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Smart electric fence the WALL-E

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ABSTRACT

People living in rural areas of Sri Lanka are facing difficulties as wild elephants who in forest reserves entering villages. These wild elephants attack people and destroy the properties of villagers. The dump yards, garbage management areas and cultivated lands are attracting elephants for food. Elephants enter into the village from the nearby forest in search for food. The government has created the electric fence to prevent elephants from entering the village. Elephants break the electric fence and enter the village making these efforts useless. Elephant attacks have increased over the years killing humans as well as elephants. This system can predict and take precautionary action in order to minimize elephant attacks. Our systems are composed of automotive electric fence using light sensor and Thermal sensor. The light sensor will activate the fence when the sun goes down and the thermal sensor will detect the elephant and activate the fence during the daytime. When the elephant breaks the fence and enter, laser sensor will activate the siren. By geo point location system (GPS) technology, control room officer can view the exact place where the fence was breached. Data mining was used to predict wildlife officers about the areas where attacks are happening mostly. This system is beneficial for officers as well as villagers to prevent elephant attacks and save human and animal lives.

Keywords: *Arduino, Android, GPS, Tracking, Data mining, Algorithms, Data Analysis, Database, Google maps, API, Sensor, Emergency Inform, Laser, Electric fence*

1. INTRODUCTION

This is the project that can be used to minimize the problems faced by the village people and the wildlife department officers from elephant's attacks. In this project, the normal electric fence converts into a smart electric fence (Wall-e).

The normal electric fence only defends the elephants and protects the area. But Walle is Smarter.it doing a great work than the normal electric fence. If the Normal electric fence has broken (by elephant attack) the elephants will enter the village or dump yard. Mostly elephants are entering at night time. At this situation, villager unable to know that the village is under risk and elephants is entering to village or dump yard. At a situation like this wildlife officers also unable to know that the which place the electric fence has breakdown and elephants are entered to village or not. Regarding this problem in this research project, Advanced Autonomous Alerting will be activated (AAA). For AAA Research team created a microcircuit that will inform the wildlife officer (by Android Application) and Research team used wide area listening Cyrene to inform villagers that village is under risk of elephants. Most elephants are hated to hear the Cyrene; an extra advantage there is 80% possibility that the elephants will run away from the wall-e.

Research team intent to create a circuit to identify the elephants by their Body temperature. In a normal situation when the elephants move near to the Wall-e The Highly Advanced Thermal sensor will activated, detect the elephant and send an activated message to Wall-e Android Application. By This android application wildlife officer can easily view the detail about the electric fence map get to know which areas are the fence is activated and which places elephant's moves mostly. Another main problem the wildlife department officers facing is Activating and deactivating the electric fence manually day by day. If the control room officer is unable to activate the fence all the night village or dump area is under risk. To solve this problem Research team created an advanced light sensitive autonomous system to activate and deactivate the Wall-e. Research team intent to use an advanced light sensitive light sensor to detect the sunlight and activate the Wall- e during the night time. When the sun rises sensor will detect the light and Wall-e will deactivate. According to the collected

data Research team identified and analyzed the areas where the most dangerous, most attacks happening, elephant crossing, most vested villages by Data Mining Technology. Research team created another Android Application named Wall-e plus to locate our position and find the distance within the elephant pass and our position. Users can view the elephant passes by the goggle Application Program Interface (API). Users can easily view where places or streets are under risk near user's location and be alert. When the Wall-e is activated active messages will go to this Android Application Program Interface also. User can view the details easily.

2. LITERATURE REVIEW

Development of Electric Fence Management System Using Wireless Network Technology– Traditional electric fence has been helpful as a guard of crops [1]. However, its system has some problems. This device can be used only as a defense from animals and it cannot notify the voltage which occasionally drops this paper describes a demonstrative experiment in a mountainous region and suggest an approval to resolve some problems. Temperature- Sensitive Device to Detect Breathing of animals and birds - in this paper a simplified online monitoring system is presented to transduce the breathing air temperature, which is warmer when exhaling and cooler when inhaling to corresponding sound [2].

Data Collection and analysis protocol for human-elephant conflict situation in Africa - in this paper base of protocol to giving the idea of how to prevent elephant conflict and other details [3]. If used to gathered excel sheet and data mining to use this system Acoustic Detection of Elephant Presence in noisy Environments - this paper explains for automated detection of elephant presence and evaluation a large dataset of wildlife recordings [4]. The experiments show that the proposed detector outperforms existing methods and the signal enhancement strongly improves the robustness to noise sources from the environment.

Sensor-based Breakage Detection for Electric Fences this paper explain for there are rich farmlands near the elephant habitats and elephants raid these farms in sear of food [5]. This has been the main cause for nearly 70 human deaths and over 200 elephant deaths that have been recorded each year in the recent past. This article establishes for detection device in wireless senses.

