PREVENTING INFILTRATION OF ANIMALS USING THERMAL CAMERAS AND INFRA-SOUNDS IN FARMLANDS.

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Abstract: Human interventions in the forest have led to themigration of wild animals into human habitations. To overcome this problem various methods have been tried butnone is very effective. Present work attempts to address theissue by developing a system that uses thermal imaging technology combined with machine learning to detect and recognize animal species and then use the characteristic sound of a specific frequency to divert them back into forestareas. By this system, the damage to crops can be minimizedto an extent that will save the farmers from incurring lossesand also reduce the response time to find animals. It also eliminates the use of tranquilizers and electric fences whichcould injure both humans and animals.

Keywords : Thermal image Processing, Neural networking,Audio Amplifier, Digital Signal processing, Geo-fence areas.

I. INTRODUCTION

Today thermal images are effective in detecting animals in low light conditions, nowadays computer GPU s are very powerful and are capable of performing and implementing complex machine learning algorithm which involves complex mathematical calculations quickly. So thermal cameras can be used in detecting animals in field areasautomatically using neural networks. every animal has adifferent hearing range. Every animal has its range so a different irritating sound frequency. These sounds can be used for irritating animals, and use it to avoid accidents and collisions with crops. This is manually done by people by constantly monitoring animal activity near the field areas.[3][4][5]

II. METHODS:

1. *Collection of DATA-SET*

More than 2000 images were collected from various data setslike “animals with attributes 2”, “FLIR Thermal Data set forAlgorithm Training”, and “LTIR v1.0”. 80%of the data-set was used for training and the remaining 20%+ was used for testing the algorithm.[1]

2. Detection Using Feature Extraction and MachineLearning Techniques

Various feature extraction and machine learning approaches are utilized in thermal imaging to find, identify, and categorize wild animals. A threshold that may be adjusted dynamically is used to find hot things. A thermal feature extraction technique is utilized to categories the animals. Thermal fingerprints are computed for each observed object using morphological procedures. The thermal signature, which represents the heat characteristics of things, is somewhat invariant to posture, scale, rotation, and translation.DCT (Discrete Cosine Transform) is used to parameterize thethermal signature and compute the feature vector, which is then used for classification. A classifier called k-nearest neighbor (kn N) is used to distinguish between animals and non-animals. Additionally, we demonstrate the performance of the YOLO convolution neural network, which was trainedon a subset of our thermal image data set, in detecting animals in thermal images using a bespoke data set. [2]

3. Sound Generation and Time-Varying Low Pass Filter

High-Impedance audio amplifiers are used for producinglow-frequency sound waves. The audio signals are generatedfrom local digital oscillators, the type of signal depends on the type of animal ,and the frequency of the sound wave is time-varying. The signal is continuously passed through an Infinite Impulse Response(IIR) Low Filter which removes the high frequencies of the Sound before amplification. For this application, the IIR filter is preferred over Finite Impulse Response(FIR) because the IIR is Computationally faster, more efficient ,and easy to get steep transition band filters.

4. *Deployment*

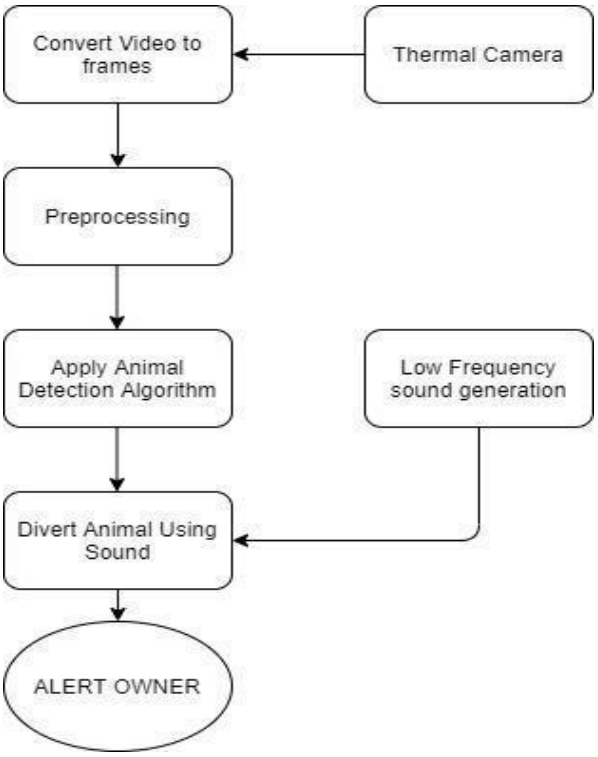

Figure 1 : Flowchart of deployment

Several Thermal Cameras are placed at different places in thefield such that all area is being surveyed. The live feed is distributed in frames and each frame is processed to check ifany animal is present in any. All the processing is done on anNVIDIA Jetson-embedded computing board. High- impedance audio amplifiers will be producing low-frequencysound waves. After the complete process is done informationis informed about the time of intervention, the time duration for which the sound was generated ,and the animal.

