# An Experiment to study Impact of Chemical Repellent & Repeller Sounds on Animals for Crop Protection

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**Abstract**

India is an Agriculture-dominated country. Also the population of India is second largest in this whole world. In this situation crop protection is as important as crop production. We have designed a device that can improve crop protection from wild life attacks. A proposed device designed to protect crops not only from birds, but also from wild animals. It is also intended to detect any type of fire in the vicinity of the cropland. It can also detect soil moisture levels and alert farmers if they become too low or too high. We conducted an experiment in this research study to investigate the impact of various chemical repellent along with repeller sounds on Animals. To reduce crop destruction, we are using ultrasonic frequency generator in our model that will act as a repeller. But after a certain period of time, they become habituated of it. So, we have conducted an experiment to check the pattern of their behavior against this frequency and also we have experimented with various types of sound to repel the wild animals from crop-field. Based on this pattern we can improve the repeller system.

**Keywords:** Crop Protection, Repeller Frequency, Repeller Sound, Ultrasonic, Behavior, Wild Animals, Crop Destruction

## 1. Introduction

Precision agriculture incorporates the notion of smart farming, which comprises real-time data collecting, processing, and analysis, as well as automation technologies in agricultural

procedures, allowing for enhanced overall cultivation management and performance, along with better informed decision-making by farmers. Together with improving agricultural output in limited resources, it is important to minimize crop loss due to a variety of problems(Muangprathub et al., 2019).

Crop losses or crop damage can be caused by flood, fire, drought, wildlife attacks, or agricultural pests and illnesses. Floods and droughts are natural disasters. And it is impossible for us to solve these problems on our own. However, the next two reasons, pests/insects and animal attacks, can be avoided by implementing the proposed IoT paradigm(Kumar Mishra & Sonal, 2022). In this research, we carried out an experiment to explore the effect of various repeller sounds on animals(Yusman et al., 2018). We are employing an ultrasonic frequency generator in our model as a repeller to decrease crop destruction. Yet, after a while, they grow accustomed to it. As a result, we conducted an experiment to examine the pattern of their behavior in relation to this frequency, as well as experiments with various types of sound to repel wild animals from crop fields(Haque, Sonal, Haque, & Kumar, 2021). We can improve the repelled mechanism using this pattern.

### 1.1 Stimulus Reception (Visual and Auditory)

Frightening devices prevent wildlife that is causing or is going to inflict damage by employing a single stimulus or a combination of stimuli. The animal's senses of sight, smell, taste, touch, and hearing are used to detect stimuli. The majority of terrifying devices affect the senses of sight and/or sound. The taxon, species, sex, and age of the animal all influence visual and audio sensitivity. The following visual and aural information is a brief summary of the abilities of chosen animals and is provided to serve as a foundation for the construction of frightening devices(Samarasinghe, 2019).

When contemplating acoustic alarming devices, the auditory capability of animals is essential. The frequency of sound is measured in Hertz (Hz), and the volume (decibels) at the sound pressure level is determined in decibels (dB SPL). 2105 Pa is the sound pressure level. Humans have an absolute sensitivity of 0 dB SPL and can perceive sounds at frequencies ranging from 20 to 20,000 Hz(Vashi et al., 2017). Ultrasonic frequencies are those above 20,000 hertz (Hz) and infrared frequencies are those below 20 hertz (Hz)(Gilsdorf et al., 2002). Table 1 shows the decibel values for several common sounds.

| Sound level (dB SPL*) | Sound |
|---|---|
| 0 | Softest sound humans can hear |
| 10 | Normal breathing |
| 20 | Leaves rustling in a breeze |
| 30 | Very soft whisper |
| 40 | Quiet residential community |
| 50 | Department store |
| 60 | Normal speaking voice |
| 70 | Inside moving car |
| 80 | Loud music from radio |
| 90 | City traffic |
| 100 | Subway train |
| 110 | Loud thunder |
| 120 | Amplified music in night club |
| 130 | Machine gun fire at close range |
| 140 | Jet engine at takeoff |
| 180 | Space rocket at blastoff |

