



WILD ANIMAL INTRUSION DETECTION IN FIELDS USING MACHINE LEARNING

Mrs. D. Archana¹, P. Vikram², B. Shivani³

¹Assistant Professor, Dept. of Information Technology, Anurag Group of Institutions, Hyderabad, India ^{2,3} UG Scholar, Dept. of Information Technology, Anurag Group of Institutions, Hyderabad, India

Abstract— Wild animal incursion has long been a source of contention for residential people. Among the creatures that pose a hazard to home intrusion are deer, dogs, cattle, and monkeys. These animals may enter anyone's house and cause damage to the property and people's home gardens. This may result in a considerable reduction in security and the need for additional financial protection to deal with the consequences of the damage. This issue must be addressed promptly, and an effective remedy must be developed and implemented. As a result, our initiative seeks to remedy this issue. To address these issues, an animal incursion alarm system may be employed using wireless sensors that automatically send an alert message with an image to the landowner and municipal authority. This enables early warning notice to take applicable action grounded on the type of raider.

Keywords: raider, incursion, hazard.

I. INTRODUCTION

Wild animal incursion has long been a source of contention for farmers. Among the creatures that pose a hazard to crops are deer, wild boars, moles, elephants, and monkeys. These animals may consume crops and also roam the field in the farmer's absence, causing harm to those crops. This may result in a considerable reduction in yield and the need for additional financial protection to deal with the consequences of the damage. This issue must be addressed promptly, and an effective remedy must be developed and implemented. As a result, our initiative seeks to remedy this issue.

II. LITERATURE SURVEY

1)Prabhat Kumar Panda, Cherlopalli Srujan Kumar, Bommu Sai Vivek, Masura Balachandra, Shashi Kant Dargar, "perpetration of a Wild Animal Intrusion Detection Model Grounded on Internet of effects", Second International Conference on Artificial Intelligence and Smart Energy (ICAIS), 2022

Wild animal invasion is a massive problem that wastes vast amounts of resources and jeopardizes human lives. To address this issue, this study proposes a system that employs the Internet of Things to aid in the detection of wild animal intrusions on agricultural farms through field monitoring. The farmer receives an alert message via the IoT application. The proposed system's performance has been evaluated in relation to the captured images of the intruder and the notification alert.

Node MCU Microcontroller

The proposed model can detect any intrusion of the wild animals using an ultrasonic sensor and can capture the image using ESP32 camera module and a notification alert is sent to the authorized person through the IoT application.

They haven't made improvements including the use of IR cameras and wide-angle cameras to increase system versatility.

[2] Srushti Yadahalli; Aditi Parmar; Amol Deshpande, "Smart Intrusion Detection System for Crop Protection by using Arduino", Second International Conference on Inventive Research in Computing Applications (ICIRCA), 2020

husbandry remains one of India's most important diligences. It's critical for both mortal survival and profitable growth. Indeed moment, traditional systems similar to creatural scarecrows are used in agrarian fields to keep catcalls and creatures from disturbing and feeding on growing crops. Because similar ideas have numerous excrescencies, perfecting agrarian protection has come to a major issue in recent times. As a result, the focus of this paper is on proposing a system that detects interferers, monitors any vicious exertion, and

also reports it to the system's proprietor. It functions as an adaptable system that provides growers with a practical system for icing the total safety of their spreads from any attacks or trespassing conditioning.

OV7670 model

OV7670 model Then, the proposed work has used a stir detector and IR detector, which efficiently detects any movement of interferers. still, OV7670 is generally a better choice because it's cheaper than the OV2640 camera If VGA resolution at 30 fps is good enough for your design.

3) Muneera Begum H., D.A. Janeera, Aneesh Kumar. A.G, "IOT grounded Wild Animal Infringement Identification, Diversion and Alert System", International Conference on Inventive Computation Technologies (ICICT), Muneera Begum H proposes using the Internet of effects and a Wi-Fi-grounded wireless microcontroller unit to prop in the identification of wild beast intrusions at agrarian granges. The Energeia IDE is used to prototype the transmission of information from the transmitter knot to the timber officer. At the field's corners, pillars correspond to an electronic unit with a buzzer, vibration detector, ray sensor, ray diode, RF transeiver, and ultra-low power microcontrollers. When a violation occurs, the Wi-Fi module sends an alert communication. The proposed system is tested using a beast database. The timber officer is notified via a Python garçon.

