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# Solar Powered Wild Animals Repellent System by Edge Detection Method with Insects Trap Using IOT

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**Abstract:** In recent years, the increasing conflicts between humans and wildlife have led to the development of innovative solutions for mitigating such conflicts. One approach involves the use of solar-powered wild animal repellent systems that utilize Internet of things (IoT) technology to detect and deter animals from entering human settlements. In this study, we propose an intrusion detection system for a solar-powered wild animals repellent system by edge detection method with insects trap using (IoT). The proposed system consists of PIR sensor deployed strategically and Edge detection method (EDS). vicinity of the human settlement, such as motion sensors and infrared sensors. These sensors are connected to a central control unit that collects and analyses the data. The control unit communicates with a cloud-based server through (IoT) protocols, enabling remote monitoring and control of the system. When an intrusion is detected by the sensors, the control unit triggers a series of actions to repel the animals. This may include activating deterrent devices such as speakers, LED lights. Additionally, real time alerts can be sent to the concerned authorities or residents through mobile applications or phone calls.

**Keywords:** PIR –Passive infrared Sensor, EDS - Edge Detection System

## I. Introduction

Tamil Nadu constitutes 4.0% of the country's total geographical area with about 130,058 km2. It is one the biodiversity-rich states in India, largely due to its varied edaphic, climatic and topographic factors with an elevation ranging from sea level to 2637 m2. Topographically the state can be classified into Coastal Plains, Central Plateau, Western Ghats and Eastern Ghats. The temperature varies between 200 -450C during daytime and 150-300C at night time, depending on elevation and geographical position. While it is apparently dry through January to May, the state incidentally receives an annual rainfall of about 1150 mm from Southwest (June-September) and Northeast (October December) monsoons. The vegetation in Tamil Nadu is broadly categorized into three major groups based on the classification by Champion and Seth (1968).

i) Tropical forests
ii) Montane subtropical forests and
iii) Montane temperate forests.

Regions with a high concentration of endemic species are considered and promoted as hotspots for conservation priorities. Endemic species are usually restricted to peninsular regions, mountain peaks and unique geographical regions apart from islands. Among the endemics, the narrow endemics are more vulnerable and can easily get depleted due to anthropogenic interferences. Based on the diversity and distribution of the endemic species in India, Nayar (1996) recognized three metacenters and 25 microcenters of endemism of which the mega center Western Ghats and five microcenters occur in Tamil Nadu. The concentration of endemic species in Tamil Nadu is more in Western Ghats, which is also the richest biogeographic province of the Indian subcontinent and represents one of the best non-equatorial tropical evergreen forests in the world.

## II. Literature Review

This review aims to protect the crops from wild animals and birds, Insects traps by using IoT. Monitoring in wildlife ecology has increased dramatically in recent years. Using edge detection system to detect the birds and using PIR sensor to detect the wild animals also blue LED light to attracts the small insects, The function of PIR sensor to detect the animals and provide the irritating sounds to protect the crops from wild attacks and damages by birds and insects.Choose appropriate sensors to detect the presence of pests or insects. This could include motion sensors, infrared sensors, or environmental sensors like temperature and humidity sensors to detect conditions that attract pests. And also determine the most effective and humane method of repelling pests. This could involve ultrasonic devices, flashing lights, or emitting specific scents or frequencies that repel pests without harming them.Consider the power requirements of the system and choose a suitable power source. Battery-powered options may be necessary if the system is deployed in outdoor or remote areas. It helps the farmers to protect their crops from wild attacks.

## III. Problem Solving

Generally,Modernised animal repellent system plays major role in case of protecting crops from agricultural fields So, the aim is to find a solution to the above problem by Developingan automated wild animals repellent system made by using Edge detection system, PIR sensor, and also LED lights to detect and capture the wild animals, birds and Insects.

