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An Efficient Warning System for Human Elephant Conflict

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ABSTRACT

Human-elephant conflict (HEC) is the major problem faced by much human habitation. This problem leads to crop damage, human injuries and death caused by elephants, and deleterious effects to the resources. These pachyderms intrusion is increasing day by day particularly in forest border areas. Nowadays Prevention system for human-elephant conflict is a necessary one. Continuous monitoring and tracing of elephants is difficult due to its large size and movement. Many methods had been implemented for elephant's intrusion detection and warning systems. The main aim of the project is to design a wireless sensor network based system for elephant intrusion. Static and mobile sensors are used for the detection of intrusion and a sink node which acts as a base station collects the information from different sensors. The information collected by sink node is based on the priority considering different places of sensor deployment. The message collected is automatically transmitted to the forest officials to avoid the intrusion of elephants. Based on the information received the officials take the proper action.

Keywords : Elephant Intrusion, Static Sensor, Mobile Sensors, Sink Node.

I. INTRODUCTION

The word elephant means ivory. There are two species of elephants remaining in the world one is African elephant (Biological Name: Loxodonta Africana) and the other is Asian elephant(Biological Name: Elephas maximus).Elephants are some of the prodigious creatures in the world. They are very intelligent animals. Mostly elephants are gentle but they will attack if they feel danger for themselves or for its offsprings.There are many great facts about elephants, it is the largest of all land animals in the world, they can weigh up to 260 pound and elephants are herbivores.

Most of the people don't realize that elephants have the potential to be more perilous than other wild animals; there is always a chance for hostile behaviour. Human population increases and this leads to the fragmented wildlife habitat.

Settlement, enormous increase in agricultural growth, and developmental activities have dramatically encroached on natural habitat, which results in several conflicts between humans and elephants [1].In general there are two types of losses one is human death and other one is elephant death. Between 1980 and 2003 more than 1,150 humans and around 360 elephants have died as a result of HEC in North Eastern India[3]. Human-elephant conflict is a rapidly expanding area in research.The reasons for elephants migration into human habitation are adundant vegetation that brings elephants closer to human living areas,artificially stored water attracts elephants into living habitations during drought and badly planned structure that bars passage of elephants.

Nowadays many methods are used to reduce the reduce the human elephant conflict. The main aim of these systems is for only two reasons, one is provides early warning to the peoples and the other is to transmit the information to the forest officials to chase the pachyderms far from main areas to forest.

II. METHODS AND MATERIAL

A. Light and Camera Method

In many areas modern digital cameras are used to record the movement of animals,audio and video of animals.However, due to the practical limitation of using

these cameras "light and camera" is preferred.It uses LEDs and camera which act as virtual fence to detect the intrusion of elephants in between.. It is non-invasive and cost efficient method but reliability is a challenge during day time and night time. Also, setting virtual fence in addition to exact alignment of lights is not possible due to the location.

B. Ultrasound Method

Ultrasound option is generally used to locate animals and this technique is termed as sonography and ultrasonography. Ultrasound Imaging is used for locate the elephants accurately but the limitation is these ultrasound waves does not reflect clearly so it needs a exact rotating techniques. The operating distance is also a limitation.

C. Infra sound and Seismic Communication Method

Infra sound option uses the ultrasound emitted by elephants. Seismic communication uses ground vibration or pressure to detect when there is any elephant movements and uses proximity techniques to locate them. There are significant technological challenges in hardware complexities in infra sound and seismic communication devices. However the buried sensors will have power problems as well. Then this sensors can be destroyed by the wild animals.climatic Climatic condition is also a major factor which destroys the buried sensors.

D. Wireless Sensor Method

Recently most of the wireless or sensor network based animal monitoring and detection techniques tagged or a tracking device is used. But these techniques are impractical because large number of elephants would need tagging. Radio Frequency (RF) techniques are considered as an alternative for the elephant alert. RF module is used to transmit the information to the wildlife authorities for prevention measures.The limitation is power consumption,lifetime of the sensors and difficult to deploy sensors in forest border areas.

E. Vocal Spectrum Method

The human-elephant conflict reduction using the vocal communication of elephant is done in this method. Normally the elephant uses vocalization to communicate over long and short distances. The call produced by elephants is recorded using FM system consisting a FM transmitter and a FM receiver at the base station.

An audio mike is used to convert audio signals into electrical variations and amplified. An audio jack is used to send audio input to PC for the analysis purpose.A program written in Matlab is used to detect the audio features of elephant calls.

F. Radio Frequency Method

The implementation of radio frequency as elephant presence detector for the human elephant conflict prevention.Wireless technology using radio frequency(KYL 200 L) is preferred in this method.Four node receivers are placed outside the habitat boundary where the elephant crossings are often.A transceiver is attached on an elephant necklace.If the elephant comes near to the boundary where the sensors are placed ,the nearest node among the four nodes to elephant arrival will send data to server about the presence of elephants.This acts as an early warning to the guards and people living near to that areas. The data received is processed by the microcontroller which then sent directly to the server using KYL 200 L or passing through the other nodes to be forwarded to the server.