WSN and IoT

The base station node at the centre of the field notes the intruder entry and activates the corresponding node based on the animal vicinity.

The perimeter control is improved by over 95% with the placement of sensor nodes at regions of early warning.

[4] Bhanu K. N, Sahana K, "Farm Vigilance: Smart Internet of things System for Farmland Monitoring and Animal Intrusion Discovery using Neural Network", Asian Conference on Innovation in Technology (ASIANCON), 2021

The internet's ability to connect all electronic devices has given rise to the Internet of Things era. In addition, machine learning implementation on the Internet of Things to automate ongoing activities in numerous technical and non-technical fields has grown. Using a Convolution Neural Network, this work attempts to automate farmland activities such as irrigation and animal intrusion detection. In terms of accuracy, the proposed system performed better.

Internet of Things (IoT)

Using a Convolution Neural Network, this work attempts to automate farmland activities such as irrigation and animal intrusion detection. In terms of accuracy, the proposed system performed better.

The system can be integrated with email notification for farmers also along with soil fertility and crop prediction can be included to enhance the system.

[5] S. Jeevitha, S.Vengatesh Kumar, "A Study on Sensor Based Animal Intrusion Alert System Using Image Processing Techniques", Third International conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC), 2020

A beast intrusion alert system is created by utilising wireless detectors to shoot an automatic alert communication with an image to both the squatter and timber officers. Grounded on the type of meddler, this can induce an early warning announcement to take applicable action. The detector detects the movement of the beast, and the camera captures the image. The image is also classified by a microcontroller, and the GSM module sends the alert announcement SMS to the timber department and the property proprietor. This check is used to more understand the multitudinous way, tools, and experimental setups used to cover humans from beast intrusion. IoT (Internet of effects), Detectors, Image processing, Microcontroller, GSM module are some of the terms used.

GSM module

Detecting creatures by using camera includes a larger number of image processing operations in a live videotape. Any creatures that move briskly will be captured as a blurred image that may lead to misclassification as the system might not be suitable to identify an intrusion.

[6] Udayamoorthy Venkateshkumar, Anirudh V, Dipok Khanali V, Ezhil B, "Farm Intrusion Detection System using IoT", International Conference on Electronics and Renewable Systems (ICEARS), 2022

Through this device, when someone intrudes on the farmer's farm, the farmer will receive an alert on the app installed on their mobile device. When the farmer receives the alert, he will be able to go to his farm and check for any unusual movement. In addition, an alarm will be installed on the farmer's property, alerting neighbouring localities/farmers. Any type of intrusion into his/her farm can thus be avoided. This system could significantly reduce farmers' concerns about the safety of their farms and cattle.

PIR and IR sensor

The proposed solution can be installed in any farmlands and works well in any type of climatic conditions.

Farmers also face problems like decrease in their crop yield due to animal intrusions.

7)P.Manikandan,G.Ramesh,P.Lokesh,P.Narasimha Raju, Durga Prasad, P. Madhu, " IOT Based Farm Protection System from brutes and Humans Theft using ESP32 with Camera Module ", 2nd International Conference on Advance Computing and Innovative Technologies in Engineering(ICACITE), 2022

P. Manikandan describes a system that detects beast and mortal movement on a ranch and cautions the ranch proprietor via an IoT operation. The Arduino IDE is used to write laws for the prototype, the ESP 32 camera module is used as a microcontroller, and the Blynk operation is used to transmit dispatches and images of the meddler. mortal and beast intrusion into the ranch can be controlled using this system, and also bring- effectively.

Arduino IDE

Human and beast intrusion into the ranch can be controlled using this system, and also bring- effectively. Arduino boards are substantially programmed in C or C language. Arduino lacks support for some veritably notorious languages like Java, Python, and JavaScript. Notorious languages like Java, Python, and JavaScript.