## IV. Experimental Setup

A simple wild animal repellent system can be created using an ultrasonic sound generator and a motion sensor. Here's a verbal description of the circuit diagram:

1. Power Supply: Begin by connecting a power supply to the circuit.
2. Motion Sensor: Connect the output of a motion sensor to the input of a microcontroller or a dedicated circuit that can detect motion. The motion sensor will detect the presence of wild animals or any movement in its range.
3. Microcontroller (Optional): If you're using a microcontroller, connect its output pin to the input of the ultrasonic sound generator. The microcontroller can be programmed to trigger the ultrasonic sound generator when motion is detected.
4. Ultrasonic Sound Generator: Connect the output of the microcontroller or the motion sensor (if not using a microcontroller) to the input of an ultrasonic sound generator. The ultrasonic sound generator produces high frequency sound waves that are inaudible to humans but can be unpleasant for wild animals.
5. Speaker or Transducer: Connect the output of the ultrasonic sound generator to a speaker or a transducer. The speaker or transducer will convert the electrical signals from the ultrasonic sound generator into audible sound waves that repel the wild animals.

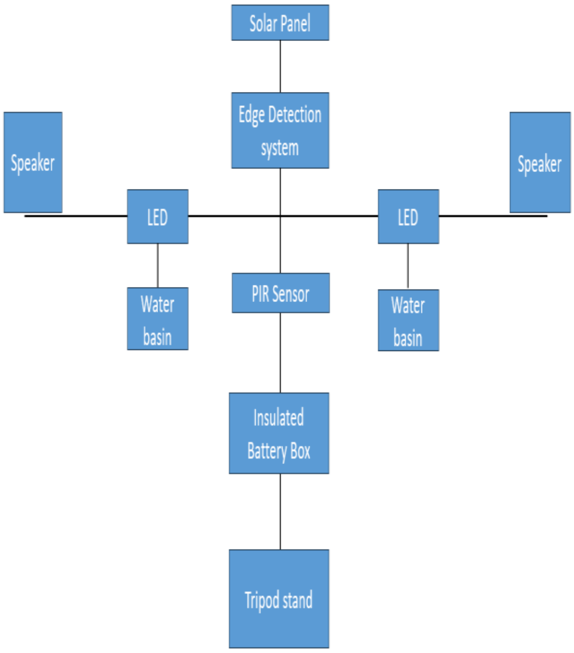
Remember, this is a basic circuit diagram and may not include additional components like power regulation, filtering, or amplification. It's essential to consult an electronics expert or refer to specific product datasheets for a detailed and accurate circuit diagram based on the chosen components.

Fig:1 Prototype Setup.

**Block Diagram–**

A block diagram is a visual representation of a system or process that uses blocks to represent different components or stages and lines to connect them, indicating the flow of information or signals. It provides a high-level overview of the system's structure and functionality.

Overall, a block diagram provides a simplified and visual representation of a system, allowing for a better understanding of its structure, relationships between




Block diagram: 1

## V. Fabricaton

Machine fabrication is a value-added process that involves the construction of machines and structures from various raw materials. The process of fabrication started in the machine shop on the basis of engineering drawings and the availabilities of the shop with respect to machining (facing, drilling, knurling, plain and step turning, welding, etc.).

## VI. Design Considerations

1. **Sensors:** Choose appropriate sensors to detect the presence of pests or insects. This could include motion sensors, infrared sensors, or environmental sensors like temperature and humidity sensors to detect conditions that attract pests.
2. **Repellent Mechanism:** Determine the most effective and humane method of repelling pests. This could involve ultrasonic devices, flashing lights, or emitting specific scents or frequencies that repel pests without harming them.
3. **Power Management:** Consider the power requirements of the system and choose a suitable power source. Battery-powered options may be necessary if the system is deployed in outdoor or remote areas
4. **Data Processing and Analytics:** Determine how the collected data will be processed and analyzed. This could involve using machine learning algorithms to identify patterns or trends in pest behavior or using data to optimize the repellent system's effectiveness.
5. **User Interface:** Design an intuitive and user-friendly interface for users to interact with the system. This could be a mobile application, a web interface, or a dedicated control panel that allows users to monitor and control the system remotely.
6. **Security:** Implement robust security measures to protect the system from unauthorized access or tampering. This includes using encryption protocols, secure authentication mechanisms, and regular software updates to address potential vulnerabilities.
7. **Scalability:** Consider the scalability of the system to accommodate different environments and varying numbers of pests. The system should be able to handle a growing number of devices, sensors, and data points as the deployment expands.
8. **Integration and Compatibility:** Ensure compatibility with other IOT devices or platforms, allowing for integration with existing smart home systems or automation frameworks.
9. **Maintenance and Support:** Plan for regular maintenance and updates to the system. Provide a support mechanism for usersreport issues or seek assistance with troubleshooting.

