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DETECTION AND PREVENTION OF ELEPHANTS INTRUSION INTO CROP FIELDS NEAR FOREST AREAS

R.Hemalatha[1], T.Kanmani[2], C.Keerthana[3], S.Ponlatha[4], I. Selvamani[5],
Final Year[1,2,3], Department of ECE, AVS Engineering College, Salem, Tamilnadu,India
Associate Professor[4,5] Department of ECE, AVS Engineering College, Salem, Tamilnadu,India
Email-ID:keerthanachinnadurai@gmail.com Email-ID:ponlathasenthil@gmail.com

ABSTRACT

Crop damage by wild elephants is a serious issue in forest border areas. This crop damage also causes social and economical issues. Though traditional methods like fencing, noise-making, drum beating, use of fire crackers, construction of elephant barriers etc are used so far. The results obtained by these methods are not effective in all situations. So, this project uses embedded and wireless sensor systems to eliminate human-elephant conflict. Migration of elephants occurs over the entire year. So we have to develop an intrusion detection system to detect the intrusion of elephants into the crop fields. This can be done by using geophones which converts motions of elephants into electrical signals. when elephants enter into the forest border areas, an early warning through SMS is sent to the near by forest officials and also to owner of the crop field. We also introduce a buzzer alarm system to change the track of elephants.

KEYWORDS

Traditional methods, embedded and wireless sensor systems, geophones, early detection, buzzer alarm.

1.INTRODUCTION

Crop damage by wild elephants was studied for the past 20 years. In Tamil Nadu, krishnagiri district is bounded by vellore and thiruvannamalai districts in the east, Karnataka state in the west,state of Andhra Pradesh in the north , dharmapuri district in the south. Its area is 5143sq.kms. this district is elevated from 300m – 1400m above the mean see level. Eastern part of the district experiences hot climate and western part as contrasting cold climate. The average rainfall is 830mm per annum. The important crops of krishnagiri district are paddy, maize, ragi, banana, sugarcane, cotton, mango, groundnut, vegetables and flowers. The district has an excellent scope for agriculture business.

The crops cultivated and its coverage area are as

Table.1: Product and Area Coverage

PRODUCT	AREA
Paddy	20687 hectares
Ragi	48944 hectares
Pulses	48749 hectares
Sugarcane	4078 hectares
Mango	343444 hectares
Coconut	13192 hectares
Tamarind	138677 hectares

Due to its rich vegetation intrusion of elephants occurs very often in this areas.To prevent this damage, wireless sensor nodes are used which can sense, measure and gather information from the environment and transmit sensed data to user [1]. The technique of RF Finger printing is used to detect intruding elephant through identifying abnormal conditions [2]. Wireless technology using radio frequency is also used to detect elephant intrusion by inserting 4 node receivers are mounted outside the habitat which is often crossed by elephants and a transceiver is also mounted on an elephant necklace [3].

2.RELATED WORKS

Electric fence as intrusion detection system consumes large amount of power and high cost for implementation. To solve this problem radio frequencies are used. RF is the rate of oscillation in the range of about 3KHz – 300GHz which corresponds to the frequency of radio waves. This monitoring of radio frequency requires transceiver, wireless modules and PC. All components will establish a monitoring system that is capable of displaying the data characteristics of the sensor used, wirelessly. Sensor nodes are placed outside the habitat where the elephant intrusion takes place often. A transceiver is mounted on an elephant necklace while receiver is mounted on the receiver node. The data received will be processed by the microcontroller which then will be sent directly using KYL 200 L to the server or passing through other nodes to be forwarded to the server. This KYL 200 L is used both in transceiver and receiver. This type is used in the coverage range of 2-3km. This canbe shown in the figure 1.

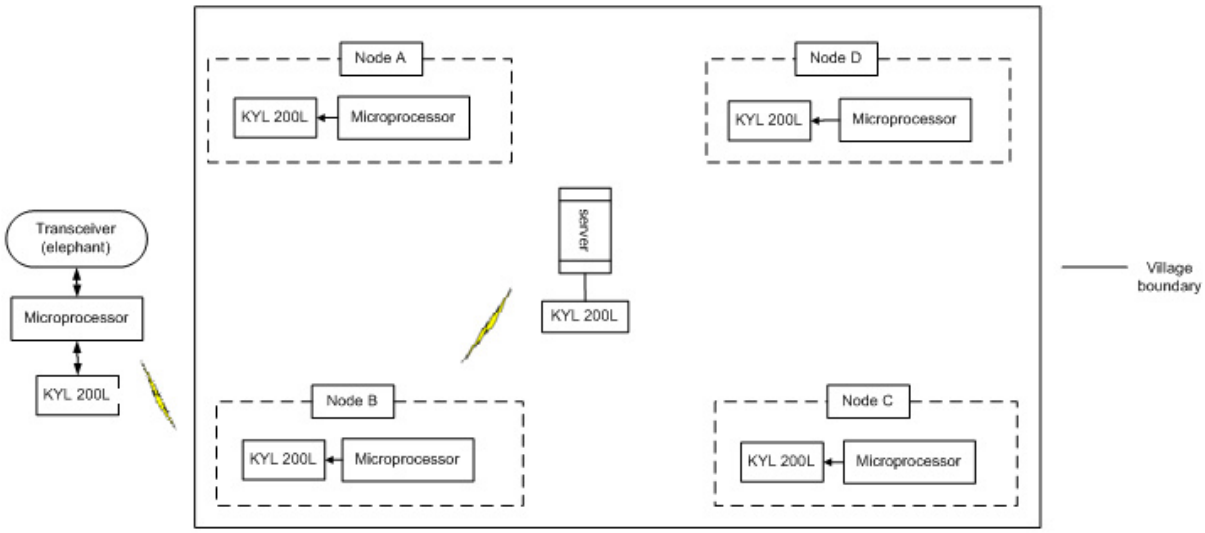

Figure 1.Transceiver mechanism of elephant's intrusion.