8)R.Nikhil;B.S.Anisha, RamakanthKumar., “Real-Time Monitoring of Agricultural Land with Crop Prediction and wild Animal Intrusion Prevention using Internet of goods and Machine Learning at Edge”, IEEE International Conference on Electronics, Computing and Communication Technologies (CONNECT), 2020

The proposed system explains how IOT and ML ways can be combined to make irrigation smart. The proposed system saves time by avoiding problems similar as constant alert over the field via IOT bias, crop vaticination assists rowers in growing suitable crops grounded on soil parameters via machine errace w, and it also aids in the f talinstallmenti forefingers are as wild cr res into the field via machine literacy ways. It also aids in water conservation by automatically supplying the shops field with a minimum quantum of water grounded on the water conditions via detectors. Eventually, during abnormal ranch conditions, SMS and dispatch announcements will be transferred to the planter’s mobile phone.

IOT and ML techniques

IOT and ML ways the proposed system also helps in the forestalment of trespassing wild creatures in the agrarian sector. one of the disadvantages of CNNs includes the fact that a lot of training data is demanded for the CNN to be effective.

[9] Hardiki Deepak Patil, Namrata Farooq Ansari, “Intrusion Detection and Repellent System for Wild Animals Using Artificial Intelligence of Things”, International Conference on Computing, Communication and Power Technology (IC3P), 2022

Some kind of mitigation plan is demanded to break this problem for both wild creatures and humans. While there are multitudinous IoT- grounded beast surveillance and repellent systems on the request, a touch of Artificial Intelligence can ameliorate its trust ability and effectiveness. This will really raise the bar that has been set by the use of IoT alone. The proposed system aims to cover mortal habitation and beast on the outskirts of the timber area/ fields by developing an automated system that detects wild beast intrusion and repels them back to the timber without causing any detriment, thereby minimising the serious impacts caused by the Human- Wildlife conflict.

ResNet and FPN (Feature-Pyramid Network) architectures, YOLO-V3

Wildlife can be slayed in defences and vengeance. Human-wildlife conflict is a worldwide problem

Flashlights and guard dogs prevent wild animal from human settlements and their possessions. But this might physically hurt the animal.

[10] M Shrihari, “A Smart Wireless System to Automate Production of Crops and Stop Intrusion Using Deep Learning”, Third International Conference on Smart Systems and Inventive Technology (ICSSIT), 2020

M Srihari offers a methodology that employs a custom- erected fine model that includes wireless detectors as a data source and is reused on Google Cloud, performing in a smart IoT enabled armature that can be gauged including on large granges. According to Holistic Agrarian checks, creatures and humans destroy roughly 35 of crops. This intelligent system uses deep literacy neural networks enforced with TensorFlow to honour creatures grounded on their trouble position as well as mortal interferers who aren't authorised on the ranch and incontinently report the intrusion to the planter. The system is accoutred.

with an Android operation that allows for remote access to the system as well as surveillance via live videotape streaming.

NoIR

Feature extraction around the body contour is extracted as a form of a signature which is then modelled to a cosine transform using kNN classifier which gives up to 85% accuracy.

Data prep API is not used to analyse the data by creating a sperate job in Dataflow API.

III. RELATED WORK

Existing system: The existing systems are also not done in real time and they’re done using images as the results are less accurate. The existing models for animal intrusion prediction are built on RCNN algorithms which may need a large training time to improve their classification accuracy. The existing models doesn't have a scalable architecture and an alarm sound. The existing system has only one class prediction system

Proposed system: First, a database for animal classification is created by capturing pictures of different animals (both wild and domestic animals). Now, a program is written with functions such as image set, retrieve image and index image. Image set function is a storage function which contains image collection. The retrieve image function is a search function to look for the image. This is done with the help of index function, which makes an image search index. We give the result of capture image function as a query to the processor. We use the Convolutional Neural Networks for image processing and identifying the animal in the fields. After the correct identification of a wild animal, Next stage is informing about the intruder to the home owner and also to the municipal authority through emails. For this purpose, we use the cloud service AWS SES. Also, a false alarm is avoided by replying ‘no’ to the message. In case, if the beast is not harmful.

IV.SYSTEM DESIGN

SYSTEM ARCHITECTURE

This graphic provides a concise and understandable description of all the entities currently integrated into the system. The diagram shows how the many actions and choices are linked together. You might say that the whole process and how it was carried out is a picture. The figure below shows the functional connections between various entities.

