| ISSN: 2582-7219 | www.ijmrset.com |

| Volume 1, Issue 2, May 2020 |

Detection of an Elephant Intrusion

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ABSTRACT: One of the most instigators of human-wildlife conflict generally is competition for space. this is often very true for wild elephants, which require relatively large territories to live in. Human–elephant conflicts occur when elephants raid crops in the fields, which are scattered over an outsized area interspersed with forests. Here we describe different approaches to identify elephants and possible ways of monitoring the national wildlife parks and the surrounding farm land. We used a seismic sensor to detect the vibration made from the elephant foot and when it matches the loaded data in the pic controller it will activate the buzzer and the data is transmitted to the forest officer through RSSI transmitter. There it is received by the RSSI receiver and it is displayed in the LCD.

KEYWORDS: RSSI transmitter, RSSI receiver, vibration sensor, pic controller, embedded c

I. INTRODUCTION

In the three years 2015-2018, human-elephant conflict caused 1,713 human and 373 elephant deaths by unnatural causes and killed by humans. Experts say various factors, including habitat disturbance and urbanization, might be the explanation for the alarming rise in unnatural human and animal casualties when elephants raid crops in the fields, which are scattered over an outsized area interspersed with forests. Data showed that the highest numbers of human casualties had occurred in West Bengal (307 deaths), followed closely by Odisha (305). In 2018 alone, 227 people were killed by wild elephants in 16 States, with Assam reporting the very best number (86) and .8 to 1 million hectares are damaged, affecting a minimum of 5,00,000 families across the country.

To manage the matter, the government has initiated projects that protect the national wildlife parks with electric fences. However, maintaining the electrical fence is additionally, because of its large perimeter and thus the shortage of obtainable manpower. A selected concern is that of locating faults in electric fences since these typically span varieties of hundred miles.

Elephant researchers have discovered that there is more to a mock charge than meets the or the ear, for that. It seems that foot stomping and low-frequency rumbling also generate seismic waves within the ground which travel nearly 20 miles along the surface of the world, according to a replacement study with in the Journal of the Acoustical Society of America (JASA). More astonishing is that the discovery that elephants could also be ready to sense these vibrations through their feet and interpret them as warning signals of a foreign danger. By using this vibration, we can easily detect the presence of elephant by using the suitable device and restrict the movement of elephant towards farm land.

II. LITERATURE REVIEW

Elephant intrusion systems were developed to detect the elephants trying to intrude on the human habitat within the forest borders. A surveillance system was developed that has seismic sensors to detect the signals from the elephant by its movement. The intrusion detection system detects the movement of the elephants using the vibration sensor. The vibration sensor senses the elephant's vibration and feeds into the raspberry pi. When the vibration matches the particular value range, the camera catches the elephant's image. Then image processing is done. The recorded image is compared with the pictures of the elephants that are stored already. This is done with the help of Google Image processing API. Once the image matches with the stored images, the alert message is sent to the forest department with the help of Google messaging API. This was explained by N. Suganthi.[1]

A concept by Roman Beresik in seismic sensor system for human activities and vehicle movement detection The target detection is based on seismic signals which are approached via given assumptions on basic characteristics of human footfall seismic feature in time and frequency domain. The vibrations, caused by persons, vehicles movement or other activities in a particular area, are propagated within the ground as elastic waves that are measured by seismic sensors. It

| ISSN: 2582-7219 | www.ijmrset.com |

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implies that seismic sensor system properties have to be adequate to capture and process the seismic signal as a result of human (vehicle) activity. The signal processing of knowledge from seismic sensor system may be a complex problem thanks to the character of seismic signals, decreasing of the signal-to-noise ratio (SNR) of the seismic signal with the increasing of distance and also the necessity to discriminate human footsteps from other targets, seismic background noise, and interference.[2]

Then in another paper, it depicted that the breakage detection system for fences should be low cost and to use the existing infrastructure as much as possible. Rather than using radios or GSM communication devices, a solution that uses the fence wire itself for communication purposes is desirable. A system is used to locate breakages in electric fences used for containing elephants within wildlife parks. The fence controller component controls the task of switching between the fence pulse generator and the communication pulse generator components. This allows the use of the existing pulse generators used in the wildlife parks as the fence pulse generator without any modifications. It deploys several specially designed nodes along the fence to detect breakages. This solution does not require a separate communication infrastructure to control the nodes used for breakage detection. The control signals are sent to the nodes using the fence wires. The first is to recognize whether the fence is broken and the second is to identify the location of the breakage by Eranda Tennakoon.[3]

