



# Survey On Smart Siren to Alert Animals About Train Tracks in Image Processing

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**Abstract**—Animals frequently come into contact with the trains that utilize railway lines, which puts them in grave risk. Many fatalities are caused each year by the inability of animals to escape accidents at the high speeds of trains. A smart siren system that employs image processing technology to find animals on or near the train tracks and warn them of an approaching train can be created to solve this issue. The proposed system captures an image of the surrounding region using cameras that are installed on the sides of the tracks. After that, computer vision algorithms are applied to these photographs in order to identify any nearby animals. Animals may hear the sound that is emitted by a smart siren when it is triggered after it detects animals. To guarantee that animals are warned of the impending train in advance, the siren can be installed at various points along the tracks. This approach can encourage coexistence between animals and people while drastically reducing the amount of animal deaths on railway lines. Overall, the smart siren system suggested in this research can provide an innovative and effective solution to stop animal collisions with trains and to increase safety for both humans and animals.

**Keywords**—Smart siren, Train tracks, Early Warning

## I. INTRODUCTION

As many animals are killed each year in collisions with trains, railway tracks have emerged as a regular hazard to wildlife. These mishaps not only endanger the animals but also endanger the trains, throw off schedules, and sometimes even kill people. Thus, it is vital to create workable ways to lower the rate of animal mortality on railroad lines. Creatures of various sizes, including huge mammals and smaller creatures, are at risk of colliding with trains due to this widespread problem. In addition to harming animal populations, these mishaps often force railroad operators to incur enormous financial losses. The identification of animals in images and videos has shown significant promise in recent years thanks to computer vision methods, and this technology may be used to create an automated system for animal detection and warning. A more dependable and effective way to stop animals colliding with trains may be made by combining a smart alarm system with image processing technology. We suggest an intelligent siren system that alerts train operators when animals are found on or near the tracks using image processing technologies. In order

to identify nearby animals, the system employs cameras mounted on the rails to take pictures of the surrounding environment. These photos are then analyzed using computer vision algorithms. A smart siren is activated when animals are detected, and then it makes a sound that animals can hear. The suggested technique might drastically lower the amount of animals who perish on railroad lines while also fostering harmony between animals and people. The following pictures show the cause of accident due to the animals interruption



Fig.1. Animals interruption in roads



Fig. 2. Animals interruption in railway tracks .

In fig 1. It shows that the animals are crossing the road ways which are the main causes for the accidents which are taking place in road . In fig 2 . It shows the

animal which is standing in railway track and cause blocks

## II. FLOW CHART

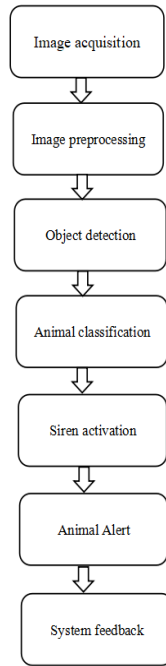


Fig.3 Flow chart

The Fig.3 flow chart shows that the flow of image is occurred and the image processing is done and an object detected and the animal is classified and the siren is activated and which makes animal to avoid unwanted activities and the data is collected as a feed back.

## III. OVERVIEW

### A. Related Works

Reno Sato [1] discuss the importance of energy reduction for edge devices that use deep learning, as these devices are often required to operate in areas where commercial power is not available. They also draw attention to the difficulties in applying deep learning to the identification of wild animals, such as the necessity for a significant quantity of training data and the danger of over fitting. The authors then go over their suggested strategies for cutting back on energy use, which include streamlining data transfers between edge devices and the cloud and optimizing the deep learning 5model. Finally, they give experimental findings that show how effective their strategy is. Manu Y. M.[2] highlights the drawbacks and difficulties of conventional fire prevention methods, such as the possibility of false alerts from smoke and flame detectors. They contend that these systems are unreliable and may cause unneeded evacuations, which can be expensive for companies. The authors suggest a computer vision-based system that makes use of surveillance cams to spot fires and send an alert to a nearby fire brigade in order to resolve these problems.

