Elephant Intrusion Detection and Repulsive System

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Abstract: Elephant intrusion causes a major problem like crop damage, human death and injuries. Elephant Intrusion has been on the rise in the forest border areas with groups of elephants entering into human habitation and creating a heavy loss to grown plants in agriculture land and their properties. The surveillance and tracking of elephants by humans alone may not always be effective. Mostly the elephants enter into the agriculture land in the night. Detecting elephant intrusion and driving it back is very difficult by the farmers because human cannot watch full night. So, we develop a system which detects the elephant intrusion, creates an alert and repel the elephant away from human habitat. Elephant intrusion detection are useful to avoid human elephant conflict as they stray into agriculture areas searching for food, resulting to economic losses and in extreme cases human casualties. Hence a system to detect elephant intrusion into human habitat and to alert the habitat and forest officials is essential.

Keywords: human death and injuries, agriculture land and their properties.

I. INTRODUCTION

Our work deals with Elephant intrusion in the forest border areas, which is a common problem in this division. Statistical study was taken up by Sugumar and Jayaparvathy in the region of interest. Agriculture land damage by elephants is also high. To repel the elephant, the combination of two techniques were proposed. One is electric fencing, but in this only when the detection of animals in the field of surveillance the electric current to the fencing is connected. The major disadvantage of electric fencing is it causes accidents to humans and power consumption.. The second is alert given through the mobile phone to the field owner or people around the field, they can use any traditional technique to repel the elephant from the field.

The objective of the study is to design a system to spot elephant intrusion in the human habitat region of the forest border in Maruthamalai-Thanikandy zone which spreads to a length of 13 km and width of 0.4 to 1.5 km.limits.

II. LITERATURE SURVEY

Elephant intrusion systems were developed to detect the elephants trying to intrude the human habitat in the forest borders. A surveillance system was developed that uses seismic sensors to detect the signals by the movement of the elephants. The signals were processed; features were extracted and were checked with stored patterns of elephants in the database. On successful match of the recorded pattern, the system processor will generate an alert message with the GPS position of the sensing node. The objective of this study was to analyze the usability of seismic features for effective detection of the seismic waves by the movement of the *pachyderms*.Several sampling of the records were checked out in order to find suitable geophone configurations and to establish good samples of seismic record pattern in the database, which will afford reliable results given by Dr. M.Prabhu. An Embedded system was developed to focus on the problem of detecting elephants in forest border areas using Internet of Things was developed by R.Maheshwari. The main aim of this work was to alert the peoples in and around the forest areas and to prevent their life. Here the sensing and actuating technologies are enabled using raspberry Pi. The obtained data from the Vibration sensor was sent serially to Raspberry pi via Arduino. Thus, in the existing work Geophone (for sensing vibration) and Web camera (for capturing photos of Elephants) to have effective monitoring was enabled and false alarm was reduced. The authors used Cloud Computing for effective utilization of shared resources. As infrastructure was provided by a third-party and accessed via the Internet, users can connect from anywhere.

Other method was proposed by R.Hemalatha et al that uses geophones to sense the vibrations of elephants. The geophones were placed in the areas where elephants often intrude into the habitat. Geophones gives electrical signals corresponding to the vibrations and these signals were further processed using microcontroller. An alert message was sent to the necessary forest officials and also to farmers. Buzzer alarm circuit was also used to prevent elephant intrusion when an elephant reaches 50m of distance from the crop field. This system was very effective and consumes only low power. The readings of geophone was in the range of about millivolts. The coverage area of geophone is 24m. Additionally, when more number of geophones are used then the coverage area will be increased. A system for unsupervised Elephant Image Detection System (EIDS) as a solution to human elephant conflict in the context of elephant conservation was proposed by Sugumar and Jayaparvathy. The elephant image taken in the forest border areas were transmitted to a base station via a radio frequency (RF) network. The received image was decomposed using Haar wavelet to get multilevel wavelet coefficients, with which image feature abstraction and similarity match between the elephant query image and the data base image was performed using image vision algorithms. A mobile message was sent to the officials indicating that an elephant has been spotted in the forest border and was approaching human habitat. A quadruped robot was developed for the human-elephant conflict mitigation by Sugumar and Jayaparvathy. It uses a wheeled quadruped robot, which was designed specially to move in the terrains. The robots are l