III. RESULTS AND DISCUSSIONS:

Using the YOLO algorithm, animals are found and classified.The categorization process made use of a feature extraction approach. Then, using morphological alterations, heat fingerprints were computed for each discovered object. The k-nearest neighbor classifier was then applied to distinguish between animals and non-animals. After everything was set up, sample thermal videos were gathered and sent into the system to test it. The technology demonstrated greater than 80% accuracy during testing. Successful detection and classification of every animal. After the creatures were discovered, a low-frequency sound wave was produced to sway the animals using high

Figure 2: Thermal Camera Capturing an Animal

impedance audio amplifiers and a nearby oscillator. The lowfrequency of the sound waves was continuously shifting. Allother sound wave harmonics were filtered out, and the only pure low-frequency sound was amplified and generated, having less than 85 dB. It had a time-varying infinite impulseresponse filter that was able to filter out low-frequency noises with great precision and minimal noise. Additionally, if an animal was discovered, the involved party was contacted viatailored mobile SMS, which included contained a picture of the animal discovered. On-board computing was used for allprocessing.

IV. CONCLUSION:

In this paper, we have developed an animal detection and repelling system. The system was successfully tested. Animals were successfully detected and a clean low- frequency sound was produced. This is a new approach and better than existing methods as the system works on simple predefined algorithms that don't even require much maintenance or physical labor. Also, the sound pollution produced is less as it produces sound only when the animals enter the Geo-fence area and for a particular time. Thissystem can be used to reduce damage to crop yields without harming the animals.

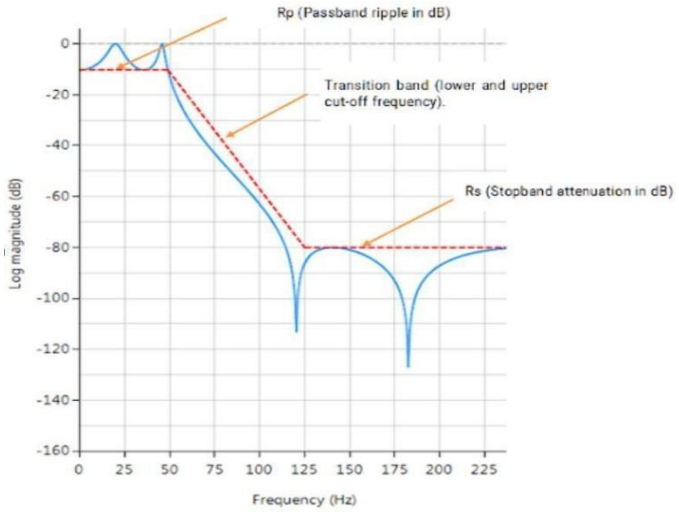

Figure 3 : Spatial Amplitude

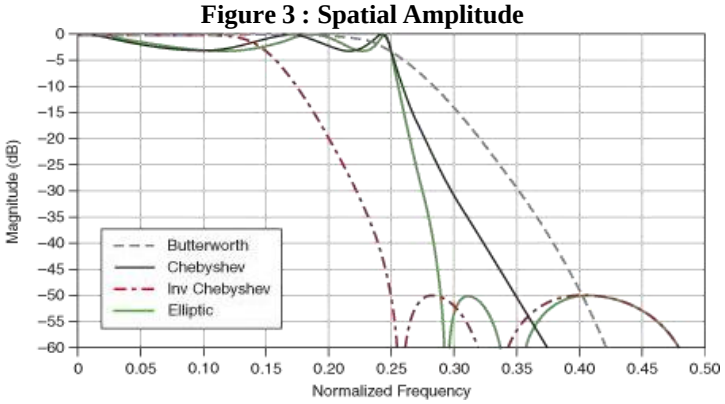

Figure 4 : Generic Amplitude

V. REFERENCES

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