G. Proposed Work

The work intend here is designed as to be as a simulation model and simulation is done by the network simulator.Wireless sensor act as a boundary sensors and detect the intrusion of animals.Here the boundary sensor is the combination of mobile and static sensors. The intrusion of animals is considered here as a event occurance.If any event occurs it is detected by the static sensors.

The mobile sensor go to the place where the static sensor placed and collects the information from the static sensors.The information collected by the static sensors and the information is given to the output node which is considered as base station from the particular area.The sink node is assumed as a base station.This sink node sends the information to forest officers about the intrusion of elephants.

H. Static and Mobile Nodes

Networks of low-power, low-cost, and widely distributed wireless sensor nodes are being developed for many applications which includes surveillance and localization. Neverthless,due to energy as well as communication constraints, combinations of static nodes and mobile nodes are used to expand or fill in coverage areas and reduce energy costs. The mobile nodes are helpful in receiving the information quickly from the static sensors and transmit it to the sink node which is assumed to be the base station. The sink node transmits the information according to the priority because the sensors are placed in different areas where the priority is given to the places where the people living habitat is located.

I. Features of Static and Mobile Sensors

The integrated use of mobile and static sensor nodes is a desirable approach that allows the deployment of advanced surveillance systems . On one hand, simple and cheap static ground sensor nodes allow massive deployment, making it possible to cover large areas . On the other hand, mounting expensive and sophisticated (high-end) sensors on mobile platforms allows their usage in different locations of a covered area.Combining these two types of sensors, the low-end static sensors can trigger the usage of the high-end one mobile sensor in different locations upon demand, which allows having a lower number of these expensive sensors,thus resulting in a positive influence in the overall cost of the system, without losing functionality.

J. Sink node

In wireless sensor networks, the datas collected by the sensor nodes are forwarded to a sink node. Therefore, the placement of the sink node has a great collide on the energy consumption and lifetime of WSNs. The energy-oriented strategy considers the minimizing of the total energy consumption in the networks, while the lifetime-oriented strategy focuses much more on the lifetime of the nodes which consumes more energy in the faster manner.

K. Design Description

Network used here is hybrid wireless sensor network with static and mobile nodes**.**The transmission of information is faster by using the two types of nodes.The network simulator tool is used for elephant detection.The collected data from mobile nodes is transmitted to the sink node.From the sink node the indimation is sent to the forest official.

Static Sensor forms a backbone to support monitoring.It monitors the environment and report where suspicious events appear and detect only one attribute.Mobile sensor move to the event locations to conduct more in-depth analysis .It can analyze multiple attributes of events.They have more powerful sensing and computing capabilities.

They can move to the specific location to carry out missions like analyzing or broken nodes.Multiple Attribute Mobile(MAM) Sensors is used.The MAM sensors are heterogeneous in nature and concurrent events may arise in the sensing field.

The placement of sink node is important in sensor network system.Most importantly the life time and energy consumption should be considered as important parameters in the sink node.Here the sink node is assumed to be a base station.From the sink node the information is transmitted to the forest officials to indimate that there is an intrusion in the particular area.

III. RESULTS AND DISCUSSION

At first the static and mobile sensors are defined. The static sensors are placed in the form of quadrants so the quadrants are separately defined and the neighbor nodes are shown in the output figure 1.1

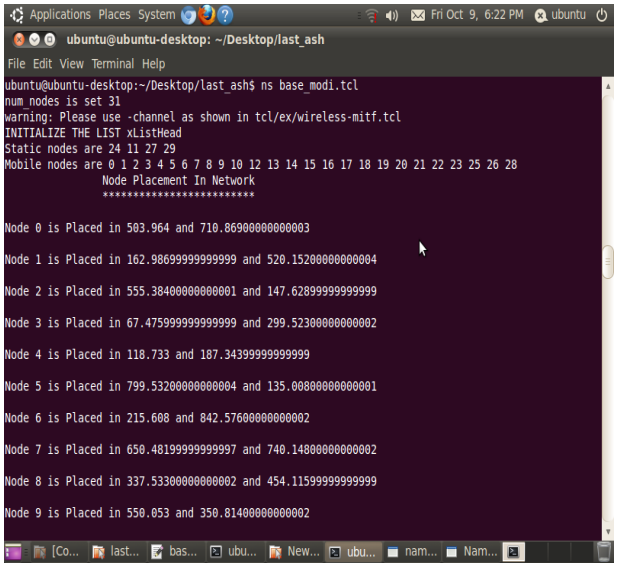

Figure 1.1 : Defining static and mobile nodes

In figure 1.1 it defines the place of node in the wireless network and the nodes number are given to the nodes.The static and mobile nodes are separately defined.The total number of nodes used here is 31 including the sink node. Each and every node should know the neighbouring nodes and that is shown in figure 1.2.The distance specification according to the coordinates is also defined in this figure. If there is correct information about neighbouring nodes the transmission of the particular node will become easier because it will take time for detecting the neighbouring nodes.

