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Design and fabrication of solar powered bird scarer

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Abstract

All around the world, birds are a major threat in the field of agriculture causing damage to economic field crops, storage houses and also dirtying human life areas. In order to distract these birds away, many traditional methods such as Scarecrow models, Hawk kites, Colored lights, Lasers, Flashes, Chemicals and firing gun etc.., are used which nowadays do not seem very effective. In this project an effective bird deterrent technique i.e, Solar Powered Bird Scarer has been developed. For this project the conversion of the solar energy is done by the solar panel and this energy is made use of bird scarer. Crop and yield losses due to rodents, birds and animal is increasing at a faster rate. Our project aims to control wastage of crops and food grains due to birds. The main focus of agricultural engineering is to apply various engineering and technological principles in crop production to maximize production and to minimize the losses.

Keywords*:* Solar panels; Bird scarer; Sustainable agriculture; Reduce labor cost

1. Introduction

In the ever-evolving landscape of agriculture and aviation, the presence of birds can bring both beauty and adversity. While they enrich ecosystems, their congregations can wreak havoc on crops and endanger air traffic. As traditional methods of bird control struggle to keep pace with these challenges, the integration of solar power emerges as a beacon of innovation and sustainability. This introduction sets the stage for exploring the fabrication of a solar-powered bird scarer, a technological marvel designed to deter avian intruders while minimizing environmental impact. By harnessing the inexhaustible energy of the sun, this device promises not only enhanced effectiveness but also reduced operational costs and carbon footprint. Join us as we delve into the intricacies of crafting a solution that marries cutting-edge technology with ecological responsibility. In response to these challenges, harnessing solar power presents an innovative and sustainable approach to bird deterrence. By utilizing renewable energy sources, such as solar panels, we can create bird scarers that operate autonomously, requiring minimal human intervention and reducing reliance on non-renewable resources. This introduction delves into the fabrication process of a solar-powered bird scarer, exploring its components, functionality, and potential impact on bird control strategies. n agriculture and aviation, birds can pose significant challenges, often leading to crop damage or safety hazards. Harnessing the power of the sun to create an effective bird scarer not only addresses these issues but also offers an environmentally friendly solution. This introduction provides an overview of the fabrication process, highlighting key components and benefits of utilizing solar energy in bird deterrent systems.

Objectives

- To design and fabricate solar powered bird scarer.
- To analyze the efficiency of the bird scarer.

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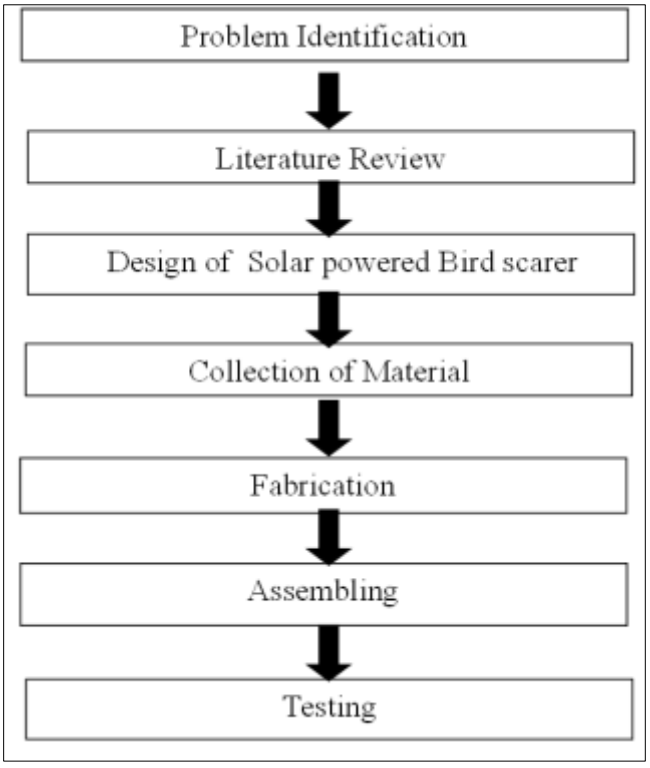
2. Literature Review

Vikrant Rajesh Suryawanshi et.al.,(2015) entitled as "DESIGN, MANUFACTURE AND TEST OF A SOLAR POWERED AUDIBLE BIRD SCARER AND STUDY OF SOUND RANGES" said that All around the world, domestic birds are a major threat in the field of agriculture causing damage to economic field crops, storage houses and also dirtying human life areas. Such most common pest birds in India are House crows (Corvus), Common myna, Jungle myna, Brahminy starling, White cheeked bulbul, Acridotterestritis etc. In order to distract these birds away, many traditional methods such as Scarecrow models, Hawk kites, Coloured lights, Lasers, Flashes, Chemicals etc are used which nowadays do not seem very effective. An effective bird detterent technique i.e. Solar Powered Audible Bird Scarer has been developed. Different sounds due to which different species of birds get dettered were also noticed and studied. One most important observation was that the success of the scarer mainly depends on the predator sound type, its volume, quality and its repetitive nature. From this literature, we are using gunshot sound type which scares the birds effectively.

