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RAILWAY-ELEPHANT CONFLICT MINIMISATION USING RADIO FREQUENCY TECHNOLOGY

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Abstract - *Elephant crossing of the railroad causes human-elephant conflict, train collisions, elephant deaths, and elephant injuries. In several Indian states, railroad tracks go across areas that support wildlife. Due to railroad crossings in India, accidents that led to the 249 elephants died between 1987 and 2018. It is quite challenging to keep an eye on and manage the elephants along the forest railway line. In India, trains travel through forests at a speed of 50 to 55 km/h during the day and 35 km/h at night. Once an elephant is spotted, the engine driver is unable to stop the train. We are developing a system which detects an elephant when it is crossing railway track and alerts loco pilots of nearby trains and nearby station master. We are using yolo to detect the presence of an elephant, radio frequency technologies to alert loco pilot and station master, Arduino uno and nano devices for transmitting and receiving signals.*

Key Words: YOLO, Radio frequency, Arduino UNO micro controller

1.INTRODUCTION

Animal deaths are a growing cause for concern worldwide as it disturbs the ecological balance and, in certain circumstances, puts the species itself in peril. The Indian Elephant already holds the category of endangered according to the International Union for Conservation of Nature (IUCN). Human life is inextricably linked to the large animal elephant, particularly in India.

Elephants have a significant role in Hindu tradition, mythology, and culture and are also revered as sacred animals in addition to serving as a metaphor for mental fortitude. Hinduism regards Lord Ganesh, who has an elephant head and is revered for removing obstacles from people's lives. As a result, every auspicious task typically begins with a prayer to the Ganesh with the Elephant Head. In comparison, elephants currently face a lot of hardship in their lives. It is currently an endangered species because of human activities.

Elephants, a massive mammal, are the ones that suffer whether it be from the selfish humans destroying forests for their greedy ivory tusks or from the expensive ivory tusks of the mammal.

Our proposed system detects elephants on the track and notifies the engine driver and station master of their presence, reducing conflicts between elephants and trains. The system's primary objective is to lessen the elephant-train conflict.

The elephant is the YOLO (You Only Look at Once) object detection model. system consists of a camera which will monitor the railway tracks continuously and check every second for the presence of an elephant. The technology which is used to detect the

Once the elephant is detected the system will send a response to Arduino nano which acts a microcontroller that transmits signals using radio frequency modules to the receiver which will be another microcontroller (Arduino uno) present at the loco pilot and the nearby station master.

The system will also contain a GSM(Global System for Mobile communication) transmitter which will send a text message to the nearby station master about the elephant detected. This feature will help the station master whenever he/she is not available at the station.

The system will also send an email to the station master using SMTP(Simple Mail Transfer Protocol) which will help station master to maintain data about the number of elephants that are crossing the railway tracks.

In this system we will be using a transmitter and a receiver which will start communicating with each other when the system finds the presence of an elephant on or near the railway track.

2.LITERATURE SURVEY

[1] DR.M.Senthamil Selvi, S. Jansi Rani, et al.,(2022) in their paper titled "**Elephant Intrusion Detection and Repulsion System using MATLAB "** stated that the sonic wave produced by the elephants serves as the suggested system's input. The acoustic data is analyzed using Raven

Pro 1.5 software. The recorded acoustic waves are filtered with MATLAB software to remove ambient noise, and the filtered sounds are then examined for recorded spectrogram patterns. SMS messages will be sent to the station master, train operator, and forest authority if the elephant sound is successfully matched.

[2] Sapni De Soysa, Shakthi Manawadu, Sisuru Senanayake (2020) in their paper titled "**Computer Vision, Deep Learning and IoT Based Enhanced Early Warning System for the Safety of Rail Transportation**" stated that proposed prototype model for detecting elephant intrusion in real time and a detection method. In order to find the elephant on the track, the system uses IOT and image processing concepts. An ultrasonic sensor is used to find objects in front of the sensor, and an LCD is used to calculate the object's distance. Buzzer alarms emit a loud alarm that alerts residents of the village that an elephant is on the track and that the elephant is moving away from it. After an object is detected by a sensor, the system automatically turns on the webcam to determine whether the object is an elephant, and if so, it sends the engine driver a text message alerting them that an elephant has been found. In this case, an image processing technique is being used to determine whether an object is an elephant or not. To identify the elephant object in front of the train, MATLAB concepts are used.