Figure 1. Data showing the various sound and its decibel values

The main problem of using frightening devices is that animals quickly become adapted to external stimuli within a short period of time(Gilsdorf et al., 2002)(*Sonic Deterrents in Animal Damage Control: A Review of Device Tests and Effectiveness on JSTOR*, n.d.). The method by which animals adapt to and avoid new views, noises, and odours over time is known as **habituation**(*Sonic Deterrents in Animal Damage Control: A Review of Device Tests and Effectiveness on JSTOR*, n.d.). Changing the position of the devices and combining visual and auditory stimulation may help to delay habituation(Gilsdorf et al., 2002). Although total damage removal is usually unattainable, a combination of fearful stimuli delivered over a short period of time frequently reduces damage to a bearable level. We reviewed the scientific literature on the use of scary devices to reduce birds and animal damage and collated data to establish their effectiveness(DEEPA SONAL, 2022). When used in combination with other devices, frightening devices may be more effective than when used alone. We conclude that while absolute damage removal may be unattainable, scary devices and/or combinations of devices can help reduce wildlife damage(Haque, Sonal, Haque, Kumar, et al., 2021). Ultrasonic scare devices are unsuccessful at scaring birds and mammals, whereas other devices provide some protection. The timely application of a range of scary devices can be part of a cost-effective integrated approach for reducing wildlife damage to manageable levels(Aravinda & Krishnareddy, 2022).

## Chemical Repellent

To keep wild animals away from crops, chemical repellents can be applied. These repellents contain active ingredients such **Anthraquinone, Butanethiol, and Methyl Anthranilate**. On the other hand this Chemical Repellent shows a very less habituation impact on animals, because it always shows its impact on animals. But with time, it may be decrease its impact on some animals but it is more impactful than sounds.

An ester of anthranilic acid with the chemical formula C8H9NO2, methyl anthranilate is often referred to as MA, methyl 2-aminobenzoate, or carbomethoxyaniline.

An aromatic organic molecule having the chemical formula $C_{14}H_8O_2$, anthraquinone is also known as **anthracenedione or dioxoanthracene**. Different quinone derivatives are included in isomers. The isomer 9,10-anthraquinone, in which the keto groups are situated on the central ring, is the one to which the term "anthraquinone" is referring.

We are using Chemical repellent along with repelling sound so that this create an unpleasant surrounding for animals and they ran away.

**Research Methodology**

After detecting the animals near the crop-field, we conducted the experiment to find out the most suitable repeller sound. In this experiment, we used and tested for various sounds that can repel the animal most efficiently. According to a story in **"The Times of India"**, villagers in Uttarakhand were being unable to effectively deal with foraging wild boar – exterminating them was turning out to be a difficult and time-consuming process.
Upon learning that wild animals tend to stay away from areas they associate with human habitation, **the farmers decided to play songs over loudspeaker systems in their fields – and among these were ultra deep bass songs,** as well as bhajans(*Honey Singh Scares Away Wild Boars in Nainital! | Chandigarh News - Times of India*, n.d.).
Loud noises, such as explosions from gas exploders, sirens, and recorded animal sounds, are frequently utilized as frightening devices. Animals prefer to avoid regions with loud and/or strange sounds at first(Aravinda & Krishnareddy, 2022). The main problem of using frightening devices is that animals quickly become adapted to external stimuli within a short period of time. So we are using the changing sound at output signal(Giordano et al., 2018).
At the input pin of microcontroller, ultrasonic sensor is attached whereas at the output pin, we are using following sound at the speaker.

Following are the sounds we used as repeller sound.

1. **"Ambulance Siren" Sound**
2. **"Train Siren" Sound**
3. **"Lions Roar" Sound**
4. **"Ultra Deep bass song" Sound**

In the Figure 2(a) and Figure 2(b) given below, the simulation of the circuit and the programming code to develop this module is being given.