By considering these design considerations, you can create a robust and effective loT-based repellent system that helps control pests while leveraging the power of connected technology.

## VII. Design Objectives

1. **Effectiveness:** The primary objective of a wild animal repellent system is to effectively deter and repel wild animals from a designated area. The system should be designed to discourage animals from entering the protected area or to drive them away if they have already entered. The repellent measures employed should have a high success rate in deterring a wide range of wild animals.
2. **Safety:** The safety of both humans and animals should be a key consideration in designing a wild animal repellent system. It should not cause harm or distress to the animals but rather act as a deterrent. Additionally, the system should not pose any risks or hazards to humans or the environment.
3. **Versatility:** A good wild animal repellent system should be versatile enough to be used in various settings and adaptable to different types of wild animals. It should be effective in repelling a range of species such as large mammals, birds, or rodents. The system should be adjustable to accommodate different animal sizes, behaviors, and habitats.
4. **Durability and Reliability:** The system should be designed to withstand harsh environmental conditions and have a long operational life. It should be resistant to weather elements such as rain, wind, and extreme temperatures. The repellent devices, barriers, or methods used should be reliable and consistent in their functionality, requiring minimal maintenance.
5. **Environmentally Friendly:** The design should prioritize environmentally friendly solutionsthat do not harm the ecosystem or disrupt the natural balance.

## VIII. Passive Infrared Sensor for Animals

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low- power, easy to use and don’t wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, “Passive Infrared”, “Pyroelectric”, or “IR motion” sensors.

PIRs are basically made of a pyroelectric sensor (which you can see below as the round metal can with a rectangular crystal in the center), which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low.

| Product Name | Measuring Range | Key Features |
|---|---|---|
| *Grove PIR-Motion Sensor* | A maximum distance of 3m to 5 m. Also, the default distance is 3 m and an Angle of < 120° | You can adjust the measuring distance. Besides, it is possible to adjust holding time at a speed of approximately 0.3s to 25s. |
| *Grove Adjustable-PIR motion sensor* | Also, a max distance of 3m to 6m. X-axis angle=110° and Y-axis angle=90° | Also, you can adjust the measuring distance and holding time. |
| *Grove mini-PIR motion sensor* | A max distance of 2m to 5m. X-axis angle=110° and Y-axis angle=90° | It is mini-sized. Additionally, you can adjust its sensitivity. |
| *Large Lens Version* | A maximum distance of 9m and an Angle of < 120° | The large lens covers a wider range. Also, it has a large angle connector. |
| *PIR Motion Sensor Module* | A maximum distance of 3m to 7m and an Angle of < 120° | It's possible to adjust the measuring distance. |
| *Mini PIR Motion Sensor Module* | A maximum distance of 7m and an Angle of < 100° | It is relatively mini-sized. |

**Table: 1**

**How PIR Works**
PIR sensors are more complicated than many of the other sensors explained in these

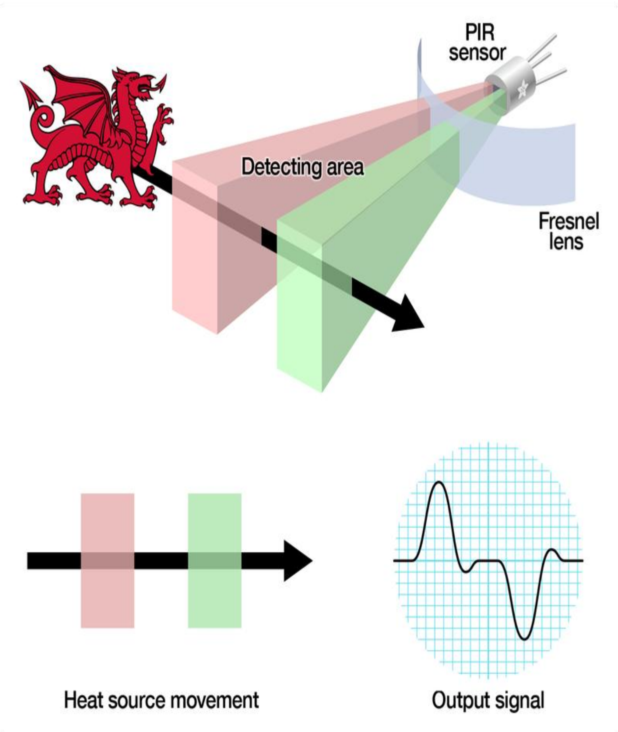



**Fig: 2**

Tutorials (like photocells, FSRs and tilt switches) because there are multiple variables that affect the sensors input and output. To begin explaining how a basic sensor works, we'll use this rather nice diagram

