FORM 2

THE PATENTS ACT, 1970

(39 of 1970)

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The Patent Rules, 2003

COMPLETE SPECIFICATION

(See section 10 and rule 13)

TITLE OF THE INVENTION

"SMART SOLAR-POWERED SCARECROW SYSTEM WITH IOT INTEGRATION FOR BIRD DETERRENCE AND MONITORING AND METHOD THEREOF"

Applicant(s)

NAME	**NATIONALITY**	**ADDRESS**
1. Mr. S. Ravindran	Indian	Associate Professor, Department of Mechanical Engineering, Sri Sai Ram Engineering College, Sai Leo Nagar, West Tambaram, Chennai-44
2. Ms. R.Yoghamithra	Indian	Student, Department of Mechanical Engineering, Sri Sai Ram Engineering College, Sai Leo Nagar, West Tambaram, Chennai-44
3. Ms. Anusuya P	Indian	Student, Department of Mechanical Engineering, Sri Sai Ram Engineering College, Sai Leo Nagar, West Tambaram, Chennai-44
4. Ms. Priyanka A N	Indian	Student, Department of Mechanical Engineering, Sri Sai Ram Engineering College, Sai Leo

		Nagar, West Tambaram, Chennai-44

The following specification particularly describes the nature of the invention and the manner in which it is performed:

FIELD OF THE INVENTION

[001] The present invention relates to a Smart Solar-Powered Scarecrow System with IoT Integration for Bird Deterrence and Monitoring and the associated method. This innovation addresses the need for effective bird deterrence techniques to aid farmers in reducing crop damage and alleviating stress. The invention utilizes solar energy to power the scarecrow, thus conserving electricity. The system incorporates IoT technology, enabling real-time monitoring of environmental conditions through mobile applications.

BACKGROUND OF THE INVENTION

[002] Agriculture, a critical pillar of rural economies, is increasingly challenged by environmental changes and wildlife interactions. While birds are essential for pollination and maintaining ecological balance, they also pose a significant threat to crops by consuming seeds and plucking ripe fruits, leading to considerable agricultural losses. Traditional scarecrow methods have been employed to mitigate these threats; however, as avian intelligence evolves, these static deterrents have proven increasingly ineffective. This scenario underscores the urgent need for innovative and technologically advanced solutions that can offer more effective bird deterrence while accommodating the dynamic behaviors of wildlife.

[003] Prior art in this field includes various attempts to enhance scarecrow functionality. Akash Kolhekar et al. (2022) developed a solar-powered scarecrow equipped with motion detectors, loud sound

buzzers, and Wi-Fi cameras, which aimed to improve bird deterrence. Monali Dange et al. (2022) focused on integrating IoT technology for real-time monitoring of environmental conditions, enhancing farming efficiency. However, these systems either lacked comprehensive deterrence mechanisms or faced limitations in adapting to diverse environmental conditions and bird behaviors.

[004] Further advancements have been made with the implementation of automated scarecrows. Dr. P. G. Mehar et al. (2022) proposed automated scarecrows with PIR sensors and movable arms, while other researchers suggested integrating 360º cameras for complete surveillance. Despite these advancements, the traditional approaches often fall short in providing a fully integrated solution that combines advanced deterrence technologies with real-time environmental monitoring and user-friendly operation.

[005] The primary shortcomings of the existing prior art include insufficient adaptability to evolving bird behaviors, limited scope in environmental monitoring, and inadequate integration of modern technologies. Many prior systems lack comprehensive functionality, such as effective movement mechanisms, real-time data analysis, and holistic deterrent strategies that address both visual and auditory threats.

[006] The present invention addresses these limitations by offering a Smart Solar-Powered Scarecrow System with IoT Integration for Bird Deterrence and Monitoring. This system integrates multiple advanced

features: solar power for energy efficiency, IoT technology for real-time monitoring via mobile apps, PIR sensors for accurate bird detection, a 360º camera for comprehensive surveillance, and a variety of deterrent mechanisms including buzzers, lasers, and ultrasonic waves. The system's ability to combine these features into a cohesive, smart solution represents a significant advancement over prior art, providing a more effective and adaptable approach to safeguarding crops from bird damage while minimizing energy consumption and enhancing overall operational efficiency.