[3] Surbhi Gupta1 , Neeraj Mohan2 , Krishna Chaitanya Nagaraju3 , Madhavi Karanam4 (2020) in the paper titled as "**Deep Vision based surveillance system to prevent train-elephant collision**" stated that the proposed system employs embedded video cameras to identify the elephant in proximity using a deep vision-based model. For the purpose of identifying elephants in images and videos, four different models are proposed. A brand-new, lightweight CNN model is suggested. ResNet50, Mobile Net, and Inception V3 are three Transfer Learning (TL) models that have been tested and tuned for elephant detection. These extremely precise and accurate models can alert the trains, saving a priceless.

[4] R. Rathish, ,S. Prabhu, S. Tharani(2021) in the paper titled as **"Railway Line Tracking System for Reducing Animal Accident "** stated that the goal of this project is to develop a sensing system that can identify where specific track objects are located. The movement of the object is detected using humidity sensors. To find objects on the track, a GPS locating device is also present. The humidity sensor that keeps track of objects and alerts the central system and approaching train.

[5] Aritra Acharyya , Prasenjit Dey , Abir Datta & Sukanya Bose (2020) in their paper titled "**Analytical Modelling of Video Surveillance System Along Forest Railway Tracks** "stated that the authors have created a analytical model to help determine the angular alignment, position, and length-related parameters of a proposed real-time video surveillance system to be installed along rail road tracks or highwayspassing through open or moderate ly or extremely denseforest regions.

The proposed system is capable of providing round-the-clock real-time surveillance of the railway tracks or high ways and its surroundings in order to prevent accidents caused by animal-train or animal-vehicle collisions.

[6] 1 Kanchana.V, 2 Dr. M. Prabu (2016) in the paper titled as "**An Approach to reduce elephant death from train accidents** " stated that the goal of this project is to develop a sensing system that can identify where specific track objects are located. The movement of the object is detected using humidity sensors. For the purpose of finding objects on the track, a GPS locating device is also present. The humidity sensor that keeps track of objects and alerts the central system and approaching train.

[7] Pushkar Shukla, Isha Dua ,Balasubramanian Raman, , Ankush Mittal (2021) in the paper titled as "**A computer vision framework for detecting and preventing Human -Elephant Collisions**" stated that the The proposed system includes a scene-based overhead camera that can keep an eye on the crossing. A SSD object detection algorithm will use this feed as input and find any objects therein. Once the object has been found, it will be watched closely. If the object has been on the tracks or close to them, a warning will be sent to the two train stations that are closest to the object, instructing the trains to slow down.

[8] 1 Mr.Prashant K. Kulkarni, 2 Akshay Suyash Bal, 3 Yogesh Namdev Bandekar, 4 Pratap PradeepAmare(2022) et al., in their paper titled **" Elephant Intrusion Detection System"** states that the proposed system will keep track of real-time video data to look for elephants and alert the train driver if one crosses the railway track as it approaches. To identify elephants from real-time video data, the HAAR feature extraction and adaptive boosting-based machine learning algorithm are employed.

[9] Amit Nagarkoti,Revant Teotia,Amith K. Mahale, Pankaj K. Das(2019) et al., (2019) in their paper titled **" A novel object detection system for improving safety at unmanned railway crossings"** explains the proposed system includes a scene-based overhead camera that can keep an eye on the crossing. A SSD object detection algorithm will use this feed as input and find any objects therein. Once the object has been found, it will be watched closely. If the object has been on the tracks or close to them, a warning will be sent to the two train stations that are closest to the object, instructing the trains to slow down. The operator will also receive the object once it has been detected, so they can advise the driver on what to do. For humans, honk, and for animals, slow down.

[10] Rakesh Kumar Mandal (2019) et al. (2019) in their paper titled "**A Prototype Model to Detect Elephants near the Railway Tracks "** states that a prototype model that detects the vibrations of elephants roaming close to the railway tracks has been created using geophone sensors. With the aid of Arduino, these vibrations are transmitted to the nearby servers. The ANN model created here is used by the server's software. Elephants that are present close to the railroad tracks are precisely located by the device, and it sounds an alarm to frighten them away.

[11] Sayan Dutta1 · Arati Paul2 · Debasish Chakraborty2 · G. Srinivasa Rao3 (2021) in their paper titled "**Elephant–railway conflict minimization using real-time video data and machine learning** " stated that the proposed system will keep track of real-time video data to look for elephants and alert the train driver if one crosses the railway track as it approaches. For the purpose of identifying elephants from real-time video data, the HAAR feature extraction and adaptive boosting-based machine learning algorithm are employed.