A Multistatic Rader Array for Detecting Wild Animals during Pasture Mowing - this paper explains group members has a tendency to gift a police work method that is predicated on microwave signals [6]. This incoherent radar system uses antennas organized as a matrix and a sign superposition principle. It detects the reflection signature of covered targets of an explicit form the low computing power required permits a large space to be scanned for a brief time.

Modeling Pulse Reflections due to Multiple Discontinuities on Electric Fence Structures -this paper explains for mathematical model through which the propagation characteristics of high voltage
(HV) transient pulse of a multiwire electrical boundary line that has discontinuities attributable to masses, faults, and branches, can be accurately expected [7]. The boundary conditions for each section area unit derived from relations

to the opposite sections and initial conditions to comprehend an answer to the frequency domain.

An Efficient Animal Detection System for Smart Cars Using Cascaded Classifiers – this paper explains for Animal-Vehicle Collisions (AVCs) is a difficult problem of the creation of cars [8]. Consequently, such collisions cause many human and animal deaths, thousands of injuries, and billions of bucks in property injury once a year.

Elephants and Electric Fences: A Study from Sri Lanka - these papers gives to how to prevent the elephant conflict [9]. This is very true of the densely inhabited geographical area. A new study from the country appearance of one strategy to deal with this downside. The same problem occurs in our country this paper gives one by one to how to get the idea to prevent elephant

Human-Elephant Conflict and Solutions to it in Sri Lanka - this paper explains the foremost instigators of human-wildlife conflict [10]. Human-elephant conflicts occur once elephants raid crops of shifting cultivators in fields, that square measure scattered over an outsized space interspersed with forests. Depredation in human settlements is another major space of human-elephant conflict occurring in little forest pockets, encroachments into elephant surround, and on elephant migration routes. Between 1999 to the tip of 2006 once a year nearly a hundred wild elephants were killed. Elephants square measure being killed by farmers to safeguard their crops and homes.

Survey Paper on Elephant Tracking Using Acoustic Sensor [11]- Acoustic wave sensors are a class of microelectromechanical systems. It modulates surface acoustic waves to sense a physical movement. The acoustic sensor used to detect/record the sound of elephant vocalization. However, the large variety of noise sources present in the wild impedes automated analysis methods. As a result, no system exists so far that is ready to operate in the field. So far research on the acoustic investigation of elephant calls has a deal with highly selective tasks such as the identification of elephants by their calls and the analysis of particular call types e.g. rumble types.

An Automated System for Remote Elephant Tracking to Reduce Human-Elephant Conflict [12] - Automated System for Remote Elephant Tracking (ASRET) has been proposed which will be a type of wireless sensor network (WSN). Such system will work based on sensing the elephant activities nearby human habitat through seismic wave detection and will generate some alert for consequent actions. Present work has been devoted to developing an effective architectural and algorithm for such ASRET system. Along with the algorithm, the technical specifications and functionality of the different units of the proposed system have been discussed elaborately. The core algorithm of ASRET system has been designed and simulated with MATLAB Simulink and simulation outcomes have been analyzed. In other words, using the designed software model, proposed ASRET system algorithm has been verified with simulation experiment.

Surveillance and Tracking of Elephants Using Vocal Spectral Information [13] - Many methods are followed to avoid HEC: Construction of elephant proof trenches, solar electric fencing, beehives to mitigate elephant crop

depredation. Satellite technology with elephants tagged with radio collars. In the design and implementation of an electronic sensor and analysis system for the detection of the said Infrasound elephant calls. In designed an infrasound recording system (hardware and software consist of a speaker (infrasound sensor) as an analog input, an amplifier, an anti-aliasing filter, an analog to digital (A/D) converter and finally a PC application which is used to analyze the recorded signal. In the possibility of using the elephant communication (elephant rumbles) to detect the presence of a herd of elephants in close proximity, in this work, the authors have recorded the low-frequency infrasound pattern but they do not compare with that of other animals to confirm an elephant occurrence. In the above methods, audio features of elephants were used for detection.
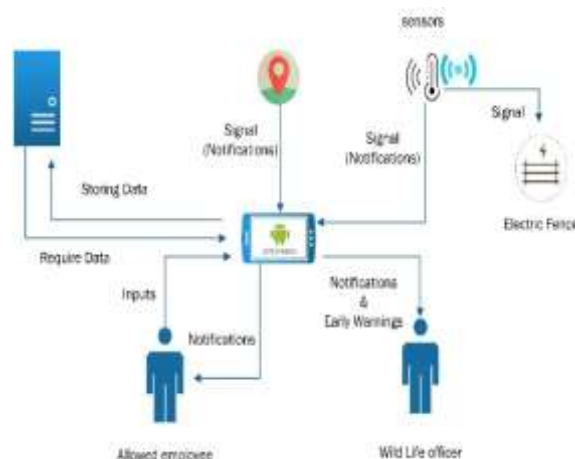
3. METHODOLOGY

The proposed Smart Electric Fence (Wall-e) is using the prototype methodology of Software Development Life Cycle (SDLC). The software prototyping is referring to building software application prototypes which display the functionality of the product under development but may not actually hold the exact logic of the original software.