A. Karthikeyan proposed the way to provides early warning to the peoples and therefore the other is to transmit the knowledge to the forest officials to chase the pachyderms far away from main areas to the forest. He used LEDs and camera which act as a virtual fence to detect the intrusion of elephants. Ultrasound imaging is used to track the elephants precisely but the limitation in the ultrasound waves not capable of reflecting the waves so it needs exact rotating techniques. Seismic communication uses ground vibration or pressure to detect when there's an elephant movement and uses proximity techniques to locate them. Radio Frequency (RF) techniques are considered as an alternate for the elephant alert. RF module is employed to transmit the knowledge to the wildlife authorities for prevention measures. Normally the elephant uses vocalization to speak over long and short distances. This implementation of frequency by elephant detected by the detector and gives a warning sign and to prevent the human-elephant conflict. Wireless technology using radio frequency (KYL 200 L) is preferred by him.[4]

Gayathri. R proposed the Automatic Repelling System to Reduce Human Elephants Conflicts Using Sensors. It consists of a piezoelectric vibrating sensor placed at a far distance from the conserved area. When an obstruction enters the working range of the piezoelectric vibrating sensor, the sensor senses the vibration made by the obstacle or barrier and identifies whether the obstacle is an elephant or not. When the sensor confirms the presence of the elephant by matching the voltage created within the sensor and therefore the given threshold value within the Arduino micro-controller which is employed as the interface for the sensors, warning/repelling systems, and everyone other components. When the elephant's presence is confirmed, the approximate distance of the elephant from the preserved area is going to be displayed within the LCD and therefore the relay for the warning system will be switched ON. The warning system is used to make the people around that area to be alert and warn them to be safe from the elephants.[5]

I. Dua proposed a system seeks to identify elephants with the aid of a Video Camera. The suggested methodology was applied to zones having a high intervention of citizens and elephants. Regions with high human movements like roads were extracted for the initial video frames. This process is followed by detecting motion within the video frame. The objects within the frame of motion are identified as elephant or non- elephant with the help of PHOG features and support vector machines classifiers. A data set constituting images of elephants and other objects were used for training the proposed algorithm. Overall accuracy was attained when static images containing elephants and other objects were classified. The same approach for detection was applied to spot moving elephants within the video frames. Successive frame differentiating enables the detection of moving objects. The moving objects are then classified using a PHOG and SVM classifier as elephants or other objects. Particle filtering techniques are then applied to track the location of the moving elephant. The total number of particles that overlap with the region with high human interference. The elephant is said to be in a danger area if a large number of particles overlapping are greater than a threshold.[6]

Rong-Hou Wu discussed the strength of Received Signal Strength Index(RSSI) signals thanks to changes within the environment, and therefore the effects of your time domain and frequency domain on RSSI signals. RSSI signal strength in connection is categorized as when it is (>40) as good and (35- 40) as Acceptable and (< 35) as Poor when the data rate is within 2 Mbps. From this experiment, we learn that the sampling time doesn't have any relationship to the signal. Moreover, when RSSI signals are placed in the time domain and frequency domain, there is no sign of periodic phenomenon. RSSI signals from a spread of perspectives, and it's found that multipath fading and therefore the change in the environment plays the best role in affecting RSSI signals. Even though the experiments are conducted under attempts to take care of a gentle and unchanging environment, it's still unsuccessful to find out the regularity of RSSI signals and repeatability. From this experiment, the following can be concluded: There is no relationship between the changing of RSSI signals and sampling time. When collecting data during a wide-open area (field, rooftops), changes in RSSI signals are still evident but can decrease drastically under the effects of objects in its path. In the time domain and frequency domain, RSSI signals don't have a periodic phenomenon. RSSI signals' variance and its strength aren't directly associated with one another, but they've individually trusted the environment complexity.