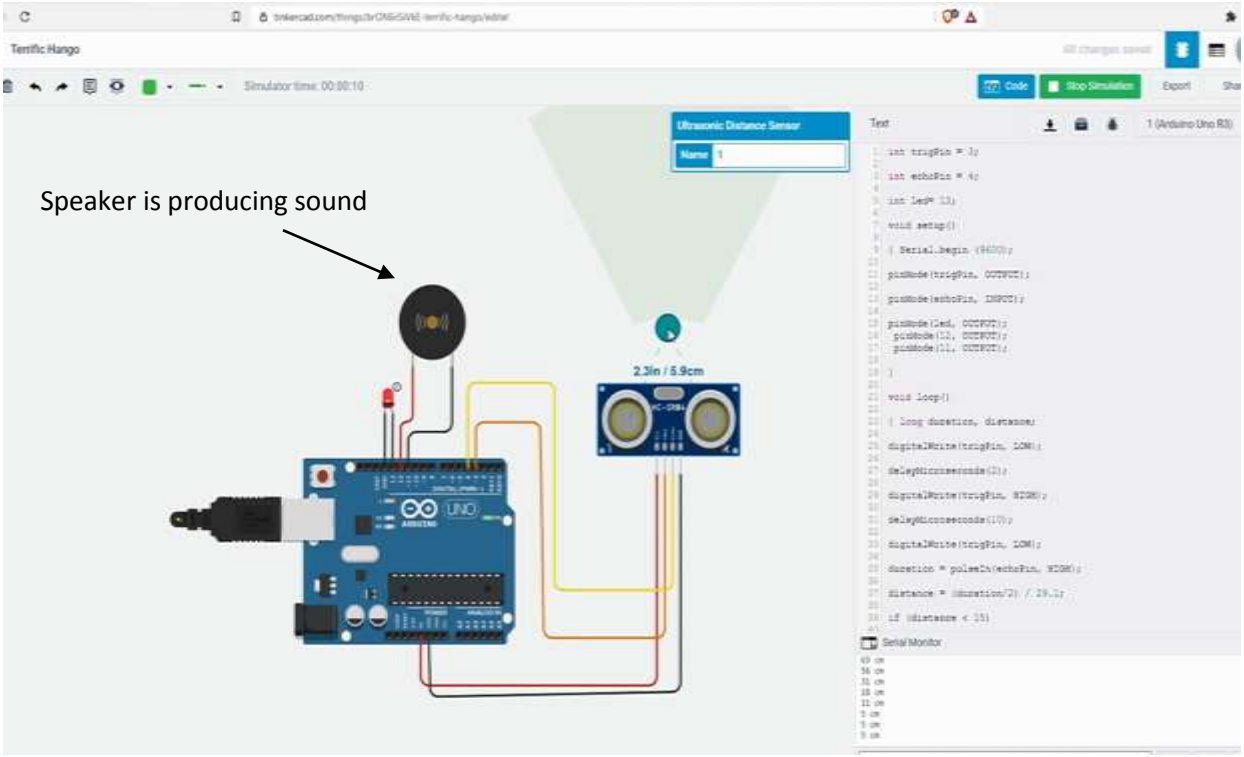


Figure 2(a). At output pin, speaker is producing sound when object comes closer

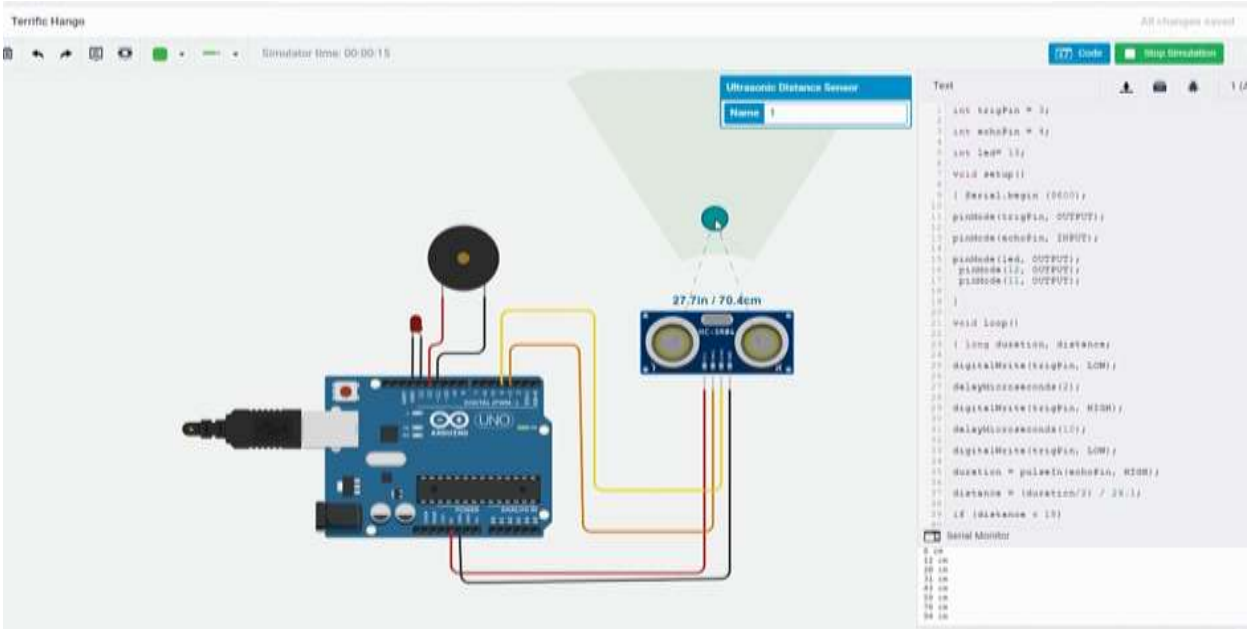


Figure 2(b). At output pin, speaker is stopped producing sound when object is going away.

