Monitoring & Tracking System for Elephants Using GPS/GSM with Smart Electric Fencing

*K.Rajalashmi1, V.S.Hemachandira2, S.Saravanan1, M Chandru1, R.S.Kaviyadevi1
1Department of Electrical and Electronics Engineering, Bannari Amman Institute of Technology, Sathyamangalam, Tamilnadu, India ,
2Department of Mathematics, Kongu Engineering College, Perundurai 638060 Erode.
3Department of Electrical and Electronics Engineering, Sona College of Technology, Salem, Tamilnadu, India.
rajalashmikannan@gmail.com

Abstract. Increased urbanization majorly causes human wildlife conflicts. Annually 30-40 elephants were killed during crop raids in India. Several million dollars were paid as the compensation for the people. Electric fencing is used to give an impulse shock to elephants but it is an open loop system it continuously gives the electric supply there will be the wastage of the electric supply. The presence of elephants can be tracked using GSM/GPS module and the required electric fencing can be turned on/off automatically by sensing the elephants. This system also used to automatically monitor elephant and also prevent its injuries during rail crossing. It also made necessary food arrangement by tracking the elephant activities. Electrocution of elephants will be greatly reduced and elephant life and human life can be greatly protected. This system protect the elephants and human and it will be very useful to maintain the ecological balance in the world.

Keywords: Security barrier, impulse shock, alert system, tracking

1. Introduction
Consistently, various elephants continue wounds and pass on in the wake of slamming into trains on railroad tracks. There have been different instances of wild Indian Elephants being murdered by illicit electric wall amid a previous couple of years. Human-Elephant strife in India is especially high, as elephants going between ensured saves through human-populated regions will attack horticulture fields, making a huge number of pounds of harm harvests and structures. To shield natural life from assaulting their harvests ranchers now and then retreat to set up wires unlawfully associated with high voltage power. In a previous couple of years, there have been various occasions of individuals in a round about way murdering elephants with these unsafe natural life hindrances.

The checking of wild creatures is proposed to Intelligent Fleet Management System with GPS and GSM [1-2]. The fence breaking and acknowledgment of fence climbing is communicated in [3]. The execution of electric fences as elephant boundaries in, Kenya [4-6]. The model is clarified for natural life and biological observation in [7]. Creature circumstance following administration utilizing RFID, GPS [8] early ready framework for forestalling natural life vehicle impacts in Alps districts communicated in the VSN technique [9]. Examination of postponement tolerant sensor systems for observing and following free-meandering creatures in [10]. Cell phone correspondence in powerful human-elephant peacemaking in Kenya [11]. Advances in natural life street crossing lord y-ready framework: New
engineering and exploratory approval [12]. Untamed life protection and rail track observing utilizing remote sensor networks[13-17]. The progression of remote sensor systems yields an assortment of remote sensor organizes for untamed life following. One common application for remote sensor systems is in creature following and observing in untamed life conditions. Countless have been done in following creatures with sensor systems [18].

A mechanized unsupervised elephant picture discovery framework (EIDS) as an answer for human-elephant strife with regards to elephant protection. The elephant's picture is caught in the backwoods fringe zones and is sent to a base station through a RF arrange. The got picture is deteriorated utilizing Haar wavelet to get staggered wavelet coefficients, it performs picture include extraction and closeness coordinate between the elephant question picture and the database picture utilizing picture vision calculations. A GSM message is sent to the woods authorities demonstrating that an elephant has been recognized in the woodland outskirt and is moving toward human living space [19]. Wildlife following and environmental observation are critical for scientific checking, untamed life restoration, malady control, and supportable biological advancement. However, innovations for them two are costly and not versatile. Likewise, it is imperative to tune the checking framework parameters for various species to adjust their conduct and increase the best aftereffect of observing. For the transient framework, everything utilized is off-the-rack and can be effectively acquired from the market.

1.1 Electric fencing

Electric fencing is used to prevent animals and intruders from trespassing into a particular area. An electric fence energizer changes over mains or battery control into high voltage beat. The energizer discharges these heartbeats on to a protected fence line about once consistently. The beat itself is just around 150 microseconds in length. This heartbeat is regularly known as the "stun" and is felt by any creature which contacts a zapped fence. This is an open circle framework that makes misuse of power.

1.1.1 Principle of electric fencing

Electric fencing is based on a simple principle in which energizer contains two terminals. A thin insulated wire is connected to a fence terminal and another terminal is connected to an earth ground wire. At the point when the creature reaches the fence, the circuit gets shut. When the circuit gets shut then the creature gets a stun. Here the present streams starting from the energizer the fence line and through the creature from putting weight going back and forth line. It converts battery supply power into short, high DC voltage pulses and sends pulses of energy out to the fence wires. Now it is an open-loop system when an animal makes a contact with that fence wires then it the circuit becomes closed-loop system then shock delivered.

