A Device to Minimize Human-Elephant Conflict.

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Abstract— Human-Elephant conflict over the years has become a major concern for wildlife management in India.This is a very common problem in both North and South Bengal. The major affecting area in North Bengal is the Terai-Duars area. Apart from the role of railways, there is a huge loss of habitat of elephants. The increasing mismanagement of the Duars tea garden increases the huge loss. The dolomite extraction near the border of West Bengal and Bhutan is also the cause of the loss and human-elephant conflict. The human-elephant conflict is also not less in the region of South Bengal (in the region of Purulia, Bankura, and West Midnapore). In this region, the increase in human population is affecting the habitat of the elephants, which is causing the human-elephant conflict. We are focussing on this major issue to minimize human elephant conflict and developing a 360o Ultrasonic SODAR device which will help in tracking the movement of elephants 24x7 and the movement will be displayed on a screen with a buzzer for alerting the people near the buffer zone of any forest area. In this paper the device has been modified to increase the range.

Index Terms— Elephant movement, elephant tracking system, ultrasonic sensor, human-elephant conflict, Arduino UNO board, ultrasonic SODAR, North and South Bengal.

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1 INTRODUCTION

Human-elephant conflict has been a major issue in West Bengal nowadays. Every third day there is an incident of either a death of an elephant or a human because of this human-elephant conflict. The major concerned coming up is the recent incident which happened on 27th January, 2016 (the very first incident on human-elephant conflict in this year) where elephants were literally killed by spreading of electrical wires and death of two elephants happened by the stampede of their feet on those live wires. We are particularly focusing on South Bengal and North Bengal – Terai and Duars region.[1] Here, we are concerned about both human and elephants. The elephant habitat in West Bengal extends over 4200 square kilometre. The northern districts of West Bengal provide a suitable habitat for elephants in the region extending from the Sankosh river in the east to the Mechi river in the west. West Bengal has two elephant reserves: Eastern Duars ER and Mayurjharna ER. About 650 elephants occur in West Bengal over two distinct regions:
North Bengal (Jalpaiguri and Darjeeling): 529, and
South Bengal (West Midnapur, Bankura and Purulia): 118.
West Bengal also receives seasonal visits of other small groups of elephants from Assam/ Jharkhand/ Odisha in addition to above. In recent years, the increased human-elephant conflict in the districts of Purulia, Bankura and West Midnapur has become a serious challenge for the forest staff of these areas. These three districts of South Bengal are severely affected due to elephant depredation. On an annual average, 100 people become victim of this human-elephant conflict.

2 REGION OF STUDY

In West Bengal, it was established through information received from the Divisional offices (Anon 2010, Anon 2013a) that there were three distinct groups of elephants that were moving around in the conflict zone of West Midnapore – Bankura. One was the migratory elephants from the Dalma WLS, which consisted of two to three herds and having a total number of 80 – 90 elephants. The second was a group of 20 – 25 residential elephants that moved around in groups of 3 – 4. The third was again a group of 20 – 25 elephants which has stayed back from retreating Dalma group and have also become residents but known as Mayurjharna group because of their distinguishable behaviour. (Shown in Map 1). Another human-elephant conflict in this region is the train hit accident which occurs when elephants try to pass the railway track in North Bengal region (Duars, Gorumara forest region) section in the forest area; this has resulted in the death of 20 elephants in the last five years.[2] According, to foresters around 30 elephants have been killed in the Duars since the narrow-gauge railway track was converted to broadgauge. The usual route which the Dalma elephants follow for migration and during migration. The usual route has been given below from the place of starting till the end of their migration.

Jharkhand (Dalma Hill) – Jhargram Division – Midnapore Division – Rupnarayan Division – Panchet Division – Bankura North Division – Panchet Division – Rupnarayan Division – Midnapore Division – Kharagpur Division – Jhargram Division – Jharkhand.

3 LITERATURE REVIEW

The objective of tracking is to gain a clear knowledge about the elephant (tracked one). It also depends on environmental factors. But it is difficult to trace elephant habitation due to their movement from one place to other in search of new habitation.