Arinola Bola AJAYI et.al., (2022) entitled as "DEVELOPMENT OF A RENEWABLE ENERGY POWERED AVIAN PEST SCARER" said that A renewable energy powered avian pest scarer that is humane, environmentally friendly and not habituatable to avian pest is developed. It consists of pop-up scarer, an axial fan blower that is powered by batteries which is always charged back with the power from the sun through Photovoltaic (PV) modules and a motion sensor that usually senses the presence of birds before they land and activates the scarer in a panic motion. The scarer is made to pop-up and flutter in the air immediately the sensor detects flocks of birds, so as to be more effective in scaring the intruders, so that the birds do not land. It is effective in scaring stray and flocks of birds because of its sudden pop-up whenever it senses the presence of birds. From this literature, they are using avian pest scarer which is not much effective but we are using Solar powered bird scarer which is effective.

3. Methodology



3.1. Problem Identification

- Crop protection.
- Economic loss prevention.
- Profit maximization.
- Ecosystem balance.
- Reduced labor costs.

3.2. Collection of materials

We collect the material like Arduino UNO, LCD, Buzzer, Regulator, Relay, Motion detecting sensor, Ultrasonic sensor, Switch, Battery, Solar panel, for the fabrication of our project.

3.3. Fabrication

The fabrication process of a solar-powered bird scarer typically involves assembling components such as solar panels, batteries, motion sensors, and sound or light deterrents onto a structure that can be placed in areas where birds are a nuisance. The solar panel charges the batteries, which power the deterrents when triggered by motion sensors, scaring away birds.

3.4. Assembling

Assembling a solar-powered bird scarer involves mounting the solar panel onto the structure to capture sunlight, connecting it to a rechargeable battery to store energy, integrating motion sensors to detect bird activity, and attaching deterrent devices like sound emitters or flashing lights to scare off birds when activated. Wiring and proper placement are crucial for effective operation.

3.5. Testing

Testing a solar-powered bird scarer involves verifying that the solar panel charges the battery effectively, ensuring the motion sensors detect bird activity reliably, and confirming that the deterrent devices activate as intended when triggered. Additionally, testing the durability and weather resistance of the assembled unit is important to ensure long-term functionality in outdoor environments.

4. Components and its properties

4.1. Components used

- Arduino Uno
- Ultrasonic Sensor
- Motion Detecting Sensor
- LCD
- Regulator
- Relay
- Switch
- Solar Panel
- Battery
- Speaker
- Power Supply Board
- Sound playback module
- Buzzer

4.2. Arduino Uno

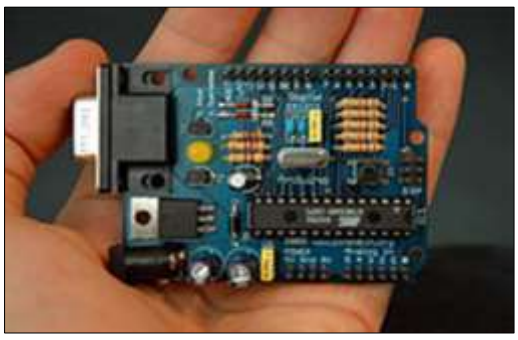


Figure 1 Arduino Uno

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits

4.3. Ultrasonic Sensor

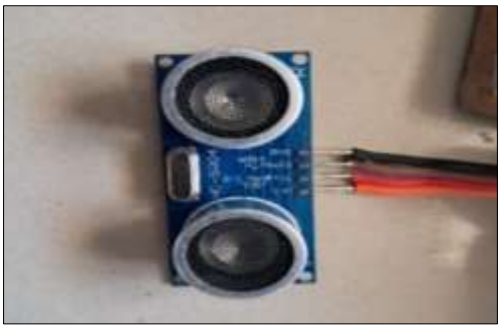


Figure 2 Ultrasonic Sensor

In a solar-powered bird scarer, the ultrasonic sensor serves as the eyes and ears of the device