The function of the electric function is to keep out animals and secure residents inside the perimeter. The purpose of electric fencing is to provide a shock to the animals to protect residences. The fence contains insulators, posts, wires, and gates. It uses non-insulated wire all points of contact between the electrified wires and any point of grounding is always insulated to prevent leakage or shorting out the fence. The required length of the insulator depends on the type of post used. Metallic posts require insulators that wider than the post. The current flows in the fence wires are properly maintained the unwanted current flows through the fence wire should the minimized. Conducting wires can be either single or multi-stranded and range in diameters.
The advantages of Electric Fencing is an Electric fence that is easier and more effective to install and it requires less labour and lighter materials than a conventional fence to set up thus lower costs. They provide an imposing physical and psychological first security barrier. They have universal application. The disadvantages of Electric Fencing are special fence designs are required in dry, frozen or snow-covered soil conditions. Electric fencing is not suitable for confined areas or where animals are crowded together.

2. Hardware Implementation

This Module has two parts:
1. Elephant GPS Collar Module
2. Electric Fence Module

2.1 Elephant GPS Collar Module

![Figure 1: Elephant GPS Collar Module](image1.png)

Figure 1 shows the Elephant GPS Collar module consisting of Arduino, GPS Module, GSM Module and LCD display. Arduino is used for controlling the whole process with a GPS Receiver and GSM module. GPS Receiver is used for detecting coordinates of the System, GSM module is used for sending the coordinates to the user by SMS. And an optional 16x2 LCD is also used for displaying status messages or coordinates.

2.2 Electric Fence Module

![Figure 2: Electric Fence Module](image2.png)

Figure 2 shows the electric fence module. In this Arduino is connected to fencing relay, GSM and LCD. When the hardware is ready after programming, it can be installed and powered up. Then a SMS is sent to the system that is placed on the target and the target can be easily tracked.
Figure 3 shows the process of the elephant collar module of the proposed system. Tracking center connected with GPS collar of the elephant and the fence value. The relay module gets the signal from the tracking center and it gives a signal to the alarm circuit and the energizer. The energizer energizes the electric fence. In this, the GPS information passed to the GSM module which is connected with the Arduino energizer circuit. This signal passed to the relay module which will turn ON/ OFF the electric fence.

3. Experimental setup

This module is entirely based on the GSM transmission of signals. Figure 4 shows the experimental setup of the proposed system. The tracking center acts as the brain for the entire system. In each elephant, a GPS/GSM module is placed in the collar of the elephants. From using this location of the elephants can be tracked. Another module also placed in the electric fence energizer to automatically on/off through GSM signals. The GSM module placed in an electric fence energizer also controls on/off of fence and also transmits the fence parameters to the tracking center. This GSM Module is driven by the Arduino UNO Board.
3.1 Tracking system

Using the GPS module the location of the elephant can be obtained by using radio signals received from the satellite. This signal is transmitted to the tracking center where all the locations received from each GPS Module are monitored in a single screen. When the elephants reach a particular location near to the human locations or agricultural lands the pulse will be transmitted from the This make the entire system to be closed-loop and leads to the automation in the Solar Electric fencing for elephants. This module with small modifications can also be used to track the elephants in the railway tracks and transmit the elephant location to the railway stations. Figure 5 shows the experimental view of the tracking system in hardware.

![Figure 5: Experimental View of Tracking System](image1)

When the Elephant out of the Zone (100m), the locations shared with the Tracking Centre(Ranger) shown in the figure 6. The supply for the electric fence is Off till the Elephant enters into the particular zone. The position of the object in the form of latitude and longitudinal data meaning that the object is out of the zone. Table 1 show the tracking of elephant.When the elephant is out of the zone(100m), the locations are shared with the tracking center (i.e Ranger). When the elephant is in the Zone(100m), the locations shared with the Tracking Centre(Ranger).The supply for the electric fence is ON till the elephant leaves the particular zone (100m).

![Figure 6: Experimental View of Tracking System - Elephant out of the Zone (100m)](image2)

| Distance | Information | Electrical Supply | Animal location |
|----------|-------------|--------------------|-----------------|
|          |             |                    |                 |
3.2 Advantages
GPS is very simple to explore as it educates us regarding the present position of the item and its heading of movement. GPS works in all atmosphere so it does not require the pressure of the climate as in other investigating devices. The GPS costs is incredibly low in relationship with other course structures. Because of its negligible exertion, it is amazingly easy to facilitate into various advances like remote. The framework is refreshed normally by the US government and henceforth is advance. Electric Power wastage can be reduced. Unexpected deaths caused due to Electric Fencing and Human lives can be reduced. Provides the continuous monitoring system for Electric Fencing System.

