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Research paper

Elephant warning system using IOT

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Abstract

India is a nation of Mega-Diversity.There are large number of plants and wild animals.One of the most common problem India which is facing today is the wildlife conflicts.There are several areas and farms which are more in risk to wildlife attacks. Elephant crop raiding is very common in most of these places. An average of 250 human death by elephants are reported from India. In this paper we have tried to give a digital solution with the help of the popular Internet of Things which can give an awareness or warning to the local people about the movement of elephants in forest areas by detecting the infrasound communication of elephants. The warning will be given by an android based application.

Keywords: *Infrasound Communication; Elephant Conflicts; Mobile Alerts; App Development; IOT.*

1. Introduction

One of the biggest reasons for the human elephant conflict is the reducing forest land, more human involvement in the forest areas and rise in population.All these leads to resource scarcity for elephants and other animals also. Elephants are attracted to agricultural crops due to their higher nutritional value. Normally Elephants communicate with each other through low- frequency sounds,which travel distances of several kilometers. This elephant call is known as rumble, which falls in the infrasound band.The rumble known as harmonic sound with a frequency in the range of 14-30Hz and lasts for a duration between 0.35 to 5.0s. The upper end of a rumble be heard by the humans, although it's just a feeling in the vibrations of diaphragm.

2. Hardware module

The components used for the module are as follows:

- Infrasound sensor (microphone + preamplifier)
- LPF
- Microcontroller

The block diagram is shown in the Figure 1.

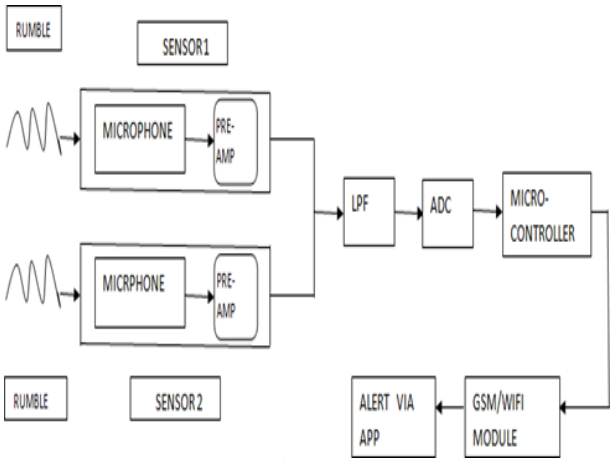


Fig 1: Simplified Block Diagram.

3. Description of the components

The purpose of the various components are discussed below.

3.1 Sensor module

The first part of the sensor module is the microphone. It is used to collect the low sound frequencies while the elephants communicate with each other.Here miniature capacitive microphones of the range 20-20KHz are used.The microphone is placed in a circular array fashion so that the vibrations lower than the range of 20kHz can also be recorded.The output vibrations from the microphone will be given to the preamplifier. The microphone and the preamplifier are connected together.They will be kept in a visible box of plastic container.This combination when created in a circular array fashion will form the designed infrasound sensor module. There are various parameters that will affect the input of the sensor module like wind, thunderstroms and lightning.Hence we can design a wind protector around the microphones to protect them from the wind and lightning.

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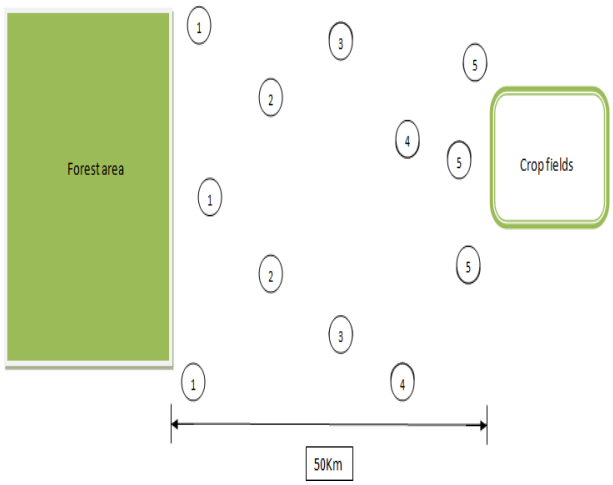


Fig. 2: Distance Estimation.

3.2. Low pass filter

The output from the infrasound sensor module will be given to low pass filter.It is of second order. It can be any type of second LPF.The main purposr of LPF is to cancel the higher frequencies of range more than 130 Hz, as we are concerned with the low frequencies only.

3.3. Microcontroller

The analog signal output from the LPF is then passed to the latest IoT microcontroller called "NodeMCU". The analog inputs are given in the analog pins.The microcontroller then processes the input signals to get the desired output value. The information is then passed on to the newly developed application via mobile phone.

3.4. Battery

To run the circuit we need a battery source .There will be two batteries each of 12v for the microphone and the preamplifier. Another 5v battery to control the microcontroller.If batteries are used then it is the responsibility of the personnel that he changes the battery at the regular intervals of the time.An alternate solution is that we can use solar power panels. It will be a onetime installment. These module can be placed in either the side of the pathways or it can also be placed at the top of the trees which is at the height of the out of the reach of the elephants.

4. Software module

The public and the forest rangers will be notified by the use of an application.The application will be a pure android application based platform.The app will be developed from the MIT App Inventor tool.Through this app the public will be able to track the location of the elephant and the distance of the elephant from the field area .The time can also be estimated from this app.

4.1. Distance estimation

Here from the figure 2, each sensors will be placed at a distance of exact 10km from each other. There are 5 batches of the sensors used.Let us assume that the distance from the forest area to the farm land is 50km.Now when the elephant comes out of the forest border, the sensor batch 1 will be activated due to the infra sound waves of the elephant which is recorded by the microphone. Thus through this the sensor module gets activated. Now the microphone will send the signal to the preamp followed by the LPF then to the microcontroller .Thus the sensor 1 will be programmed in such a way that when it gets activated it will send an alert by the app that "Elephant is at a distance of 50km from the field".Similarly after some time sensor 2 will get activated and it will send an alert that "Now at a distane of 40km".Thus through this way sensors 3, 4, 5 will be activated and the corresponding alert will be send to the people.

5. Conclusion

This is one of the idea through which we can prevent human elephant conflict and save the life of both humans and elephants.This system does not cause any harm to the ecosystem.The developed warning system has to be uesd more in forest prone area. The problems due to distance and location of elephant arrival into the villages is tried to be resolved in this paper.

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