A. Planning

In the planning stage of the Smart Electric Fence system, research team faced some problems The main problem is what kind of system needs to build and which functionalities need to implement to reduce human-elephant conflicts. Then after creating design plan research team faced another problem, which is technical and hardware problems. Because Wall-e contains two real-time hardware components. After managed problems started the project according to Gantt chart and Work Breakdown Structure (WBS).

B. Requirement gathering & analysis

Information and data required to the new system have been gathered through techniques such as research papers, interviews with wildlife officer and the allowed user's questionnaires, all the research related document were gathered and has been evaluating thoroughly. In order to identify the real requirements for the new system, the current user insolvent is essential. After getting all the prospective data, analyzing was performed. Good analyzation to had good design phase for the system and also it has helped to identify the exceptions of the user as well.

C. Design

According to the Architecture Diagram Initial step of this project was to develop a Smart Electric Fence. The system used the global positioning system (GPS) technology to identify the place of the incident. And also the system got the signals from the GPS tracker. After the analyzing signals, the system gave early warnings and notifications to Wild Life officer. When the incident pre-specified geolocation it sent a short message (SM) to Wild Life Officer.

Next step was Laser sensor was detecting the elephant exactly cross the fence, and then send geolocation short message to Wild Life Officer.
Using data mining, it gave the warnings to the users, whether users going near that locations.

D. Implementation

The research team used two deferent platforms to develop Wall-e because Wall-e has both hardware and software components. All the software components of the system were based on Android platform. All the hardware components based on Arduino platform. After completing the implementation of the android application, database, and the devices, Electric Fence wants to be positioned in the perfect manner with the electric power. Wall e must be an Android application need to be installing relevant devices like smartphone, tablets.

E. Testing

Integration of the modules and testing are done in this phase. Testing has been divided into two main parts as functional testing and non – functional testing. Functional testing used integration and system testing. While non–functional testing used performance testing and security testing. Unit testing examined and fixed the individual software modules or components that made the application or the system. Google map application, emergency information and the early warning alert system had tested under the unit testing. Each module function was tested by a specific unit test features written in the same programming language as the module. The system testing part of a testing methodology involves examining the entire system for errors and bugs. This test is carried out by checking the hardware and software components of the entire system (that have been previously unit tested and integration tested) and then testing it as a whole. Load testing was also used. It verified that the system can operate at the required response time when subjected to its expected load, and stress testing found out the failure point(s) in the system. Security was tested after the implementation. Rise in cyber-crime and the awareness of the risks associated with software vulnerabilities, application security is now something that needs to be designed and developed at the same time as the desired business functionality. Security testing has inspected the software for confidentiality, integrity, authentication, availability, and non-repudiation. Individual tests have been conducted to prevent any unauthorized access to the software code.

F. Results & Discussion
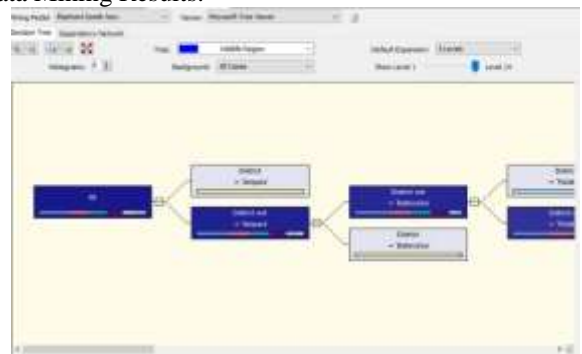
i. Alert Notification System
When the elephant come near to the wall-e it will detect the elephant and system will show the notification on the phone main screen.
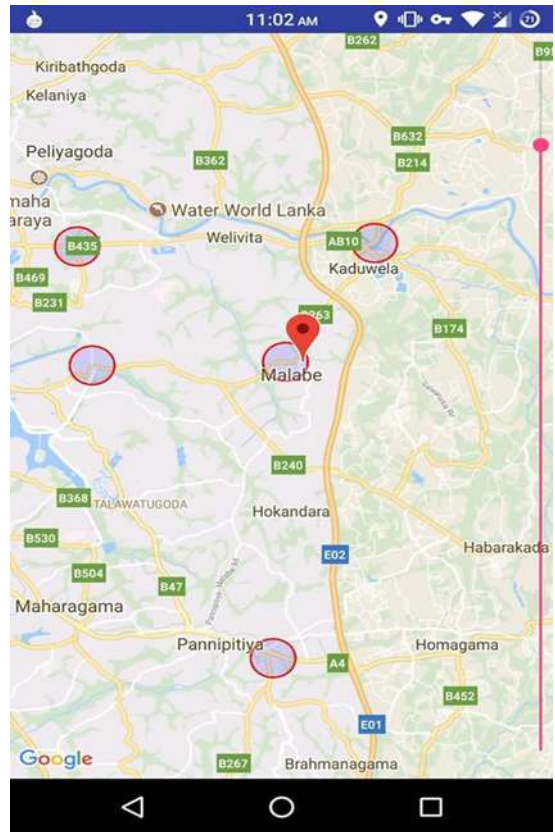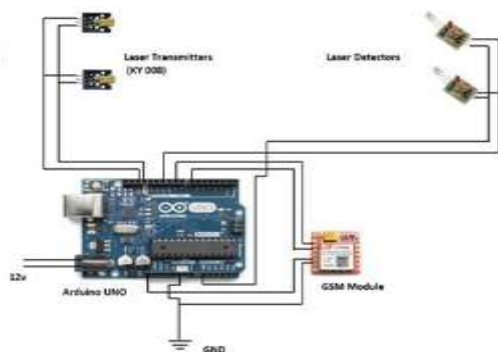
ii. Advanced Alert Notification System.