SUMMARY OF THE PRESENT INVENTION

[007] The present invention pertains to a Smart Solar-Powered Scarecrow System with IoT Integration for Bird Deterrence and Monitoring, designed to enhance agricultural practices through an innovative bird control mechanism. This system leverages solar energy for operation, thereby reducing electricity consumption and ensuring sustainability. The scarecrow is equipped with a range of features including a solar panel, ultrasonic sensors, a DC motor, a buzzer, and an Arduino board. The ultrasonic sensor detects the presence of birds and triggers a dynamic flapping mechanism controlled by the DC motor, which, combined with a buzzer, provides an effective deterrent. Additionally, the system integrates a 360º camera to monitor the environment comprehensively, ensuring no blind spots.

[008] The invention also incorporates IoT capabilities, allowing real-time environmental monitoring via a mobile app. This functionality

includes data collection from various sensors such as the DHT sensor for humidity and temperature, soil moisture sensors, and raindrop sensors, which facilitate smart irrigation management. By combining these elements, the system not only deters birds effectively but also provides critical information for optimizing irrigation practices, addressing common issues such as bird habituation and sensor sensitivity in extreme temperatures. This multi-faceted approach presents a robust solution for modern agriculture, reducing crop damage and enhancing operational efficiency.

[009] In this respect, before explaining at least one object of the invention in detail, it is to be understood that the invention is not limited in its application to the details of set of rules and to the arrangements of the various models set forth in the following description or illustrated in the drawings. The invention is capable of other objects and of being practiced and carried out in various ways, according to the need of that industry. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of description and should not be regarded as limiting.

[010] These together with other objects of the invention, along with the various features of novelty which characterize the invention, are pointed out with particularity in the disclosure. For a better understanding of the invention, its operating advantages and the specific objects attained by its uses, reference should be made to the accompanying drawings and descriptive matter in which there are illustrated preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[011] When considering the following thorough explanation of the present invention, it will be easier to understand it and other objects than those mentioned above will become evident. Such description refers to the illustrations in the annex, wherein:

Figure 1 illustrates working flowchart associated with proposed method and system;

Figure 2 illustrates perspective view associated with the proposed system, in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[012] The following sections of this article will provide various embodiments of the current invention with references to the accompanying drawings, whereby the reference numbers utilised in the picture correspond to like elements throughout the description. However, this invention is not limited to the embodiment described here and may be embodied in several other ways. Instead, the embodiment is included to ensure that this disclosure is extensive and complete and that individuals of ordinary skill in the art are properly informed of the extent of the invention.

[013] Numerical values and ranges are given for many parts of the implementations discussed in the following thorough discussion. These numbers and ranges are merely to be used as examples and are not meant to restrict the claims' applicability. A variety of materials are also recognised as fitting for certain aspects of the implementations. These

materials should only be used as examples and are not meant to restrict the application of the innovation.

[014] Referring to Figures 1-2, the present invention, titled "Smart Solar-Powered Scarecrow System with IoT Integration for Bird Deterrence and Monitoring and Method Thereof," provides an advanced solution to the persistent problem of avian crop damage. This invention leverages solar energy, IoT technology, and various sensors to create an effective and efficient bird deterrent system that also aids in environmental monitoring for better agricultural practices.

[015] The core of the invention is a solar-powered scarecrow system designed to be autonomous and environmentally friendly. The scarecrow's primary power source is a solar panel, which charges a battery to ensure uninterrupted operation even in remote agricultural settings. This solar power integration eliminates the need for external electrical sources, thereby reducing energy costs and enhancing sustainability.

[016] Central to the scarecrow's functionality is its bird deterrence mechanism, which includes a combination of ultrasonic sensors, a buzzer, and a dynamic flapping mechanism. The ultrasonic sensor detects the presence of birds by emitting high-frequency sound waves and measuring their reflection. Upon detecting bird movement, the sensor activates a DC motor that drives the scarecrow’s arms in a flapping motion. This rhythmic movement simulates a threatening presence, effectively deterring birds from approaching the crops.

Additionally, a buzzer is incorporated into the system to emit loud, alarming sounds that further discourage avian intruders.