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III. EXISTING SYSTEM

There were several methods proposed previously that deals with elephant intrusions. A system is proposed by the use of electric fences that need to be installed around the forest border area. The electric fence is used to carry a high amount of current in it. A spare system that uses geophones to detect the vibrations of the elephant, these signals are converted into electrical signals by using a micro-controller. An alert message is then sent to the forest officials by the GSM module. A real-time image detection system was proposed that detects the elephants using a seismic sensor and therefore the image was captured. The captured image was then compared with the stored images in the database by means of k-means clustering. The drawbacks of existing systems are less scalability, upgrade cost will be high, the existing system is not centralized, requires more human resources and implementation cost was high.

IV. PROPOSED SYSTEM

Based on the literature review we made, the existing system has some disadvantages which prove to be vital enough to be removed. Our Intrusion detection system detects the movement of the elephants using the vibration sensor or seismic sensor. The vibration sensor senses the elephant's vibration and feeds it to the pic microcontroller. When the vibration matches the actual value range, then it transmitted using an RSSI transmitter based on the received signal strength by using a UART device. Meanwhile when the data matches it turns on the buzzer to warn the elephant or to give an alarm sound to the elephant. The transmitted data or signal is received by the RSSI receiver by means of UART and fed into the PC or LCD intimating that the elephant was spotted.

V. BLOCK DIAGRAM

It consist of Pic microcontroller, UART, buzzer, RSSI trans receiver, seismic sensor, LCD.

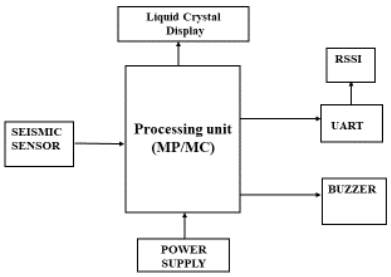

Figure. 1 Basic block diagram of elephant intrusion detection

Block Diagram description

Vibration Detection Module:

This module will have to be initialized only at the start. It will run in an endless loop. The module will check the value from the connected vibration module and compares it with the threshold value we set. If the value crosses the threshold, it will initialize the image processing module as a separate thread and it will keep on doing its work of checking the vibration. Once the vibration detected it sends the corresponding signal to the controller.

Detection Processing Module:

After being initialized by the vibration module, it will instantiate the pic controller. Then it will compare the signal with the stored signal. If the signal get matches with each other then it activates the command to the alarm signal. Meanwhile the data is transmitted using RSSI transmitter.

| ISSN: 2582-7219 | www.ijmrset.com |

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Alert System Module:

After signal get matched it will turn on the alarm device which is buzzer. Meanwhile the RSSI device will indicate strength of the received signal whether the animal is nearer to the zone or within the zone to the forest officer in the LCD device.

Hardware Module

A. Pic microcontroller:

A computer-on-a-chip may be a variation of a microprocessor which mixes the processor core (CPU), some memory, and I/O (input/output) lines, all on one chip. The computer-on-a-chip is named the microcomputer whose proper meaning may be a computer employing a (number of) microprocessor(s) as its CPUs, while the concept of the microcomputer is understood to be a microcontroller. A microcontroller are often viewed as a group of digital logic circuits integrated on one chip . This chip is used for only specific applications.

Most microcontrollers don't require a considerable amount of your time to find out the way to efficiently program them, although many of them, which have quirks, which you'll need to understand before you, plan to develop your first application.

Along with microcontrollers getting faster, smaller and more power efficient they're also getting more and more features.

In this project we used PIC 16f877A microcontroller.

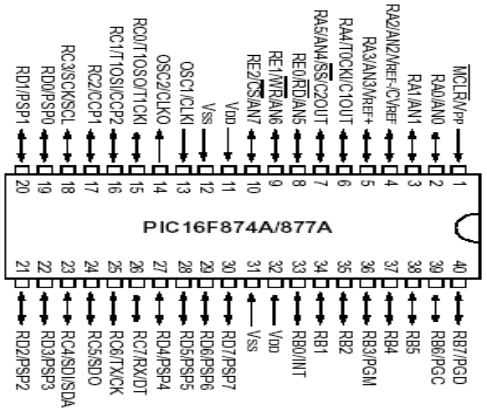

Figure. 2 Pin diagram of PIC 16F874A

a. RSSI

signal strength can vary greatly and affect functionality in wireless networking, it often makes the measurement available to users. RSSI is often done in the intermediate frequency (IF) stage before the IF amplifier. In zero-IF systems, it is done in the baseband signal chain, before the baseband amplifier. RSSI output is often a DC analog level. It can also be sampled by an internal ADC and the resulting codes available directly or through a peripheral or internal processor bus. RSSI can be used internally in a wireless networking card to determine when the amount of radio energy in the channel is below a certain threshold at which point the network card is clear to send (CTS). Once the card is clear to send, a packet of information can be sent.