When the elephant crossed over the wall e it will detect the elephant and system will show the notification on the phone main screen.

GSM module used to send and receive text messages from Arduino. According to the sending text message state, the notification will pop up.

iii. Alert Notification System.

When the user enters into an elephant threatened area, the system notified that user is not in a safe area .when the user return to the safe area he is again notified at the user is safe.

iv. Data Mining Results.

The research team collected last 18 years (since 19922010) accident details from the Sri Lanka Wildlife Department. These data were used for the data mining. There were more than 1000 records in main Elephant Death table and Human Death table and Crop Damages tables contained more than 400 data records. Research team mine data with all the records in Elephant Death table a Human Death table. But did not get better results with that data. Then research team had to fine tune the database. In that case, more than 700 data records were removed from the table. Because that data was not given proper result. The research team used only one table for the data analysis. These data are relevant to other components of the research. Research team got better results from those data tables.

4. CONCLUSION

"Wall-e" The smart electric fence that works as a protector of the village and works as an information sender to village people and wild officer. Wall-e is a smart electric and it protects the village and dumps yard peoples by its siren sound. When elephant enters the village it will inform the peoples by the siren. Wall-e can send location information to the wildlife officer and allowed user android mobile. Then they can view the fence location where the elephants attack and enter the village. The possible functionality that

research team developed in this project is to minimize the conflicts between village peoples and elephants. The research team especially focused on the problems faced by the wildlife officers to find the location of the fence where the elephants attacked, peoples to be pre-alert where location that the elephants enters to the village and automate the electric fence to activate at night time.

A. Important Of Outcome
By considering the questionnaire, most of the wildlife officer and the allowed users said that the proposed system is good. And also, few of them were said that the current system is better than Wall's Electric Fence. The reasons are someone don't know use android tablet, and they don't have devices, and someone had a problem about the accuracy these problems can be solved by giving a training and increasing our project accuracy. As the majority of the individuals in the sample population said that they use the Wall's Smart Electric Fence system is a help to reduce the Elephant Attack and the system implementation is better than the current system. And the majority (approximately 70%) of the sample population suggested that the whole system better than the current one. Finally, it is concluded that approximately 80% of the sample solution would like to establishment of the Wall's Smart Electric Fence.

B. Limitations
During the development of the project, the following are the limitations and constraints that the team figured out.

- Sensors might not be working in heavy rain.
- The research team identified some constraints that system will not be working properly.
- The sensor must be working properly a sensor reading must be accurate.
- GSM/HSPA, Wi-Fi signal errors.
- Low battery power.
- The accuracy of data mining results will directly affect the outputs of the emergency alert system.
- Mobile phone must be in the good GSM signal coverage rich area.
- Mobile phone Android os version should be a newer version and should work on all android functionalities.

C. Recommendations
The team recommends the android phone which runs the wall-e application need to have a certain speed and internet connection should be existing constantly to load the location details of the fence while using the application. The phone should be fast enough to run the android application.

D. Future Works
As the research was limited to the specific time period the research group was able to focus only on a limited number of components. "Wall-e" The smart electric fence can be developed to provide the following in the future.

- The research team selected most conflicts happened places for testing the system. After being
- 100% working Wall-e can expand all over the country.
- Can be modified this app to access all the village people.
- Improve the security of the wall-e application and protect the confidential data.
- Modify the app as a more user-friendly.

- Wildlife department officers agreed to upgrade wall-e to next level with more new features and more accuracy with their sponsor.

5. Acknowledgment

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