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aid in elephant pockets through which the elephants comeout of the forest and enter human area. Suganthi et al developed smart rover bot can also be used for elephant detection. This design was made in such a way that

quadruped robot was made to move in predetermined path to capture the elephant image in and around these pockets. This method detects the elephants in forest borders and not inside the forest. Radio frequencies was utilized for the detection of elephants. The novelties of the system lie in sensing and communication mechanisms, and the ability to monitor remotely. A transceiver mounted on an elephant necklace, while the receiver was mounted on the 4-receiver node. The data received will be processed by the microcontroller which then will be directly sent using KYL 200 L to the server or passing through other nodes to be forwarded to the server. To be able to work independently, each node will use energy harvesting technology to meet power needs by utilizing sunlight as an energy source. This monitoring system proposed by Rizki dian et al was expected to present an indication of the existence of data in of the form of elephant habitat out. Acoustic sensors are used for tracking the elephants and to avoid train elephant conflicts. Transportation is the one of the problem for animals because several elephants died in an accident. The serious issue was a number of elephants were perishing in train accidents. To reduce the death rate of elephant tracking was difficult. Minimizing Train Elephant Conflict (TEC) is only through elephant vocalization. The objective of the research was to understand the problem circumstance and possible factors for elephant death through train accidents and to minimize TEC.

For this two methods are proposed for detecting the elephants in the railway track areas (a) acoustic sensor and (b) adaptive filter and Mel-frequency Cepstral Coefficient. It modulates surface acoustic waves to sense a physical movement. The acoustic sensor used to detect the sound of elephant vocalization. This system proposed by V. Kanchana helps to moderate such conflicts in two ways: 1) A warning to train operator and station master 2) Advance information to the authorities to the forest. A warning system for the threat of wild animals is done with the help of raspberry pi. In this methodology, the process followed was the detection of motion in the video frame and identification of the objects in the area of motion using Haar descriptor as the local features which describes the unique features of animals. The group of images that were collected from the images captured by camera and through the internet sources were used to create a database for animals. In Raspberry Pi this database can only be accessed using the xml file through python coding. Thus, here the positive xml file containing 800 images of elephant, Tiger and Monkey were created and negative xml file with 1050 negative background images were created. Further, a method for combining the classifier into the cascade was done which statistically guarantees the background extraction and pictures only the object of interest. The proposed system was tested with animal database and if the wild animals were detected, then the messages were sent through the GSM. The proposed system prevent casualties that occur in areas having high human wild animal's interaction. King *et al.* discussed results from the study made to find the concept of using beehives to reduce crop damage by the elephant. Early warning system based on satellite was proposed by Venkataraman *et al.* However, this approach need tagging of elephants with radio wireless tags to which they respond aggressively and also spoil the wireless tags. An intrusion detection and alerting system (eleAlert) was designed and implemented by Wijesinghe *et al.*, An eleAlert was generated by a group of sensors to find and trace the damages instantly, and inform the people via mobile network. Electric fences are harmful to elephants. Sometimes more elephant and human beings killed by electric fencing, also it need more electric power. Pyroelectric sensor modules were used by Hao et al, to find the angular displacement of a thermal target which moving in nature. But the sensing distance is less so it is very tough to sense target moving at distant location. V.Vanitha et al proposed a IoT based product to monitor the engine. Same concept is used to develop embedded elephant monitoring system. Wireless sensor network was used for tracking wildlife animals by Alan Mainwaring and Juang & Philo. But the sensor networks has to be placed on the ground and it need straight line of sight. But mostly the sensor nodes are damaged by the wild animals. Human beings also would damage the sensor node without knowing the importance of it. Graham *et al.* have given the usage of mobile phone message in effective human– elephant conflict supervision in Kenya.

III. EXISTING SYSTEM

There were several methods proposed previously that deals with elephant intrusions. A surveillance system using seismic sensor was proposed to detect the elephant across the forest borders that uses seismic sensors to track the movement of elephants. Those patterns are compared with the recorded patterns using fast ICA algorithm. A embedded based system using IOT was developed to sense the elephant using vibration sensors. This system sends the data to the raspberry pi using Arduino. Another system that uses Geophones to detect the vibrations of the elephant, these signals are converted into electrical signals using microcontroller. An alert message is then send to the forest officials. A real time image detection system was proposed that detects the elephants using seismic sensor and the image was captured. The captured image was then compared with the stored images in the database by means of k-means clustering. The drawbacks of existing systems are less scalability, upgrade cost will be high, existing system is not centralized, requires more human resources and implementation cost was high.

IV. PROPOSED SYSTEM

Based on the literature review made, the existing system presents some disadvantages which proves to be vital enough to be removed, our system attempts to do it whose outline is presented below.