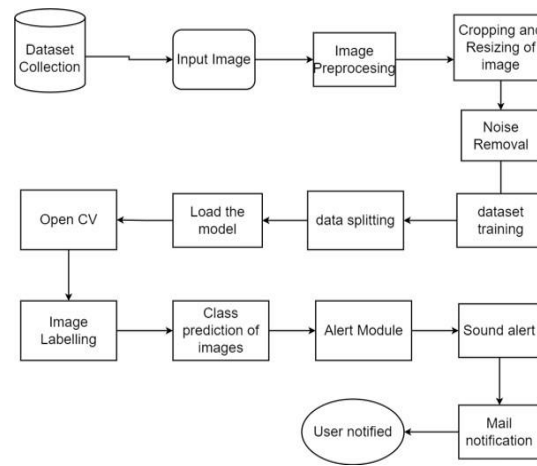


Fig 4.1 – Architecture Diagram

V. MODULES

MODULE DESCRIPTION

5.1 MODULE 1: IMAGE ACQUISITION AND PREPROCESSING

This is the first module of this system; it's used to open a camera with (the OpenCV) library. After initializing the camera it's ready to descry the beast. After the webcam starts penetrating.

Dataset Description

ImageNet

This dataset contains about 14 million images of more than 20,000 categories. There are also more than one million images with object location annotations and also class annotations. This dataset has been used in many image processing techniques like detection, classification, etc. This has become one of the standard datasets in the deep learning field currently. Also, ImageNet has been also used in computer vision research areas. Thus, it can be said that ImageNet is very widely used dataset in deep learning based approached.

NEC Animal Dataset

This dataset is mainly used for animal detection. It contains of about 5000 images of toy animals of 60 categories with different poses. Each object has about 72 images of different poses, which is done by continuously turning the toy animal using a turn able. Performance evaluation of object categories can be done by using this animal dataset.

Beast discovery in original inquiries were grounded on mortal vaticination It is seen that, if the animal is near and has no lighting problems, then a human is able to make decisions about the presence of the animal in the particular image. But human eyes get exhausted very easily, hence this limitation led to inefficiency of the method. To detect animals, computer vision has been taken into account in image processing. The detection of animals was later improved by image processing methods such as thresholding and background subtraction. But, the selection of threshold value was veritably difficult due to periodic changes in background. Researchers also used power spectrum approach in detection of animals, but found to be very time consuming and so it is not suitable for quick results.

OpenCV

OpenCV is the vast open- source library concentrated on computer vision, machine literacy, and image processing. It's known for real-time operation, which is veritably significant in current system. With OpenCV, one can assay images and vids to identify faces, objects and indeed handwriting belonging to unique humans. When it's integrated with colorful libraries, similar as NumPy, python, it's able of recycling the OpenCV array structure for analysis. We perform fine operations and use vector space to identify image pattern and its colourful attributes. Released under BSD License, the first interpretation of OpenCV was 1.0. It's free for both marketable and academic use. It supports operating systems like Linux, Mac OS, Windows, Ios and Android and interfaces with languages Python, C, C and Java. The high focus for the design of OpenCV was a real- time operation for computational effectiveness. Everything is written in optimized C/ C to take advantage of multi-core processing.

Image Pre-processing

In contrast to analog image processing, digital image processing uses computer algorithms to process digital images. Digital image processing is a subcategory or field within digital signal processing. The prints transferred via the digital camera are captured via the PC for the beast class.

The dataset is created and the set of sample photos is stored in it. After collecting the photos, the captured photo is delivered to the processing machine as a question photo. A question photo and the photos are stored in the System Storage where the indices similar to the photos are located within the photos that are visually very similar to the question photo. The returned photo ID contains the indices ranked from most comparable to least comparable; The content of the question photo is identical to the saved photo. Accordingly, the notification is sent to the owner as an intimate Message statistic.

Image

Each rudiment in an image occupies a particular position in a two-dimensional array. Pixel is the name given to these rudiments.