The technology offers video footage that can be used to estimate the number of people who are still present in the room, enabling the fire service to send enough responds to the scene based on the video. Comparing this method to conventional fire monitoring systems, the writers claim that it is more efficient, quicker, and has lower error rates. A few of the difficulties encountered by researchers in creating efficient fire monitoring systems are highlighted in the review's discussion of related work in this field. Overall, this part offers a solid basis for comprehending the necessity of a CCTV surveillance anomaly warning system in business storage. A few of the difficulties encountered by researchers in creating efficient fire monitoring systems are highlighted in the review's discussion of related work in this field. Overall, this part offers a solid basis for comprehending the necessity of a CCTV surveillance anomaly warning system in business storage. Manoj Purohit [3] discusses the advantages of image-intensifier-based night vision devices over other types of night vision devices and emphasizes the necessity of night vision devices for taking pictures in extremely low light circumstances. They also note that scintillation noise is a significant obstacle to taking high-quality pictures in dim lighting. The authors then go over a number of image processing methods that have been suggested in the literature to deal with this issue, such as local spatial filtering, wavelet analysis, and spatial-temporal filtering. Finally, they draw attention to the shortcomings of current methods and suggest their own elaborate technique for improving the performance of low-light image sensors. H.Seckin Demir[4] talks on the value of data augmentation in enhancing recognition accuracy, especially when there is a lack of training data. They discuss about the A convolution neural network (CNN) for animal recognition, an adaptive optimization framework for adjusting camera frame rate and LED illumination level based on environmental conditions, and a simulated annealing algorithm for parameter optimization make up the system's various functional sub-blocks. To train their neural network on a sizable datasets of labeled pictures, the authors use deep learning methods, synthetic data creation, and transfer learning. In order to increase their training datasets and enhance recognition performance, they also produce fake pictures. The authors claim that even in poor visibility situations, their suggested approach provides good recognition accuracy for a range of marine life species. They come to the conclusion that their approach has the potential to be helpful for energy-efficient population monitoring of marine life and long-term behaviour research. Harish S [5] discusses the issue of human-elephant conflict, which is a significant problem in forest areas and agricultural fields. Conflict occurs when elephants harm humans or crops, which triggers retribution and occasionally even results in the elephants' demise. The authors suggest an automated unsupervised elephant image detection system (EIDS) that takes pictures of elephants and transmits them to a base station through an RF network in order to solve this

problem. Through the prompt notification of forest officials when an elephant is in the area, this approach seeks to avoid conflicts between humans and elephants. The suggested strategy is a step in the direction of lessening conflicts between people and animals and conserving both human and animal life. Sachin Umesh Sharma[6] emphasizes the importance of collisions between animals and vehicles that result in traffic accidents and the necessity for practical measures to deal with this problem. They suggest a technique for spotting animals in footage or photos and calculating their distance from the car's mounted camera. The authors also go through the drawbacks of conventional techniques for animal detection that rely on human drivers, namely driver weariness and sluggish response times. Overall, the literature study highlights how computer vision methods might increase traffic safety by delivering more accurate and dependable animal identification systems. The following fig.4 have taken from the above paper .



Fig.4. Animal detected while crossing road

Anil Shetgaonkar [7] have proposed a approach to reduce man-animal conflict using bio-acoustics and image processing. For the purpose of researching various animal species in distant areas, camera trapping has gained popularity. Man-animal conflict has become a significant problem due to human expansion into natural ecosystems, though. Researchers have begun using the concepts of bio-acoustics and image processing to this issue in an effort to lessen the harm done to farmers by wild animals. Image processing is used to analysis camera-trapped photos of animals and identify them based on their physical traits, whereas bio-acoustics is used to detect animal noises linked with particular behaviors. This strategy has reduced man-animal conflict and shielded crops from harm, showing encouraging outcomes. Nawin Kongurrsa [8] focuses on the development of security systems and the challenges faced by traditional intrusion detection systems. Point out the flaws in these systems, such as their propensity for false alarms and failure to spot breaches in real time. The authors suggest an intruder detection system that employs image processing technology to monitor and record the movement of items in security systems via CCTV in order to resolve these problems. The outcomes of the experiments demonstrate how well this system works to identify breaches and immediately notify security employees. Airports, banks, and public spaces are just a few security-related situations where the suggested method could be used.

TABLE .I . A Overview Of The Reference Papers

Ref. No.	Method Used	Advantage	Disadvantage
[1]	1. Optimizing the deep learning model 2. Reducing data transfers	1. Improved accuracy 2. Energy efficiency	1. Dependence on synthetic data 2. Reduced model complexity
[2]	1. Computer vision-based system 2. Image processing 3. Raspberry Pi 4. Fire detection algorithm 5. Alert transmission 6. False alert validation	1. Quick response time 2. Minimizes risks 3. Reliable 4. Easy installation	1. Limited coverage 2. Dependence on electricity 3. False alarms
[3]	1. Gray transformation methods 2. Histogram equalization methods 3. Retinex methods 4. Frequency-domain methods 5. Image fusion methods 6. Defogging methods 7. Machine learning methods	1. Comparative analysis with other algorithms 2. Real-time performance 3. Improved contrast and image quality	1. Limited evaluation scenarios 2. Complexity 3. Delay and latency 4. Limited to image-intensifier-based night vision device
[4]	1. Deep learning 2. Synthetic data generation 3. Adaptive optimization framework 4. Residual neural network 5. Transfer learning	1. Energy efficiency 2. High recognition accuracy	1. Dependence on environmental conditions 2. Limited applicability

The above papers are taken for the survey on smart siren to alert animals about train tracks in image processing. That includes methods ,advantages and disadvantages .