[12] Meelan Chamling1 · Biswajit Bera1(2018) et al., (2016) in their paper titled "**Likelihood of elephant death risk applying kernel density estimation model along the railway track within biodiversity hotspot of Bhutan–Bengal Himalayan Foothill** " stated that the s model takes into account historical data on accidental deaths as well as secondary information on train speeds, habitat fragmentation for elephants, the distance between croplands and railroad tracks, human encroachment with electric fencing, etc. EDRAS IMAGINE 16.4(v16.4.0.752) software was used to digitally process Landsat 9 Operational Land Imager—OLI (2020) satellite images to analyze anthropogenic activities as well as changes in land use and land cover. On the ArcGIS 10.3 platform, analogous digital thematic maps have also been created. Elephant Death Risk Score (EDRS), which considers the first and second order properties, is considered when computing Kernel Density Estimation(KDE)intensity(risk).The entire distribution is given a fixed bandwidth, which is calculated using the nearest neighbor distance mean method. Based on the calculated lambda value, a kernel density map is produced to show the risk of elephant death (neighbor index).

[13] Pushkar Shukla, Isha Dua ,Balasubramanian Raman, , Ankush Mittal(2021) et al., (2015) in their paper titled **"A computer vision framework for detecting and preventing Human - Elephant Collisions "** stated that prototype model that detects the vibrations of elephants roaming close to the railway tracks has been created using geophone sensors. With the aid of Arduino, these vibrations are transmitted to the nearby servers. The ANN model created here is used by the server's software. Elephants that are present close to the railroad tracks are precisely located by the device, and it sounds an alarm to frighten them away.

[14] Sherif Sakr , Radwa Elshawi, Amjad Ahmed, Waqas T. Qureshi, Clinton Brawner, Steven Keteyian, Michael J. Blaha, Mouaz H. Al-Mallah (2018) in their paper titled **"Pose Trainer: Correcting Exercise Posture using Pose Estimation "** stated that the goal of this project is to develop a sensing system that can identify where specific track objects are located. The movement of the object is detected using humidity sensors.

3.METHODOLOGY

From the above we can say that there is still a chance to develop a better model to detect the elephants using machine learning and alert the loco pilot and station master using radio frequency technologies. Some of the major disadvantages of the previously developed systems are some models requiring continuous human monitoring, some models using old GSM technologies to alert loco pilot and station master. Our model overcomes all these major drawbacks of the previously developed systems. Our proposed system detects elephants on the track and notifies the engine driver and station master of their presence, reducing conflicts between elephants and trains. The system's primary objective is to lessen the elephant-train conflict the system consists of a camera which will monitor the railway tracks continuously and check every second for the presence of an elephant. The technology which is used to detect the elephant is the YOLO (You Only Look at Once) object detection model. Once the elephant is detected the system will send a response to Arduino nano which acts a microcontroller that transmits signals using radio frequency modules to the receiver which will be another microcontroller (Arduino uno) present at the loco pilot and the nearby station master.

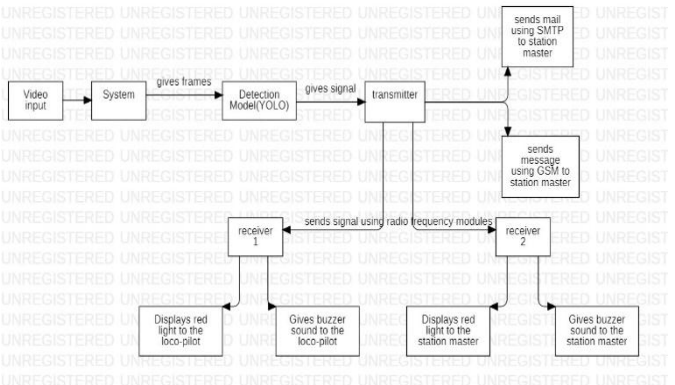

Fig 1: Overall workflow chart

The system will also contain a GSM(Global System for Mobile communication) transmitter which will send a text message to the nearby station master about the elephant detected. This feature will help the station master whenever he/she is not available at the station.

The system will also send an email to the station master using SMTP(Simple Mail Transfer Protocol) which will help station master to maintain data about the number of elephants that are crossing the railway tracks. In this system we will be using a transmitter and a receiver which will start communicating with each other when the system finds the presence of an elephant on or near the railway track.

The modules/packages which we are using for this project are YOLO, Arduino, Radio Frequency, Python, Flask, SMTP, MQTT.

4.CONCLUSION

This application's main objective is to save elephants by alerting the station master and the loco – pilot and glowing the red signal nearby places where elephant is found on the railway tracks.

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