4.4. Motion detecting Sensor

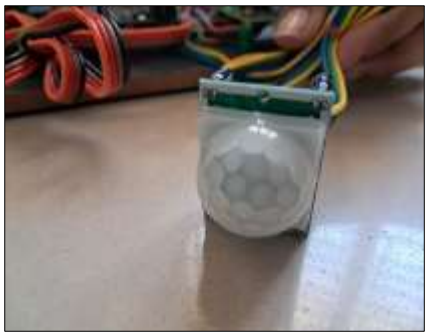


Figure 3 Motion detecting sensor

Incorporating a motion-detecting sensor in a solar-powered bird scarer could be highly effective

4.5. LCD (Liquid Crystal Display)

Figure 4 LCD

A **liquid crystal display** (commonly abbreviated **LCD**) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector.

4.6. Regulator

Figure 5 Regulator

A regulated power supply is very much essential for several electronic devices due to the semiconductor material employed in them have a fixed rate of current as well as voltage.

4.7. Relay

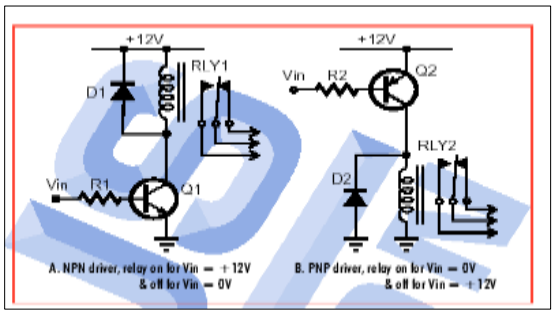


Figure 6 Relay

A **relay** is an electrical switch that opens and closes under the control of another electrical circuit.

4.8. Switch

Figure 7 Switch

In electrical engineering, a switch is an electrical component that can break an electrical circuit, interrupting the current or diverting it from one conductor to another.

4.9. Solar panel

Figure 8 Solar panel

A solar panel in a solar-powered bird scarer is used to harness sunlight and convert it into electricity to power the device

4.10. Battery

Figure 9 Battery

A 12V battery in a solar-powered bird scarer serves as the energy storage unit, storing power generated by the solar panel during the day to be used during times when sunlight is not available, such as at night or on cloudy days

4.11. Speaker

Figure 10 Speaker

The speaker in a solar-powered bird scarer serves as the primary component for emitting deterrent sounds or ultrasonic waves to repel birds from specific areas.

4.12. Power supply board

Figure 11 Power supply board

A power supply board, often found in electronic devices like TVs, computers, and appliances, converts incoming electrical power into the appropriate voltage and current needed for the device to operate.

4.13. Sound playback module

Figure 12 Sound playback module

The sound playback module in a solar-powered bird scarer is a component that emits sounds or ultrasonic frequencies to deter birds from specific areas.

4.14. Buzzer

Figure 13 Buzzer

A buzzer or beeper is an audio signalling device maybe mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke.

5. Design and fabrication process

5.1. Design

Design is the process of creating or planning the structure, appearance, and functionality of objects, systems, or solutions to achieve a specific purpose or goal. It encompasses a wide range of disciplines, from industrial design and graphic design to architectural design and software design. Design begins with a clear understanding of the problem to be solved or the desired outcome. It involves defining the purpose and goals of the design. Develop detailed plans, including specifications, dimensions, materials, and tolerances for each component. Use computer-aided design (CAD) software to create 2D and 3D models. Choose appropriate materials based on factors like strength, durability, and cost. Consider the manufacturing processes required. Design the machine's mechanical, electrical, and electronic components. Plan the manufacturing process, including machining, welding, or additive manufacturing. Ensure that components can be assembled easily. Build a prototype to test the machine's functionality and identify any issues. Make necessary adjustments and improvements. Once the prototype is finalized, proceed with mass production if required. Feedback and testing help improve the design over time.