TABLE .II: A Overview Of The Reference Papers

Ref. No.	Method Used	Advantage	Disadvantage
[5]	1. Wireless systems and IOT technology 2. PIR sensors and cameras 3. Content-based image classification (CBIC) algorithm 4. Micro controller 5. GSM technology.	1. Early detection 2. Low-cost and easy to implement 3. Preventing human-elephant conflict 4. Response times and more effective	1. Maintaining the system may be high 2. False alarms 3. Regular maintenance

		management of wildlife.	
[6]	1. Boosted cascade classifiers 2. Animal images from the KTH datasets and NEC datasets 3. Color normalization 4. Content-based retrieval algorithm (CBIR)	1. Improve road safety by providing more efficient and reliable animal detection systems. 2. Detect animals in videos or images and determine their distance from the camera mounted on the vehicle.	1. Detect animals up to a distance of 20 meters only 2. Effectiveness of the system may be limited by factors such as weather conditions, lighting conditions, and the presence of other obstacles on the road. 3. Beyond a speed range of 30 to 35 kmph
[7]	1. Camera trapping 2. Bio-acoustics	1. Targets them with specific sound frequencies 2. It is a non-invasive and cost-effective	1. Limitations in identifying animals in low-light or poor weather conditions 2. Possible habituation of animals to the sound frequencies over time.
[8]	1. Image processing technology for object tracking and detection 2. Blob analysis 3. Internet connectivity	1. Capture the movement of objects and detect intrusions in real-time 2. Optimizes intrusion detection via CCTV	1. High false alarm rates

#### IV. EXISTING ALGORITHM

##### A. Deep learning

The system that is being presented uses a convolution neural network as its deep learning algorithm. (CNN). An artificial neural network design called a CNN is very effective at image identification tasks. They accomplish feature extraction and categorization using a network of linked nodes that are organized in various levels. To extract features at various spatial scales, a collection of learnable filters is convoluted with the input picture. The high-level representations created from these characteristics through a series of nonlinear transformations are then employed for classification. Back propagation, a technique for learning network weights, modifies the weights to reduce the discrepancy between projected and actual outputs

##### B. Content-based retrieval algorithm

The content-based retrieval algorithm (CBIR) is a method for finding pictures or movies based on the visual information they contain. In CBIR, the system examines a picture or video's characteristics, like its color, texture, and form, and compares them to a database of comparable images or videos. The algorithm

then searches the database for the most visually comparable photos or videos to the query image or video. CBIR has been extensively employed in many different applications, including multimedia databases, surveillance systems, and medical imaging. However, due to the distance functions employed to determine the degree of dissimilarity between the search picture and the database image, CBIR systems have certain disadvantages, including bad querying performance and poor recovery outcomes

##### C. Residual neural network

In order to allow information to travel across one or more network layers, the method for a residual neural network (ResNet) makes use of residual connections. To extract features, a collection of conventional layers are initially applied to the input picture. Gradient propagation is then sped up by adding the original input picture to each pair of conventional layer output using the remaining connections. This enhances training convergence and lessens the issue of disappearing gradients. In order to classify the output, it is subsequently passed through many completely linked layers. Back propagation, a technique for learning

##### D. Animal images from the KTH datasets and NEC datasets

Two publicly accessible datasets with a substantial number of animal pictures and videos are the KTH Animal datasets and the NEC Animal Datasets. These datasets are frequently used to develop and evaluate algorithms for detecting animals. The suggested animal detection system use content-based retrieval method (CBIR) to identify the animal if there is a change in the set reference backdrop using image mining algorithms. To find photos that are comparable to the query image, the CBIR algorithm compares its characteristics to those of images in the database. The system is trained on more than 2200 photos from various datasets, both positive and negative, which helps it become more accurate at spotting animals on roadways.

#### V. CONCLUSION

In conclusion, animal-train accidents are a serious issue that may affect safety, finances, and the environment. Many technical solutions have been put out to avoid these collisions, however they have limits and might not work in every circumstance. The identification of animals and the provision of early warning signals for approaching trains are two applications of image processing technology, more especially object detection and picture segmentation. Animals can be warned and persuaded to avoid railway tracks by using a smart siren system that generates sound signals tailored to certain animal species. While smart siren systems and image processing technologies have demonstrated promise in decreasing animal-train accidents, further study is required to increase their precision, lower false alarm rates, and maximize their efficacy in various settings. To properly apply these remedies and lessen the effects of



animal-train collisions, cooperation between wildlife conservationists, transportation authorities, and railway operators is also required.

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