ARDUINO BASED INSECT & RODENT REPELLER FOR LIVING & WORKING SPACES

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ABSTRACT

With so many amazing things going on in the world of science and technology, we still don't have an effective solution to ward off pests electronically. Pesticides, insecticides and other repellents are toxic and dangerous to human health. Electronic Pest Repellent (EPR) is a new technology that is cheap, environmentally friendly, effective and poses no risk to humans. Electronic pest repellents are electronic devices that are capable of producing sounds in the ultrasonic frequency range that are inaudible to the human ear but are audible to pests such as rodents, birds and insects. Sounds of this frequency (10-100 kHz) are annoying to pests and leave the place due to severe hearing impairment. The device can be used by the general public to repel mosquitoes, insects, cockroaches and by farmers to repel rodents, insects and other pests.

KEYWORDS

Arduino, Insects, Repellent, Ultrasound, Variable Frequency.

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1. INTRODUCTION

As Humans, we are conditioned from childhood to fear insects, rodents, pests usually, from a negative or traumatic experience with them in the past. Most of the time we choose from commercially available solutions, like chemical sprays, dead traps, deterrents, fast acting poisons , electromagnetic wave based repellents and many more. For a fact, they aren't as effective as they are advertised. And in itself they are harmful by nature of substances used in them, which makes them not suitable to use at home where toddlers are around. Therefore we aimed to design an electronic repeller which will use ultrasounds of a wide range of frequencies to repel the common hazardous insects and rodents. As it is a variable frequency repeller it makes the targeted insects and rodents to not adapt to the sounds which is the case the traditional electronic repellers fails and makes them inefficient. by using high-frequency pulsed sound waves to attack the pest's nervous system, and finally, the only way for the pest to survive is to leave it. Odorless, non-toxic, smokeless, silent, no side effects on the human body. It can be used continuously and is suitable for home and office use.

2. LITERATURE REVIEW

The authors of this paper [1] focus on the development of electronic composites to produce smarter, safer and more effective alternatives to harmful repellants. This article provides detailed information on ultrasonic pest repellers. This device produces variable ultrasonic frequencies that can repel, block and disrupt the acoustic communication of pests and insects. The desired outcome of this device was to reduce the use of pesticides and insecticides that pollute the soil and pose various environmental, physical and health risks. With this in mind, these chemical fertilizers affect the food chain and all the people who are part of the food chain. You can also interact with electronic repellers that use electromagnetic and ultrasonic waves to repel insects such as mosquitoes, houseflies, and spiders. , insects, fleas and cockroaches. An ultrasonic pest control system repels, not kills, pests with multi-frequency modulation alerts.

These high-intensity ultrasonic waves (25-65 KHz) are beyond the range of human hearing and temporarily disturb most pests. These (in the case of rodents and insects) nervous sounds travel directly to the brain and nervous system, causing abnormal behavior such as severe pain, discomfort, agitation, and radiation sites. This device produces variable ultrasonic frequencies that repel, trap, and block sound communication of pests and insects. By using the GSM module, the device can be controlled from anywhere in the world and can be accessed worldwide. Additionally, the use of power amplifiers, microcontrollers (Arduino UNO) and short diaphragms increase the operating range, efficiency and area of the device. With the help of BLE technology and its mesh networking capabilities, the device can also be used to cover large areas in agriculture while increasing the efficiency of the device. The biggest challenge with this device is reducing the use of pesticides and pesticides. Pesticides and pesticides contaminate the soil and pose environmental, physical, and health risks.

The author of this paper [2] presents a design concept for an automatic ultrasonic animal and insect repellent, consisting of an ultrasonic sensor, a motion sensor, a GSM module and an Arduino Uno board. Identify the sound of the pest by recording the ultrasonic signals emitted by the presence of pests in the products. Then the presence of pests is detected by PIR motion sensors. When both Arduino Uno board sensors confirm the presence of pests, an ultrasonic repeller is activated to drive animals and insects out of the area. A message is sent through the GSM module and farmers are ready to protect themselves with pesticides or pesticides depending on the crop. This project can also be utilized in agricultural functions like cattle monitoring as well.