Figure. 3 zigbee 204ghz ti cc2530

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b. Vibration sensor

The vibration sensor detects shock intensity caused by sudden knocks or hits and continuous vibration due to faulty ball-bearings on fans and other equipment. Vibration sensors are easily installed and fixed to a variety of materials using screws in the housing or with the self-adhesive material supplied. Can be used in variety of vibration detection methods. The two contacts of sensor are not connected in idle condition. When external force is acted upon either my movement or vibration, the sensor's two contact pin are closed and contact is made between the two pins. When the force is removed the sensor terminals returns back to open contacts.

Figure. 4 vibration sensor

c. Buzzer

Piezo buzzers are used in similar applications as magnetic buzzers. Piezo buzzers are constructed by placing electrical contacts on the two faces of a disk of piezoelectric material and then supporting the disk at the edges in an enclosure. When a voltage is applied across the two electrodes, the piezoelectric material mechanically deforms due to the applied voltage. This movement of the piezo disk within the buzzer creates sound in a similar manner as the movement of the ferromagnetic disk in a magnetic buzzer or the speaker cone. The frequency of the sound produced by piezo buzzers can be controlled over a wide range by the frequency of the signal driving the buzzer. A piezo buzzer exhibits a reasonably linear relationship between the input drive signal strength and the output audio power

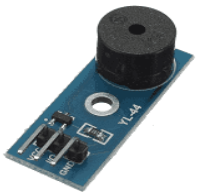

Figure. 5 Piezoelectric buzzer

d. Liquid cooled display(LCD):

It is a 16 character, 2-line alphanumeric LCD display connected to a single 9-way D-type connector. This allows the device to be connected to most E-Block I/O ports. The LCD display requires data in a serial format, which is detailed in the user guide below. The display also requires a 5V power supply. Please take care not to exceed 5V, as this will cause damage to the device. The 5V is best generated from the E-blocks Multi programmer or a 5V fixed regulated power supply.The 16 x 2 intelligent alphanumeric dot matrix displays is capable of displaying 224 different characters and symbols. A full list of the characters and symbols is printed on pages 7/8 (note these symbols can vary between brand of LCD used). This booklet provides all the technical specifications for connecting the unit, which requires a single power supply (+5V).

Figure. 6 LCD

| ISSN: 2582-7219 | www.ijmrset.com |

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VI. CONCLUSION

In this paper, we have given the details of the implementation of the Elephant intrusion detection system, the elephant is detected with the help of a seismic sensor and is confirmed by the matched data. If the elephant's presence is confirmed, an alert message is sent that the elephant is spotted. As a result of the alert, the required actions are taken. In the future, this can be implemented in security purpose areas such as Bank, Museum, Border areas by enhancing this with upcoming technologies.

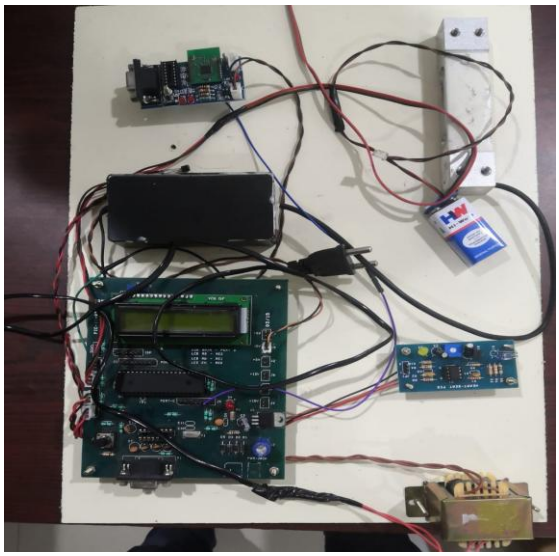

Figure. 6 Detection of elephant intrusion system

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