The passive infrared (PIR) sensor itself has two slots in it, each slot is made of a special material that is sensitive to IR. The lens used here is not really doing much and so we see that the two slots can 'see' out past some distance (basically the sensitivity of the sensor). When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors. When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a *positive differential* change between the two halves. When the warm body leaves the sensing area, the reverse happens, where by the sensor generates a negative differential change. These change pulses are what is detected.

## IX. Working Principle

A wild animal repellent system using IOT (Internet of Things) typically involves a combination of sensors, communication devices, and actuators to detect and deter animals from entering a specific area. Here's a general overview of how such a system might work:

1. **Sensor Network:** The system is equipped with various types of sensors to detect the presence of wild animals. These sensors could include infrared motion sensors, acoustic sensors, pressure sensors, or even cameras with image recognition capabilities.
2. **Data Collection:** When a sensor detects the presence of an animal, it sends a signal or data to a central control unit or gateway. This data could include information about the type of animal, its size, location, and movement patterns.
3. **Communication:** The central control unit acts as the hub of the system and is responsible for receiving the data from the sensors. It uses IOT communication protocols, such as Wi-Fi, Bluetooth, or cellular networks, to transmit the data to a cloud-based server or a local network.
4. **Data Analysis:** Once the data is received, it can be analyzed using machine learning algorithms or predefined rules to determine the appropriate action. The analysis may consider factors like the specific animal species, time of day, weather conditions, or historical patterns.
5. **Deterrent Mechanism:** Based on the analysis, the system triggers an appropriate deterrent mechanism to repel the animal. These mechanisms can vary depending on the situation and the desired outcome. Common deterrents include:
   **Visual Stimuli:** LED lights, lasers, or flashing patterns can be used to startle or confuse animals.
   Auditory Signals: Loud noises, ultrasonic sounds, or predator vocalizations can deter animals.
6. **User Alerts:** The system can also notify property owners or caretakers about animal activity through various means, such as mobile notifications, email alerts, or SMS messages.
7. **Monitoring and Maintenance:** The IOT system can provide monitoring and diagnostic capabilities, allowing administrators to track the system's performance, battery levels, and sensor functionality. This helps ensure the system remains operational and effective over time.

It's important to note that the implementation and specific features of a wild animal repellent system using IOT can vary depending on the intended application, the types of animals being targeted, and the environmental conditions. Customization and adaptation to specific requirements are often necessary for optimal effectiveness.

**Basic Program Source Code for Wild Animals Repellent in Edge Detection System:**

```
import cv2
import numpy as np
# Read the image
Image= cv2.imread('input_image.jpg', cv2.IMREAD_GRAYSCALE)
# Apply Gaussian blur to reduce noise
blurred = cv2.GaussianBlur(image, (5, 5), 0)
# Perform Canny edge detection
edges = cv2.Canny(blurred, 50, 150)
# Display the original image and the detected edges
cv2.imshow('Original Image', image)
cv2.imshow('Edge Detection', edges)
cv2.waitKey(0)
cv2.destroyAllWindows()
```

## X. Edge Detection System for Birds

Creating an edge detection system for bird capture could involve a combination of hardware and software components. Here's a general outline of how you might approach it:

1. **Camera System:** Use high-resolution cameras capable of capturing clear images or videos of birds in their natural habitat. Consider factors like weatherproofing and low-light performance if the system will be used outdoors.
2. **Edge Detection Algorithm:** Implement an edge detection algorithm to identify the outlines or silhouettes of birds in the captured images or video frames. Common algorithms for edge detection include Sobel, Canny, and Prewitt.
3. **Image Processing:** Process the captured images or video frames to enhance contrast, reduce noise, and improve the accuracy of edge detection. This may involve techniques like histogram equalization, noise reduction filters, and morphological operations.
4. **Bird Detection:** Once the edges of potential birds are detected, employ object detection or recognition techniques to distinguish birds from other objects in the scene. This could involve training a machine learning model on annotated bird images to recognize various bird species.
5. **Tracking and Localization:** Implement algorithms to track the detected birds across multiple frames and estimate their positions in 3D space if needed. This could involve techniques like optical flow or Kalman filtering.
6. **Triggering Mechanism:** Integrate the edge detection system with a triggering mechanism to capture images or video footage when birds are detected. This could be as simple as activating a camera shutter or as complex as controlling a network of cameras with synchronized triggers.
7. **Feedback and Monitoring:** Provide feedback mechanisms to monitor the performance of the system, such as displaying detected birds in real-time or logging data for later analysis. This could help fine-tune parameters and algorithms to improve accuracy.
8. **Power and Connectivity:** Ensure the system is powered reliably, whether through batteries, solar panels, or other means, especially if deployed in remote locations. Additionally, consider connectivity options for data transfer and remote monitoring, such as Wi-Fi, cellular, or satellite communication.
9. **Testing and Optimization:** Thoroughly test the system in various environments and conditions to identify and address any issues with performance or reliability. Continuously optimize the algorithms and hardware components based on feedback from field tests.
10. **Ethical Considerations:** Lastly, consider the ethical implications of using such a system, particularly regarding the impact on bird behavior, privacy concerns, and adherence to regulations and guidelines for wildlife research and observation. By integrating these components effectively, you can create an edge detection system tailored for capturing birds in their natural habitat while minimizing disturbance to their environment.

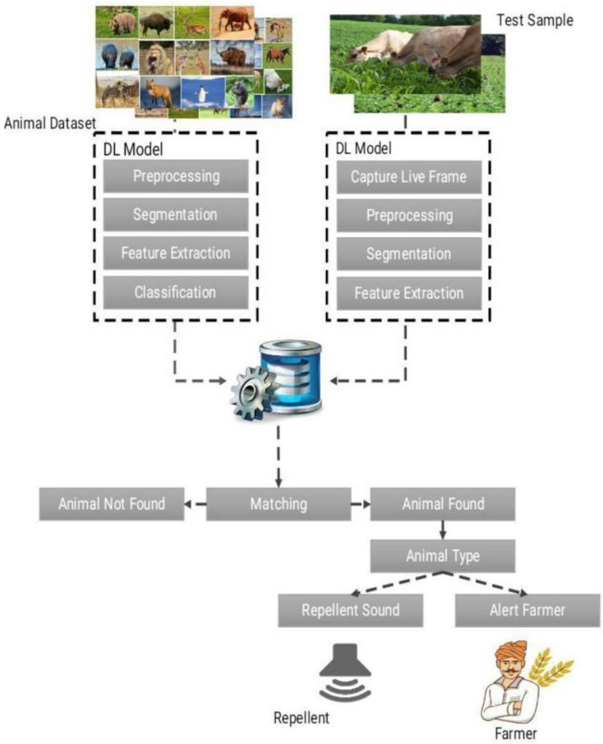



Fig: 3

## XI. Conclusion

In our paper we mainly concentrate on Animal detection is useful in the prevention of human-animal accidents and will increase human and wildlife safety, it will detect large animals before they enter the human habitat and warn the locals through audiosignals. This also helps in saving crops on the farm from animals. Efficient and stable monitoring of wild animals in their natural habitat is essential. Since there are a large number of different animals manually identifying them can be a difficult task.

This algorithm classifies animals based on their captured images so we can monitor them more accurately. This can be achieved by using effective deep learning algorithms. Humans and Wildlife have become increasingly conflicting about living space and food, causing personal injury, loss of income from crop attacks and predation by livestock, and even loss of life. Wildlife can be killed in defense and retaliation, and support for protection can be diminished.

Thus, the animals many of which are threatened or endangered are often killed in relation or to prevent future intrusions and conflicts by which the zone is to be monitored continuously to prevent the entry of wild animals. With regard to this problem, we have made an effort to develop a system which will monitor the field using a sensor to detect intruders, alter farmers and automatically execute mitigation process.

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