In this paper [3] Experimental observations have shown that bird activity is extreme early in the morning and decreases regularly throughout the day. Therefore, the field test was four times from 5 am to 8 am and from 5 pm to 6 pm. The test was conducted during both wheat and rice harvest after corn

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had been planted in the field. The target bird species were pigeons (Spilopelia senegalensis), crows (Corvus cornix), pigeons (Columba livia) and sparrows (Passer Domesticus). The flock averaged dozens of mighty birds. For analysis Stepwise multiple linear regression models involving frequency level, exposure time interval, and field to find the relationship between sound pressure level (SPL), bird departure time, frequency level, exposure time interval, and field measurement distance was used. Distance was measured as the explanatory variable, and (SPL) and bird flight time are considered dependent variables. The regression model results showed a significant association between SPL, bird departure time, and the explanatory variables. This can be inferred from the t-values and associated p-values. The explanatory variables explained 88% and 93% of the variation in SPL and bird departure times, indicating a high strength of the relationship between SPL and bird departure times and the explanatory variables. By looking at the F-value and its p-value, they concluded that the model is valid and that there is a correlation between SPL and bird departure times and explanatory variables.

In this work [4], a scheme was developed that works with fixed blocking frequencies around 26 kHz and between 34 and 44 kHz. To ensure effective performance, the ultrasonic frequency of this ultrasonic oscillator is continuously and automatically changed within a certain range. This was accomplished by changing the clock pulse output of IC1 NE555 (used as a low frequency square wave oscillator in the design) and Results were obtained from the tests performed on the device and from the testers who used the device. The developed device operated within the specified insect repellent frequencies. The results obtained from simulation and experiment , the waveforms obtained using an oscilloscope in the lab were both square waves. When the device was placed in close proximity to a subject (flies or mosquitoes), the device repelled them up to a distance of 3 meters. When placed approximately 4 meters away from the subject, the subject showed no significant reaction. The system was designed, built and tested satisfactorily and successfully executed. The system has been found to be very effective, performing according to design specifications despite minor variations in readings.

This article [5] deals with a brief review of different ways and devices for repelling insects and rodents in agricultural areas and poultry farms. A variety of manual techniques were used in the past, but subsequent advances in electronics gradually led to their use in agriculture to increase yields. Three controls were developed for the new system. The rat repellent works with your phone or a switch. Rats are repelled by the ultrasonic range of frequency produced by the device. The frequency range varies from 60 KHz to 85 KHz. The developed technology was tested on caged rats to see if it could affect the organism. Varying the ultrasound over a frequency range of 60 to 85 kHz exhibited erratic behavior in the rats, proving that the designed system helped repel dangerous rodents and pests from poultry farms. The proposed prototype design allows the device to operate for up to 12-13 hours on a fully charged battery. DTMF is the signal sent to the Arduino Uno by pressing a button on the phone's dial pad. The high and the low frequencies on the keys of the mobile phone keyboard produce two different sounds.. The third control unit uses an LDR connected to an analog pin to detect day and night and activate the night mode.

This paper [6] describes the design and testing of electronic jamming protection. The audio amplifier circuit is designed to produce ultrasound in the frequency range up to 75-80 kHz. A suitable frequency response is used to transmit these sound waves. This device is an effective alternative to pesticides commonly used on farms and homes. Oscilloscope readings indicated that the generated signal was within the repulsion frequency range of 30 to 50kHz of ultrasonic frequencies. ultrasonic signals for different pest species tested in a series of 10 experiments were within the specified range. It was determined to be five times more affordable than the insecticide propoxur, and that simulation and experimental results were consistent within ±5% measurement uncertainty.

The device designed in this study [7] is an automated pest control tool specifically targeted at bird and rodent pests. Control technology is implemented by listening to pests. The device developed is a prototype for repelling rodent and bird pests in rice. In this prototype, two sensors (an ultrasonic sensor and a PIR sensor) were used to detect pests. The dimensions of the prototype to be produced are 40 cm wide and 50 cm long on a 1/100 scale. That means the prototype created could reach an area

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of 4 x 5 m with respect to the real area. The prototype is expected to develop into a large-scale tool for direct installation and use by farmers and auto tow trucks. Repellent techniques are implemented by making sounds that can stun pests It was hoped that this prototype could be developed into a larger scale tool for direct installation and use by farmers.

[8] An acoustic deterrent that repels birds by emitting bird calls or ultrasonic waves**.** To determine the effectiveness and efficiency of ultrasonic restraint systems. Standard ultrasound equipment has been tested on a variety of animal species. There is ample evidence that researchers have successfully developed ultrasonic devices that repel birds, despite the ineffectiveness of commercial ultrasonic devices as described above. Ezeonu et al. (2012) developed and tested an ultrasonic bird repellent. Ultrasound was generated with varying frequencies between 15 kHz and 25 kHz. The waves were amplified and radiated at high sound pressure levels from a solar-powered electronic device manufactured on site.