Elephant tracking involves technical and non-technical processes[5]:

Non-technical methods: The non-technical methods/ processes/ or solutions are not just historical but have relevance even today. These methods are followed by farmers for protecting their crops and to save themselves from the human-elephant conflict. The descriptions of various non-technical methods are as follows; crop guarding (Ranjit Manakadan 2010) is a method consisting of huts in the fields and trees which helps getting a clear view of elephant movements even from a distance. Noise and throw method (Osborn F.V. 2002) consists of creating huge noise and throwing (or showering) objects, demonstrating human aggression.

Technical methods:

Seismic Sensor: Seismic sensor is a wireless sensor, which is becoming very popular in recent days in view of its capability for detecting even minute vibrations caused on earth. The combination of seismic sensors and human-elephant conflict were also exploited for military and security applications. Seismic sensors are extremely useful to classify the moving objects and detect vehicles and majorly human-elephant conflicts.[4]

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Markov Chain: An analytical model to capture the behaviour of elephants using a Markov chain is de-veloped. Here, a three-staged Markov model is used to determine the probability of elephant movement from one village to another. The values of the derived probabilities assist in determining the habitat and migration behaviour of elephants during various seasons. The corridors in the forest border areas which the elephants cross during migration to enter human habitation could be easily identified using the derived information for the human-elephant conflict. The model is used to find the probability of elephants habituating in one region.

Satellite Telemetry: Satellite tracking of elephants has advantages in the study of species that migrate across borders, have large home ranges and occupy remote and inaccessible areas. Satellite-based telemetry can be potentially used for setting up 'early warning system' towards this purpose.[5]

4 ANALYTICAL DISCUSSION

In this project, we have tried to develop an Arduino based DIY 360o SODAR device which can track any moving object both day and night. We specially need for the purpose of night because attacks of the elephants at that time which would be unknown to the people. This device will track any moving objects (herein, elephants near forest buffer zone) and display it on screen. The SODAR device consists of an Arduino UNO circuit connected with a PING Ultrasonic distance sensor. It also consists of a stepper motor. The ultrasonic distance sensor will move through 360o angle with the support of a stepper motor. A MATLAB program is written and interfaced to display the output. The device should be placed at a height of 7 ½ feet to 8 ½ feet and the area of radius of 20 metre should not contain any presence of big trees.
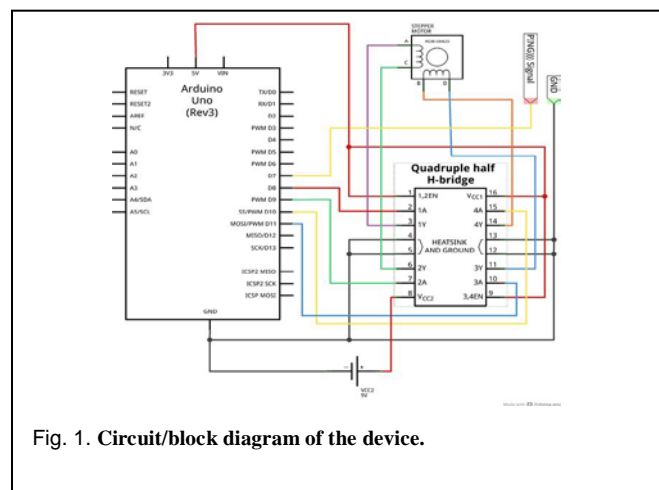
6 HELPFUL HINTS

Fig. 1. **Circuit/block diagram of the device.**

The range of the device has been modified and increased to a

range 21 feet (6.45m), which we would be implementing in advancement of the device.

7 OUTPUT APPLICATIONS AND FUTURE CHALLENGE

The device will be used to track elephants of heights of more than a height of a human being and to a height of normal Asian elephant (that is, at a height of 7 ½'' to 8 ½'' feet) when they come to attack to houses situated near any forest buffer zone areas. The buffer zone of the locality area will be installed with multiple such devices so that every side of the buffer zone could be alert of the elephants arriving near the buffer zone or rather entering them. In future, we will try to make it waterproof so that it can be placed outside the house. There should be few or no trees present of more than a certain height in or near the buffer zone of the forest areas.

CONCLUSION

To maintain the social ecology, we have tried to minimize the human-elephant conflict by building a device, advancing it with the help of advancing technology.

ACKNOWLEDGMENT

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