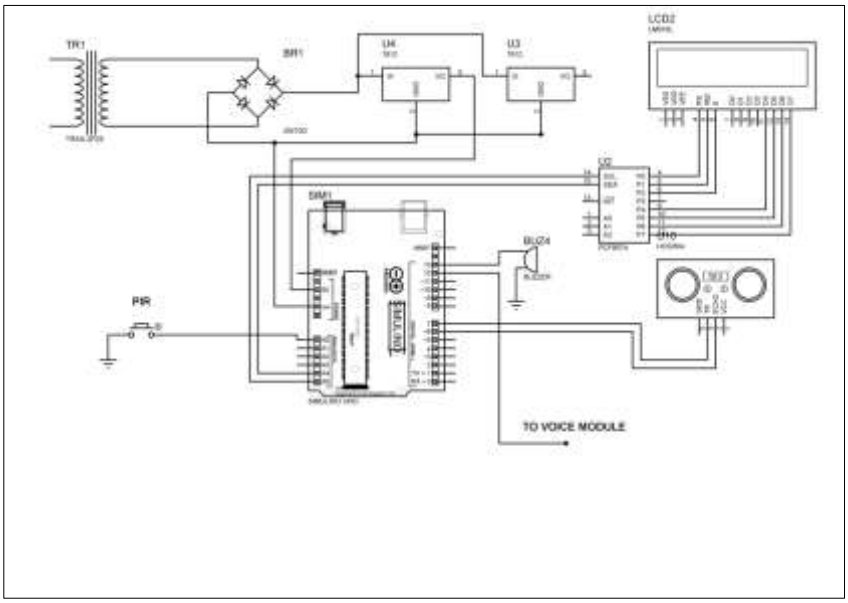


Figure 14 Design of Solar powered bird scarer

5.2. Fabrication process

The fabrication process of a solar-powered bird scarer begins with meticulous design planning, where the specifications and features of the device are defined, and detailed design drawings are created. Once the design is finalized, suitable materials such as weather-resistant plastics for the body, aluminum for structural components, and high-efficiency solar panels are selected. The components are then assembled, with the body of the scarer fabricated according to the design specifications, and the solar panels mounted onto the structure to optimize sunlight exposure. Electronic integration follows, where sensors, microcontrollers, and sound emitters are installed and connected to establish the power system. Thorough testing and calibration are conducted to verify the functionality of electronic components and optimize bird-scaring effectiveness.

5.3. Working principle

The working principle of a solar-powered bird scarer involves utilizing solar energy to power electronic components that deter birds. Solar panels mounted on the bird scarer absorb sunlight and convert it into electrical energy through photovoltaic cells. The generated electricity is stored in batteries or capacitors to provide power when sunlight is unavailable, such as during cloudy days or nighttime. Sensors detect the presence of birds within a specified range or area surrounding the scarer. Upon detecting birds, the electronic components, such as sound emitters or motion-activated devices, are triggered to emit deterrent signals or sounds. The emitted signals or sounds, often high-pitched noises or predator calls, create an uncomfortable or threatening environment for the birds, encouraging them to leave the area. Depending on the design, the bird scarer may operate continuously or intermittently to deter birds effectively

while conserving energy. During periods of sunlight, the solar panels continue to recharge the batteries, ensuring continuous operation of the bird scarer even during extended periods of bird activity.

6. Result and Discussion

6.1. Efficiency testing

The bird scarer works in day time with use of solar energy, in the absence of solar radiation it efficiently work with the help of battery where the electrical energy is stored by using solar panel. The utilization of ultrasonic waves; which human ears don't recognize, however are seen by little winged animals is a novel innovation that can viably repulse such feathered creatures from assigned spots. The bird scarer detects birds up to 10 meter and produces gun shot sound which disturb birds, encouraging them to leave the area altogether. The solar-powered bird scarer operates autonomously, harnessing solar energy to power deterrents that keep birds away from specific areas, such as crops or buildings, without the need for constant human intervention or external power sources.These device offer versatility in application, from protecting agricultural crops to safeguarding infrastructure and property from bird damage. Overall, the fabrication of solar-powered bird scarers represents a practical, cost-effective, and environmentally conscious approach to mitigating bird-related issues while promoting sustainability and efficiency

Figure 15 Fabrication of solar bird scarer

6.2. Efficiency

Table 1 Efficiency Testing of Sensor Response

S.No	Distance(m)	Sensor Response
1.	1	Active
2.	2	Active
3.	3	Active
4.	5	Active
5.	10	Active
6.	15	Not active
7.	20	Not active

7. Conclusion

In conclusion, the fabrication of a solar-powered bird scarer involves careful planning, precise assembly, and thorough testing to ensure effectiveness and reliability. By integrating weather-resistant materials, high-efficiency solar panels, and electronic components, the bird scarer can efficiently harness solar energy to power deterrent mechanisms. Attention to detail during fabrication, including proper alignment of components and thorough testing of functionality, is essential to produce a durable and effective device. Ultimately, the solar-powered bird scarer offers an

environmentally friendly and sustainable solution for deterring birds in outdoor environments, contributing to wildlife management efforts while minimizing ecological impact. Solar-powered bird scarers offer a multitude of benefits that make them a compelling choice for bird control in outdoor environments.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Author's contributions

All authors contributed equally to the conception and development of the work

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