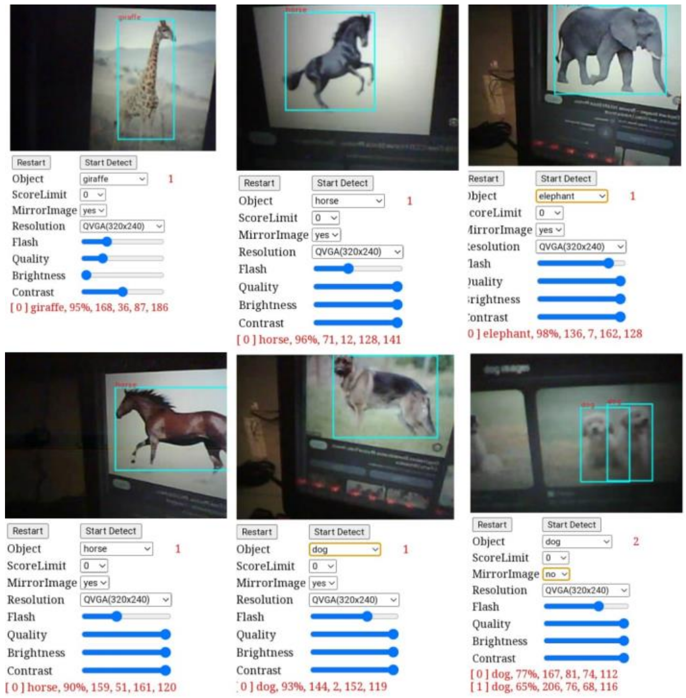

Figure 3: Streaming

CONCLUSION

We hereby conclude that our project will be useful for detecting the wildlife in the zoo, Sanctuary and the forest. The future enhancements such as controlling the robot from a very far distance can be made, also sending and receiving through the Lo-ra communication can be implemented in our project so that it can work in the remote areas. The captured images can be resized into HD quality. More wildlife detection can be implemented using the python into our project such as detecting the particular species.

REFERENCE

[1] T. Yue, "Deep Learning Based Image Semantic Feature Analysis and Image Classification Techniques and Models," 2022 International Conference on Data Analytics, Computing and Artificial Intelligence (ICDACAI), Zakopane, Poland, 2022, pp. 473-476, doi: 10.1109/ICDACAI57211.2022.00100

[2] F. Wang, P. He, T. Zhang and D. Liang, "Wildlife detection algorithm based on Inv-YOLOv5m," 2022 Global Reliability and Prognostics and Health Management (PHM-Yantai), Yantai, China, 2022, pp. 1-6, doi: 10.1109/PHM-Yantai55411.2022.9941895.

[3] M. Gabriel, S. Cha, N. Y. B. Al-Nakash and D. Yun, "Wildlife Detection and Recognition in Digital Images Using YOLOv3: Extended Abstract," 2020 IEEE Cloud Summit, Harrisburg, PA, USA, 2020, pp. 170-171, doi: 10.1109/IEEECloudSummit48914.2020.00033.

[4] M. Mangaleswaran and M. Azhagiri, "A Comparison of Different Learning Algorithms for Wildlife Detection and Classification in Animal Conservation Applications," 2023 Third International Conference on Artificial Intelligence and Smart Energy (ICAIS), Coimbatore, India, 2023, pp. 920-923, doi: 10.1109/ICAIS56108.2023.10073833.

[5] D. Ma and J. Yang, "YOLO-Animal: An efficient wildlife detection network based on improved YOLOv5," 2022 International Conference on Image Processing, Computer Vision and Machine Learning (ICICML), Xi'an, China, 2022, pp. 464-468, doi: 10.1109/ICICML57342.2022.10009855.

[6] R. Shanthakumari, C. Nalini, S. Vinothkumar, B. Govindaraj, S. Dharani and S. Chindhana, "Image Detection and Recognition of different species of animals using Deep Learning," 2022 International Mobile

and Embedded Technology Conference (MECON), Noida, India, 2022, pp. 236-241, doi: 10.1109/MECON53876.2022.9752203.

[7] A. Sathesh, K. Vishnu, A. Yuvaneshwar, V. Vellaisamy and K. Gowthami, "Image Processing based Protection of Crops from wild animals using Intelligent Surveillance," 2022 International Conference on Electronics and Renewable Systems (ICEARS), Tuticorin, India, 2022, pp. 1042-1046, doi: 10.1109/ICEARS53579.2022.9752018

[8] G. Bandari, P. L. Nirmala Devi and P. Srividya, "Wild Animal Detection using a Machine Learning Approach and Alerting using LoRa Communication," 2022 International Conference on Smart Generation Computing, Communication and Networking (SMART GENCON), Bangalore, India, 2022, pp. 1-5, doi: 10.1109/SMARTGENCON56628.2022.10083577.

[9] V. Palanisamy and N. Ratnarajah, "Detection of Wildlife Animals using Deep Learning Approaches: A Systematic Review," 2021 21st International Conference on Advances in ICT for Emerging Regions (ICter), Colombo, Sri Lanka, 2021, pp. 153-158, doi: 10.1109/ICter53630.2021.9774826.

[10] M. Kumari, A. Kumar and R. Singhal, "Design and Analysis of IoT-Based Intelligent Robot for Real-Time Monitoring and Control," 2020 International Conference on Power Electronics & IoT Applications in Renewable Energy and its Control (PARC), Mathura, India, 2020, pp. 549-552, doi: 10.1109/PARC49193.2020.236673.

[11] P. Rai and M. Rehman, "ESP32 Based Smart Surveillance System," 2019 2nd International Conference on Computing, Mathematics and Engineering Technologies (iCoMET), Sukkur, Pakistan, 2019, pp. 1-3, doi: 10.1109/ICOMET.2019.8673463.