In the simulation we have tried to show that as object(animal) is coming closer to the field, the ultrasonic sensor detects the animal and activates the output pin i.e. speaker attached with the system got started to play the various sounds. We are the playing the sound one by one to detect which sound effects the animals most.

**Data and Analysis**

We had taken 100 observations with these sounds. From the 100 observations with each sound, following table is being created that will clearly evaluate which sound is one of the most appropriates to repel the animals(Kumar et al., 2018). But here, we are making it very clear that no sound can permanently have its repelling effect on animals. We have to change the sounds time to time.

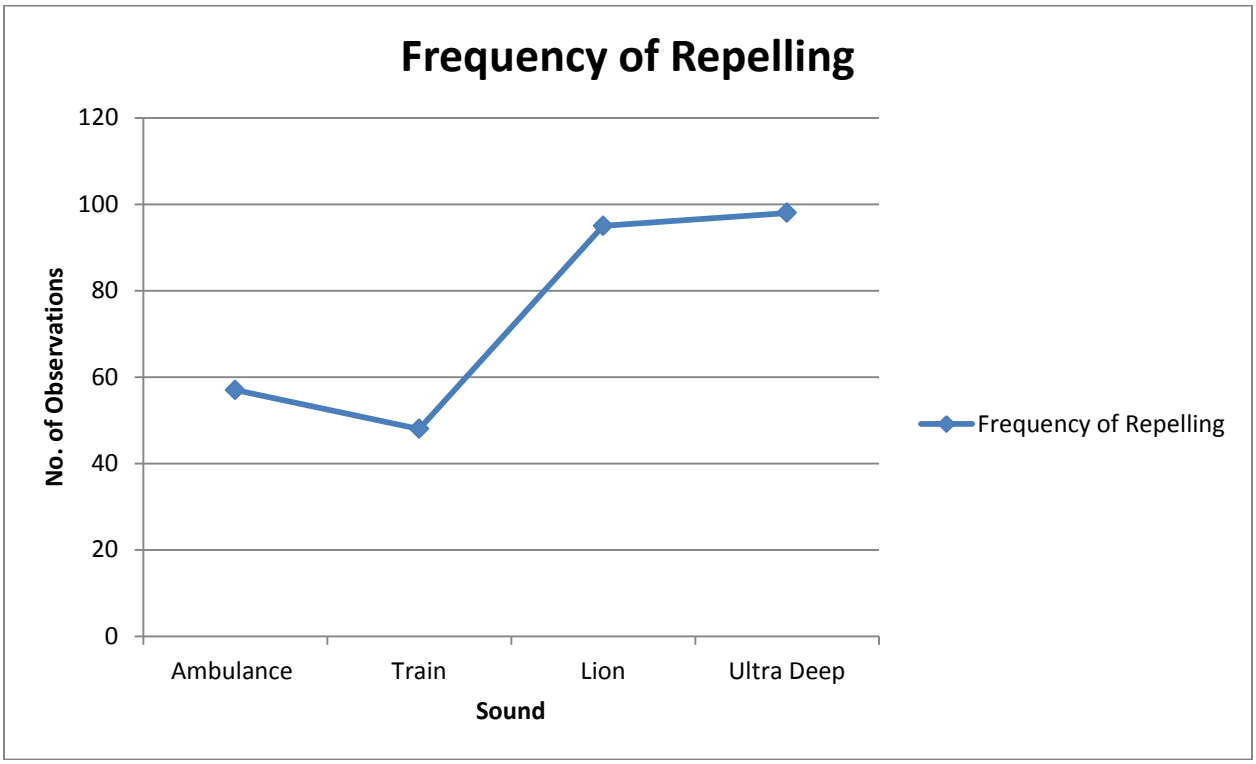


**Figure 3.** Chart showing the effect of various sounds on animals

Here, we plot a chart to show the most effective type of sound. By seeing the results of the observations taken, we have come to the conclusion that along with the use of ultrasonic frequency also we should use either animal sound or deep bass sound. As initially, we were using only ultrasonic frequency. But after these observations, we also implemented this kind of sound in the proposed model of research.

**Conclusion**

So we can conclude that although total damage removal is usually unattainable, a combination of sounds delivered over a short period of time frequently reduces damage to a bearable level. We emphasize on changing the sounds to reduce birds and animal damage and collated data to establish their effectiveness. When used in combination with other devices, frightening devices may be more effective than when used alone. Also we can use chemical repellent along with repeller sound to increase the impact. We conclude that while absolute damage removal may be unattainable, such devices and/or combinations of devices with other repellent can help reduce wildlife damage

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