Types of Images:

- Binary Image
- Black and White Image
- 8-bit colour format
- 16-bit colour format

Resizing of images

- First, we will resize all images to same size.
- It will help to reduce computization power.
- The cropped images are resized to 224X224 Pixel, which is the input size required for our pretrained network

Zooming

when an image is zoomed, it becomes magnified. The zoomed interpretation of thermal images can be used for addition.

Rotation

An image can be rotated by changing the position of an object about a pivot point at a certain angle. Image when rotated, will still look the same and would represent the case as if the picture was taken from a different angle.

GrayImage

A grayscale or greyscale image is one in which the value of each pixel is a single sample representing only a quantum of light, that is, it carries only intensity information. Images of this kind, also known as black- and-white or argentine snap, are composed simply of tones of Argentine.

Contrast enhancement

The discrepancy ranges from black at the weakest intensity to white at the strongest Differ improvement Differ improvement helps in adding the discrepancy in the image and therefore making the image contain further intensities than just a many. This was applied on images for addition since the same image can have better discrepancy on a sunny day or bright day. Our training set was named in such a way that it covered a wide range of possibilities.

Preprocessing

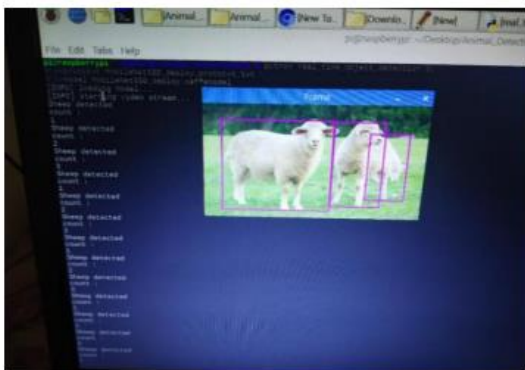


Fig. 3. Sheep counting and detection

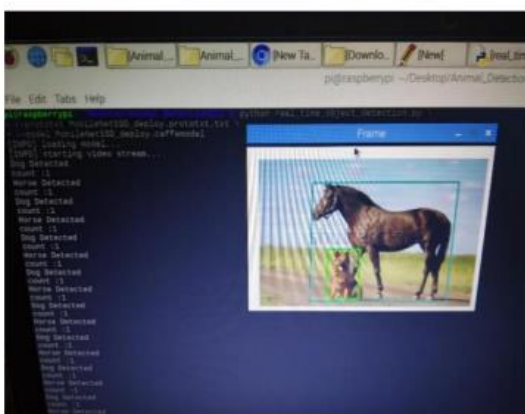


Fig. 4. Horse counting and detection

In pre-processing, we apply some methods to extract the required features of an image. It depends on input image type as well. We have denoising which is removing noise in the image. Simple box or Gaussian filter are some denoising techniques. Then we have contrast enhancement in which we correct gray level of the image. Down sampling is for increasing the speed. We have other methods like Morphological operation for binary images, scaling by some factor etc

5.2 MODULE 2: FEATURE EXTRACTION

An alternate trainable fully convolutional (conv) layer extracts high-level features during the feature extraction stage, while a fully connected layer, the classifier, deals with different combinations of those features in order to determine the final decision.

To start training, a new notebook was created on Collab and the hardware accelerator option is enabled by selecting the GPU option. GPUs are known to be much faster than Central Processing Unit (CPU) for our deep learning application. There are libraries to optimize the use of GPUs in deep learning as the NVIDIA CUDA Deep Neural Network Library (cuDNN), known as a GPU-accelerated library for deep learning.

5.3 MODULE 3: CREATING A MODEL

A neural network works on data like how the human brain works on experience in human life. Hence the accuracy of a neural network depends on the amount of data we provide. The repetition makes the memory stronger. Over time, the result gradually becomes accurate. To train a neural network, we will divide the data into three sets. In the first set, we use the data as training for the network. This will help the network establish various weights between the nodes. We use the next data set as validation data set to fine-tune. The third data set is a test to check how accurate our output is. The training time of a neural network is an important aspect because complex tasks will consume more computer power. One more issue is that the neural networks are like a black box to us. The user feeds in the data and receives answer on the other side. We can fine tune the result, but actual decision making is out of our control. Several researches are working on this problem, but it will become more serious or pressing only if the usage of artificial intelligence increase in our daily life.