3. PROPOSED METHOD

This method uses geophones to sense the vibrations of elephants. The geophones are placed in the areas where elephants often intrude into the habitat. Geophones convert this vibrations into electrical signals and these signals are further processed using microcontroller. An alert message is sent to the necessary forest officials and also to the farmers as shown in fig.2. Buzzer alarm circuit is also used to prevent elephant intrusion when elephant reaches 50m of distance from the crop field. This system is very effective and consumes only low power. The output of geophone is in the order 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. Buzzer alarm circuit is also used to change the direction of the elephant at a distance of 50m from the crop field. The testing with geophones was already done in the elephant camp. The output of the geophone was of the order of millivolts. The output voltage corresponding to the varying distances from the point of the buried geophone sensor was measured. When an elephant of weight 570 kg is close to the buried geophone, the maximum voltage output of the sensor is observed to be 9.7 mV and at a distance of 15 m the output voltage is 6.8 mV. Similarly, for a bigger elephant of 4 ton, when it is close to the buried geophone the maximum voltage output of the sensor is observed to be 16.3 mV and at a distance of 15 m the output voltage is 10.8 mV. The voltage generated by the geophone due to vibration resulting from an elephant walk was observed. Response signals were digitized using sound forge software. Each response record is 10,000 samples long. The peak amplitude was obtained when the elephant walked over the buried geophone. Due to the amplitude difference between front and rear footfalls in elephants, only the former are considered. A peak voltage is of 16.3v

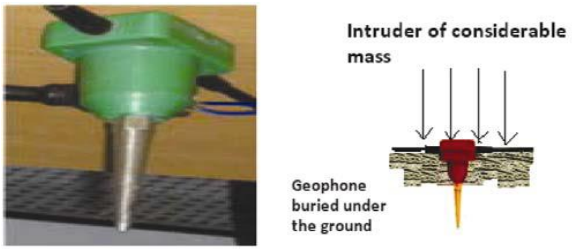

Figure 2: Buried geophone in ground

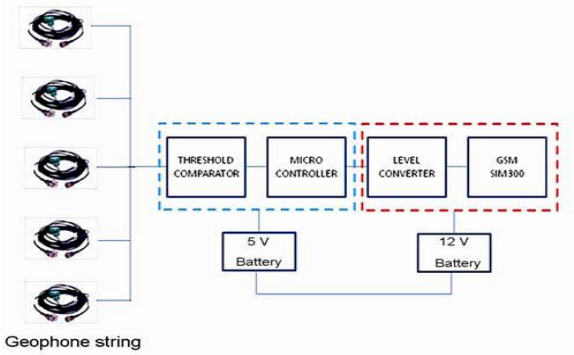

Figure 3: Block diagram of proposed system.

4. EXPECTED RESULTS

Figure 4: Test carried out in elephant camp

Distance from the point of the Sensor and output voltage of the sensor for a 570 kg elephant

Table 2(a): Distance and Voltage Measurement based on elephant weight

Distance (in m)	Voltage (mV)
15	6.8
10	7.7
05	8.1
00	9.7

For 4 Ton elephant:

Table 2(b): Distance and Voltage Measurement based on elephant weight

Distance(in m)	Voltage (mV)
15	10.8
10	13.2
05	14.7
00	16.3

5. ENERGY ENTROPY

Every audio signal has a positive and negative peak and the average of the positive and negative peaks is the energy entropy; it is never the same for any two audio signals. It is a measure of abrupt changes in the energy level of an audio signal.

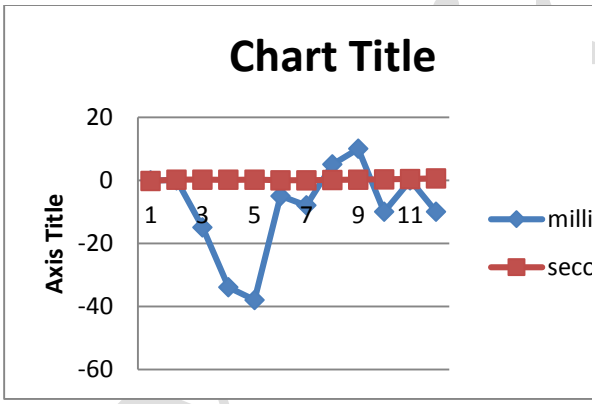

Figure.5: Geophone step response

6. RESULTS AND DISCUSSION

We have designed, tested and implemented the hardware module for intrusion detection. The placement of the sensors is decided based on the analytical model. The hardware module is implemented such that the sensors at the edge of the sensing field will detect the species once they enter the sensing range. The sensor output is recorded as an audio signal in the form of a w ave file.Figure 5 shows the simulation layout of the sensing field.The dots represent the

sensors and the line represents the moving track of the species. A square topology of 50 m × 50 m is considered for simulation. Fifty sensors are randomly placed in the sensing field.

7. CONCLUSION

The unpredictability of time and location of elephant arrival into the crop fields are considered as a major issues that is resolved in this work. Field observations shows that proposed system can be used as an accurate warning system using GSM to detect elephants in the forest areas. So this early warning system of SMS makes the owners alert and buzzer alarm at a range of 1200 KHz frequency will change the direction of elephants without interrupting farmers. This sensor network based solution is chosen as the best alternative among many others based on various practical implications and constraints. Audio signals processing of different animals intrusion into the crop fields can be done as a new method in the future implementation. This can be done by using signal processing methods. Mainly audio signals of different wild animals are detected and processed to give necessary results

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