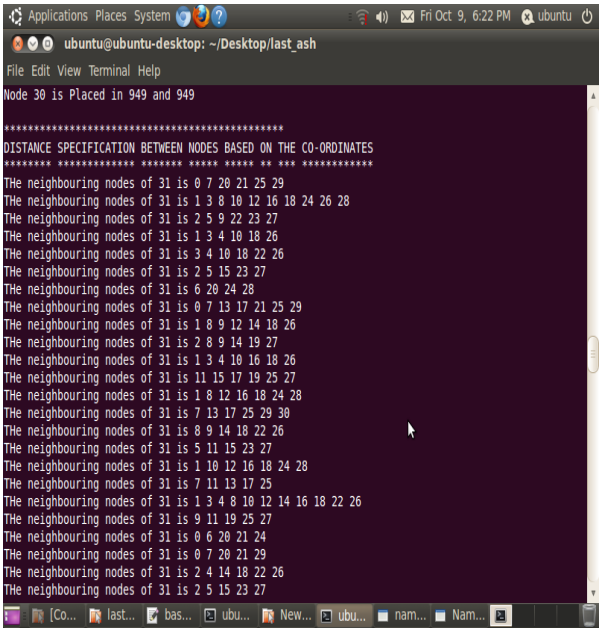

Figure 1.2 : Distance specification of nodes

The animation file is commonly known as nam file which defines the output in the form of animation so that everyone can understand what is happening exactly in the network.This is explained in the following figures given below.

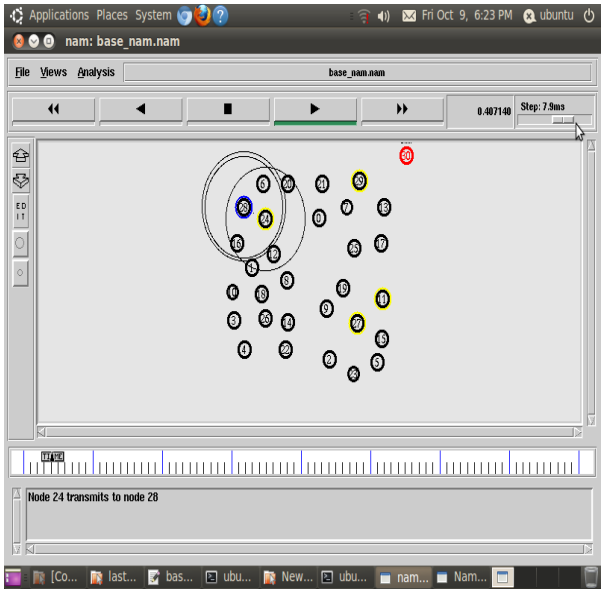

Figure 1.3 : Static and Mobile Sensor Sensing

The mobile nodes moves to the static node and collects the information from static node.The nearest mobile node respond to the static node where the event is detected.Likewise whenever event occurs at the static node the mobile node nearest to the static node collects the information. All the mobile nodes transmit the information to sink node which assumed to be base station.The figure 1.4 shows the mobile nodes transmit to the sink node.

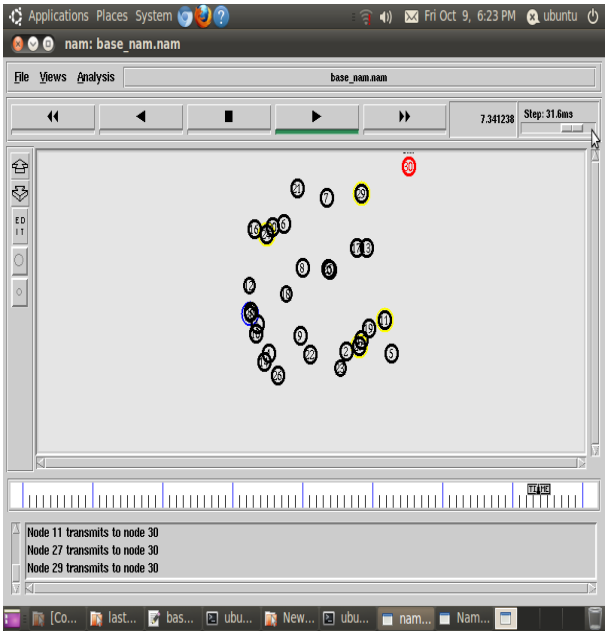

Figure 1.4 : Mobile node transmit to the sink node

Applications and Advantages

Wireless sensors are used it is more flexible, easy installation and maintenance can be done. Static and mobile nodes are used so the communication is faster. The main application is Protection for human beings because it reduces the damage of human properties. Reduction in human-elephant conflict. To redirect the elephants from living areas into forests.

IV. CONCLUSION

A concept which is applicable for early warning system to reduce human elephant conflict is simulated and the results are obtained and this gives good results. A wireless sensor technology is used so that the implementation is simple and less complex. The idea which is explained here helps the rural areas which are mostly damaged by elephants and this is automatic in nature so that it helps the forest areas to drive away the elephants into forests. The static and mobile sensors are used hence this helps in efficient transmission of information gathered. Therefore this can avoid the habitat loss of people living near the forest areas. In future this idea can be implemented in a hardware model which will be helpful for the rural areas. The system can be designed with less complexity and improved technology.

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