3.3 Disadvantages
1. GPS on a battery worked gadget, there might be a battery disappointment and you may require an outside power supply which isn’t constantly conceivable. Sometimes the GPS signals are not precise because of certain obstructions and because of some extraordinary air conditions, for example, geomagnetic storms. Data transmission may be interrupted due to using GSM Modem. Risk in a continuous reading of Electric Fence values.

4. CONCLUSION
The elephant tracking system is becoming increasingly progressively significant in animal reserves and it is more protected than other. It is the real-time, to improve the relations between human and the animals. The information and equipment together make real-time as accurate as possible. This system setup updating is very easy and it is exposed to a forthcoming prerequisite which also makes it more efficient.

Acknowledgment
This project was supported by the TNSCST

References
[1] Thong, S.T.S Han C. and Rahma TA 2007 Intelligent fleet management system with concurrent GPS & GSM real-time positioning technology 7th international conference on its telecommunications pp 1-6.
[2] Sabudin EN Muji SZM Abd Wahab MH Johari A and Ghani NB 2008 GSM-based notification speed detection for monitoring purposes International Symposium on Information Technology Vol 4 pp 1-7.
[3] Yousefi A Dibazar AA and Berger TW 2008 Intelligent fence intrusion detection system: detection of intentional fence breaching and recognition of fence climbing IEEE Conference on Technologies for Homeland Security pp 620-621.
[4] Wijesinghe L Siriwardena P Dahanayake S Kasthiratne D Corea R and Dias D 2011 Electric fence intrusion alert system IEEE Global Humanitarian Technology Conference pp 46-50.
[5] Kioko J Muruthi P Omondi P and Chiyo PI 2008 The performance of electric fences as elephant barriers in Amboseli, Kenya African Journal of Wildlife Research 38(1) pp52-58.
[6] Perera BMAO 2009 The human-elephant conflict: A review of current status and mitigation methods Gajah 30 pp41-52.
[7] Huang JH, Chen YY Huang YT Lin PY Chen YC Lin YF Yen SC Huang P and Chen LJ 2010. Rapid prototyping for wildlife and ecological monitoring. IEEE Systems Journal 4(2) pp198-209.
[8] Kim SH, Kim DH, and Park HD. 2010. Animal situation tracking service using RFID, GPS, and sensors. Second International Conference on Computer and Network Technology pp 153-156.

[9] Viani F, Rocca P, Lizzi L, Rocca M, Benedetti G, and Massa A. 2011. WSN-based early alert system for preventing wildlife-vehicle collisions in Alps regions. IEEE-APS Topical Conference on Antennas and Propagation in Wireless Communications pp. 106-109.

[10] Ehsan S, Bradford K, Brugger M, Hamdaoui B, Kovchegov Y, Johnson D, and Louhaichi M. 2012. Design and analysis of delay-tolerant sensor networks for monitoring and tracking free-roaming animals. IEEE Transactions on Wireless Communications 11(3) pp1220-1227.

[11] Graham MD, Adams WM, and Kahiro GN. 2012. Mobile phone communication in effective human elephant-conflict management in Laikipia County Kenya. Oryx 46(1) pp137-144.

[12] Viani F, Robol F, Giarola E, Benedetti G, De Vigili S, and Massa A. 2014. Advances in wildlife road-crossing early-alert system: New architecture and experimental validation. The 8th European Conference on Antennas and Propagation pp. 3457-3461.

[13] Mathur P, Nielsen RH, Prasad NR, and Prasad R. 2014. Wildlife conservation and rail track monitoring using wireless sensor networks. In 2014 4th International conference on wireless communications, vehicular technology, information theory and aerospace & electronic systems pp. 1-4.

[14] Nakandala MS, Namasivayam SS, Chandima DP, and Udawatta L. 2014. Detecting wild elephants via WSN for early warning system. International Conference on Information and Automation for Sustainability pp. 1-6.

[15] Sugumar SJ, and Jayaparvathy R. 2014. An improved real time image detection system for elephant intrusion along the forest border areas. The Scientific World Journal.

[16] Wall J, Wittemyer G, Klinkenberg B, and Douglas-Hamilton I. 2014. Novel opportunities for wildlife conservation and research with real-time monitoring. Ecological Applications 24(4) pp593-601.

[17] Rahayani RD, Gunawan A, and Ariwibowo AU. 2014. Implementation of radio frequency as elephant presence detector for the human elephant conflict prevention. Innov. Syst. Des. Eng. 5(5).

[18] Tennakoon E, Madusanka C, De Zoysa K, Kepkityagama C, Iyer V, Hewage K, and Voigt T. 2015. Sensor-based breakage detection for electric fences. IEEE Sensors Applications Symposium pp. 1-4.

[19] Liu X, Yang T, and Yan B. 2015. Research on the architecture of wildlife observation and communication system. In 2015 International Conference on Cyber-Enabled Distributed Computing and Knowledge Discovery pp 415-418.