Testing

After training, the input data for testing are images extracted from videos tracking from a camera to detect animals by applying the proposed network models from training phase.

Saving Model Weights for Deployment Uses

An effective business decision can be made based on data when a machine learning model is deployed into an existing production environment. It is the final stage of the machine learning life cycle and one of the most difficult ones. Before a model can be utilised to help make decisions, it must be effectively deployed into production. Machine learning models must be smoothly deployed into production in order for businesses to use them to start making useful judgements. This will maximise their worth. Our project's deployment is handled by the stream lighted app.

VI.CONCLUSION

In conclusion, animal intrusion detection using deep learning is a promising approach for detecting and alerting of animal intrusion in areas where animals may pose a threat to human safety or property damage. Deep learning algorithms and computer vision techniques have enabled accurate detection and classification of different types of animals, including small and large mammals, birds, and reptiles. The primary advantage of using deep learning for animal intrusion detection is its ability to learn and adapt to different environmental conditions and animal behaviour patterns. This allows for the development of robust and reliable models that can operate in real-world scenarios with high accuracy and minimal false alarms. However, there are also some limitations to consider, such as the need for large amounts of annotated data to train the models and the potential for false negatives or positives in certain situations. Additionally, the cost of implementing and maintaining such systems may be a barrier for some organizations. Despite these limitations, animal intrusion detection using deep learning has the potential to provide a valuable tool for wildlife management, conservation, and human safety. Continued research and development in this field will be crucial to improving the accuracy and effectiveness of these systems in the future. Overall, the use of deep learning algorithms for animal intrusion detection is a promising approach that can complement traditional wildlife management strategies and help mitigate the negative impacts of human-wildlife conflicts.

VII REFERENCES

- [1] Development of a Wild Animal Intrusion Detection Model Based on Internet of Things, Second International Conference on Artificial Intelligence and Smart Energy (ICAIS), 2022, Prabhat Kumar Panda, Cherlopalli Srujan Kumar, Bommu Sai Vivek, Masura Balachandra, Shashi Kant Dargar
- [2] Srushti Yadahalli; Aditi Parmar; Amol Deshpande, "Smart Intrusion Detection System for Crop Protection by using Arduino", Second International Conference on Inventive Research in Computing Applications (ICIRCA), 2020
- [3] "Internet of Things based Wild Animal Infringement Identification, Diversion and Warning System," International Conference on Inventive Computation Technologies (ICICT), 2020," by Muneera Begum H., D.A. Janeera, and Aneesh Kumar.
- [4] Asian Conference on Innovation in Technology (ASIANCON), 2021, Bhanu K. N. and Sahana K. "Farm Vigilance: Smart IoT System for Farmland Monitoring and Animal Intrusion Detection Using Neural Network."

- [5] S. Jeevitha, S.Vengatesh Kumar, “A Study on Sensor Based Animal Intrusion Alert System Using Image Processing Techniques”, Third International conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC), 2020
- [6] Udayamoorthy Venkateshkumar, Anirudh V, Dipok Khanali V, Ezhil B, “Farm Intrusion Detection System using IoT”, International Conference on Electronics and Renewable Systems (ICEARS), 2022
- [7] P. Manikandan, G. Ramesh, P. Lokesh, P.Narasimha Raju, M.Durga Prasad, P. Madhu, “IOT Based Farm Protection System from Animals and Humans Theft using ESP32 with Camera Module”, 2nd International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE), 2022
- [8] Real-Time Monitoring of Agricultural Field with Crop Prediction and Animal Intrusion Prevention Using Internet of Things and Machine Learning at Edge, IEEE International Conference on Electronics, Computing and Communication Technologies (CONECCT), 2020. R. Nikhil; B.S. Anisha; Ramakanth Kumar P.
- [9] Hardiki Deepak Patil, Namrata Farooq Ansari, “Intrusion Detection and Repellent System for Wild Animals Using Artificial Intelligence of Things”, International Conference on Computing, Communication and Power Technology (IC3P),
- [10] M Shrihari, “A Smart Wireless System to Automate Production of Crops and Stop Intrusion Using Deep Learning”, Third International Conference on Smart Systems and Inventive Technology (ICSSIT), 2020