The purpose of this paper [9] is to find an achievable way to reduce the impact of traffic on wildlife, a priority for nature conservation. Roadsides are important refuges for small animals and excellent hunting ground for hunters. This makes predators and prey vulnerable to vehicle collisions. Therefore, measures aimed at preventing these animals from approaching the streets are necessary. Here, they test the effectiveness of ultrasonic devices to keep rodents out of the way. We hypothesized that when rodents are exposed to ultrasound, they move away from the device and track.

The author of this article [10] proposed such a system that would also be beneficial in agriculture and households. This should also reduce the losses animals often cause. Here he looks at the Arduino code and uploads it to his Arduino UNO board. The Arduino UNO board connects the board to an LCD display, an ultrasonic sensor, and a DTMF decoder that detects animal frequencies and acts as a repellent. Mode 1 transmits dog and cat frequencies (22 KHZ to 25 KHZ), and mode 2 transmits input frequencies (31 KHZ to 44 KHZ) that repel flies and spiders. Therefore, when installed in these locations, the system is equipped with an ultrasonic sensor and an LCD display that indicates the selected mode of operation. Drive away animals based on the selected mode of operation.

The authors conducted a detailed review of alternative controls for house flies [11]. The house fly is the most widespread commensal pest in the world. It rarely breeds indoors, but it does invade buildings, causing problems and transmitting pathogens. Exclusion means keeping flies away from the structure. Despite the best efforts, flies can invade the human environment. Therefore, air curtains, fans, screened windows and doors are excluded. UV light traps attract and immobilize flies. The window trap invites you to a device that catches flies. Adhesive tubes and tapes rely on the tendency of flies to land on vertical lines and get stuck in the adhesive. Even low-tech fly swatters can play an important role in getting rid of individual flies. Timely-release pyrethrin aerosol dispensers are effective against flies trapped in small spaces. Poison Bait can only be used in urban environments.

This study [12] aims to illustrate the usefulness and effectiveness of automated tools that can repel agricultural pests, especially rats and birds. The tool has a passive infrared-receiving sensor that detects the presence of agricultural pests, and a servo motor activates and pulls a bell, making sounds that scare away birds and rats. This mechanism is controlled by a microcontroller called the Arduino ATmega 2560. This tool is an innovation from traditional technology, so it can easily solve farmers' problems related to agricultural pests.

In the article [13], the author constructed an EMR-generated ultrasound in the frequency range of 20-38 kHz, propagating at an angle of 45° from the source and covering a large radius. These ultrasound focused auditory stresses on mosquitoes either deactivate them or push them out of the vicinity of the device. The device is based on the 555 timer IC and can be used by the public indoors or outdoors to combat the mosquito threat, with an EMR (Electronic Mosquito Repellent) he turns off for 12 seconds, in a famous mosquito hatchery Field experiments were conducted using human chow. minute. Human prey felt the number of mosquitoes on different parts of the body. It was difficult to determine whether ground gnats were of the same species. They turned on the EMR machine and

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watched for another 12 minutes. In the first 4 minutes, 8 mosquitoes landed on human food. In his last eight minutes of his life, he saw a mosquito land on average every four minutes of his life. It was just the two of him. Mosquito landing rates differ with and without EMR ON. This demonstrates the ability of the EMR device to repel mosquitoes outdoors. Another experiment was conducted with two subjects in a closed classroom. The first human bait was placed in the center of the classroom and the second human bait was placed in each corner of the classroom. The results of these tests provided clear evidence from field observations that this device impacted mosquito landing rates. investigated (because location and environmental conditions can affect ultrasound transmission).

This paper [14] focuses on different pest control methods and also describes frequency variation generation technology based on electronic pest control machines. Using the LM 380 in an audio power amplifier circuit, we have designed a system capable of producing sound in the 75 kHz frequency range. Loudspeakers of suitable frequency ranges are used to transmit these sound waves. E-Pest Repellent is intelligently made with ANN (Artificial Neural Network). ANNs are trained on data collected from the literature to repel different types of pests. ANN output is the amplitude, frequency, and duration of the signal to repel pests. It is said to be highly effective compared to simple E-pest repellents.Comprehensive performance evaluations of e-pest repellents were conducted to determine the effectiveness of the device against a variety of pests. and ANN has received training. Her trained ANN will be used in the development of his intelligent E-Pest Repellent System. This device is intended to repel small birds, mosquitoes, flies, moths, bats and other nocturnal insects, rodents and birds in farm fields.

3. EXISTING METHODOLOGY

The above section details many of the available technologies. Each article discusses different technologies and techniques for proving to be effective repellents. Such as the development of an electronic repeller system in articles [1] [2] [4] [6] and his use of DTMF techniques in [5] [11]. This allows GSM technology to complement existing EPR. Additionally, Powering them for long hours of operation is a big challenge where some used batteries , some tried solar power and many solutions for this situation are detailed in [9][11][12][13]. All the above techniques and technologies are available separately ranging from cheaper solutions to more expensive ones but the scope of them proving to repel, is limited to some specific rodents or insects mainly rats and mosquitoes. These can be combined with each other by improving and working on the existing anomalies by completing these challenges.