Our Intrusion detection system detects the movement of the elephants using the vibration sensor. The vibration sensor senses the elephant's vibration and feeds it to the

raspberry pi. When the vibration matches with the actual value range, the camera catches the elephant's image. Then image processing is done. The recorded image is compared with the images of the elephants that are stored already. This is done with the help of Google Image processing API. Once the image matches with the stored images, the alert message is sent to the forest department with the help of Google messaging API. The figure 1 shows the proposed system.

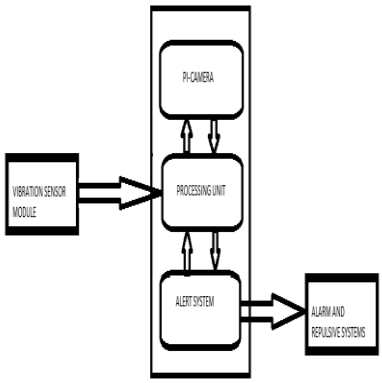

Figure 1 : Proposed System

V. MODULE DESCRIPTION

A.Vibration Detection Module:

This module will have to be initialized only at the start. It will run in an endless loop. The module will check the value from the connected vibration module and compares it with the threshold value we set. If the value crosses the threshold, it will initialize the image processing module as a separate thread and it will keep on doing its work of checking the vibration. Once the vibration detected the camera will capture the image.

B.Image Processing Module:

After being initialized by the vibration module, it will instantiate the raspberry pi camera. Then it will take the photo of the surroundings. Using the latest google API service called Google vision, it sends the photo to the cloud and gets back the JSON object file. This JSON object file contain all the possible case for the intruder. From those cases, we compare our current target i.e elephant in our case. So if the possible cases contain elephant and its possibility exceeds a certain value (70% in our case), we call and initiate the alert messaging module and stop its execution and wait for the vibration detection module to initialize it again.

C.Alert Messaging Module:

After initialized by image processing module, this module will call one of the bulk messaging API available in the market. As this is the case, we use TextLocal messaging API. Through this API, we send a specified message to the prescribed phone numbers. Then it stops its execution.

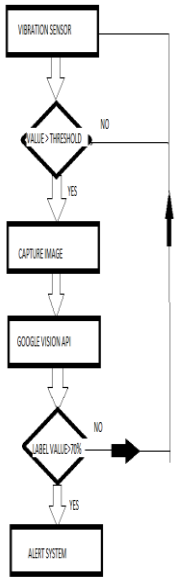

Figure 2: Flow Diagram

VI. RESULTS

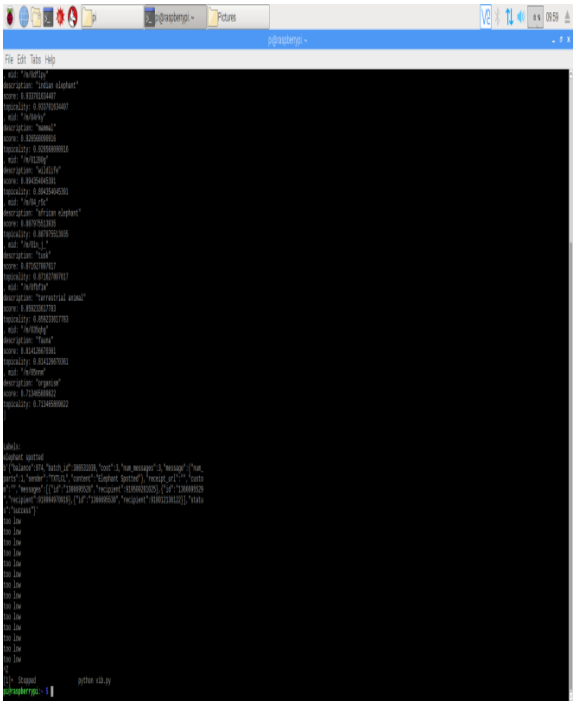

Figure 3: Output screen shot

The output will be initialized once the vibration crosses threshold and it will display the json file obtained from google cloud vision API. Based on this file it also display the presence of the elephant. If the elephant is present it will trigger the alert system and display the status.

Figure 4: Output screen shot

VII. CONCLUSION

In this paper, we have given the details of implementation of Elephant intrusion detection system, the elephant is detected with the help of vibration sensor and is confirmed by the image processing. If the elephant's presence is confirmed, an alert message is sent that shows that the elephant is spotted. As the result of the alert, the required actions are taken. In future a repulsion system for elephants will be developed to repel the elephants away from the human habitat. Audio (simulation of the sound of honey bee) that is aversion to the elephant can be played automatically with high volume to repel the elephant, when an elephant intrusion detected.

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