4. ACOUSTIC METHODS

Acoustic sensors used in recent research include piezoelectric sensors, accelerometers, microphones, and ultrasonic transducers that are used to detect and identify rodents & insects. The laser doppler vibrometer is a modern sensor that is very useful for detecting and identifying insects.

4.1 Accelerometers - Accelerometers are acoustic sensors that sense vibrations and shocks to measure environmental G-forces. It's a microchip-like device that gently but firmly attaches to the stems and stems of plants. The signals recorded by the accelerator are sent as output signals to a wireless computer for further analysis.

4.2 Piezoelectric sensors - Sensors that work on the principle of piezoelectricity. When the piezo disk deforms, a voltage is generated. Crystals, like crystals, have the ability to conduct electricity. When the crystal is subjected to an external force, it deforms and the negative and positive charges move within the crystal, creating a voltage that helps identify pests. The core of a piezoelectric sensor consists of a piezoelectric crystal that directly converts mechanical stress into electrical charge.

4.3 Acoustic Probes - Integrate acoustic sensors like accelerometers and piezoelectric sound sensors to create acoustic probes. It is usually inserted into the area of the sound field under investigation. Soil,

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stored grain or wood. Known as the SP-1 probe, the portable device combines a specialized probe and sensor manufactured by Acoustic Emission Consulting (AEC) to detect acoustic emissions produced by burrowing insects and red weevil larvae. It consists of date palms for identification.

4.4 Microphone - a type of sound device that uses IA (Impact Acoustics) to evaluate the quality of production. It helps to identify the damage of insects, scabs and buds on the seeds. It is a non-intrusive and cost-effective alternative to laborious, time-consuming and expensive manual methods.

4.5 Ultrasonic Transducers -An ultrasonic transducer is a system capable of producing and receiving ultrasonic vibrations. This converter consists of a wear plate, an active element and a back. Active elements are piezoelectric or single crystal materials that convert electrical energy into ultrasonic energy. It then recovers the ultrasonic energy and converts it into electrical energy.

4.6 Laser Doppler Vibrometer (LDV) -. Compared to other contact methods for vibration measurements, LDV has the advantage that interference between sensor and sample is actively avoided. We have developed a vibration sensor that can classify flying insect species based on flapping frequency. The sensor consists of a laser light source and a phototransistor connected to an electronic gain and filter board, used as a laser beam to measure the beating frequency of flying insects. When a wing hits a laser beam in flight, the light is partially trapped, creating small light fluctuations. These changes were detected by a phototransistor. As a result, the sensor was able to distinguish between the beneficial species and the species two harmful mosquitoes, yellow fever mosquito and west nile fever, with accuracies ranging from 70.69% to 91.3%.

5. PROPOSED METHODOLOGY

In this proposed technology, smart gadgets are designed to keep rodents away from your home and living spaces around your home. Passive infrared sensors are used to detect the presence of people when entering a room. After a successful detection, the tweeter turns off and starts emitting variable frequencies only when the room is empty. Insects and rodents such as cockroaches, mice and mosquitoes are very annoying when they are there, so prevent them from entering the room. That space not only protects the room from the most common pests, but also minimizes exposure to ultrasound, keeping teenagers and toddlers away from high-frequency sounds that can affect their age. . prefer. Long lasting with solar panel and rechargeable DC battery unit. Ultrasonic tweeters can produce frequencies between 10 and 65 kHz, which is enough to keep pesky insects and rodents away. Currently, prevention coverage is limited to one room, and costs increase with each additional room space.

6. CONCLUSION

Acoustic devices have proven highly effective in trapping, identifying, detecting, and behaviorally manipulating pest species. Acoustic devices have been used since the 1900s, but the use of sonic devices in pest control remains limited and untapped, especially in the field. A major reason for the lack of research on acoustic technology in pest control is the fact that acoustic technology is very expensive compared to other available alternatives. However, advances in technology are definitely developing devices that are cheaper and easier to use. Moreover, the latest technology has the potential to improve the efficiency and effectiveness of these devices. It is generally accepted that certain aspects of insect communication remain undiscovered, and many useful potential applications of acoustics in pest control await investigation. A fully fact-based IPM (Integrated Pest Management) strategy for the ecological control of notorious vertebrate, bird, forest, terrestrial and other pests through preserved plants. Acoustics should be viewed as an effective tool.

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