[017] To enhance the deterrent effect and ensure comprehensive bird control, the scarecrow system is equipped with multiple sensors and a control board. The Arduino board acts as the central processing unit, receiving data from the ultrasonic sensor and other environmental sensors, and executing appropriate actions based on this input. The system also includes a Digital Humidity and Temperature (DHT) sensor, soil moisture sensor, and raindrop sensor. These components work together to provide critical data about the environmental conditions surrounding the scarecrow.

[018] The DHT sensor measures ambient temperature and humidity, providing farmers with real-time information on weather conditions, which is crucial for optimizing agricultural practices. The soil moisture sensor monitors the moisture level in the soil, allowing for timely irrigation adjustments. The raindrop sensor detects rainfall and adjusts irrigation schedules accordingly, ensuring that crops receive the appropriate amount of water.

[019] The scarecrow is designed with a 360-degree camera that records the surrounding area, providing a comprehensive view of the field without any blind spots. This feature allows for continuous monitoring and assessment of the scarecrow's effectiveness and the overall condition of the crops.

[020] Furthermore, the invention integrates IoT technology through a mobile application that allows farmers to remotely monitor and control

the scarecrow system. The mobile app provides real-time updates on sensor data, operational status, and environmental conditions, enabling farmers to make informed decisions and adjustments from anywhere.

[021] In terms of construction, the scarecrow system employs a robust framework made from galvanized iron and metal sheet components to withstand outdoor conditions. The arms are constructed from ABS plastic to ensure flexibility and durability. The integration of various materials, including aluminum and stainless steel, is optimized for strength, corrosion resistance, and cost-effectiveness.

[022] The proposed scarecrow system also addresses several existing research gaps. It mitigates the issue of bird habituation, where traditional scarecrow methods become less effective over time. By incorporating a combination of ultrasonic waves, alarming sounds, and visual deterrents, the system maintains its effectiveness. Additionally, it addresses energy concerns by utilizing solar power, thus reducing dependence on external energy sources.

[023] In conclusion, the Smart Solar-Powered Scarecrow System with IoT Integration offers a multifaceted approach to bird deterrence and environmental monitoring. By integrating solar energy, advanced sensors, and IoT technology, this system provides a sustainable, effective, and innovative solution for modern agricultural challenges. The combination of these technologies ensures a comprehensive bird control strategy while also contributing to efficient agricultural practices through environmental monitoring and smart irrigation management.

[024] It is to be understood that the above description is intended to be illustrative, and not restrictive. For example, the above-discussed embodiments may be used in combination with each other. Many other embodiments will be apparent to those of skill in the art upon reviewing the above description.

[025] The benefits and advantages which may be provided by the present invention have been described above with regard to specific embodiments. These benefits and advantages, and any elements or limitations that may cause them to occur or to become more pronounced are not to be construed as critical, required, or essential features of any or all of the embodiments.

We Claim:

1. A smart solar-powered scarecrow system for bird deterrence and monitoring, comprising:
    a) a scarecrow body;
    b) a solar power unit configured to supply power to the system;
    c) an IoT module integrated within the scarecrow body for wireless communication and data transmission;
    d) a bird deterrent mechanism operatively coupled to the scarecrow body, including one or more visual or auditory deterrent components;
    e) a monitoring system integrated with the IoT module for capturing data related to bird activity;
    f) a control unit for managing the operation of the deterrent mechanism based on data from the monitoring system; and
    g) a data transmission unit configured to send bird activity data to a remote server or user device.
2. The system as claimed in claim 1, wherein the bird deterrent mechanism includes one or more of: flashing lights, sound emitters, or moving parts.
3. The system as claimed in claim 1, wherein the IoT module is configured to communicate with a mobile application or web-based platform for real-time monitoring and control.
4. The system as claimed in claim 1, wherein the solar power unit includes a photovoltaic panel and a rechargeable battery for storing solar energy.
5. The system as claimed in claim 1, wherein the monitoring system includes a camera or motion sensor to detect and record bird activity.

6. The system as claimed in claim 1, wherein the control unit includes an algorithm for analyzing bird activity data and adjusting the operation of the deterrent mechanism accordingly.
7. The system as claimed in claim 1, further includes a weatherproof enclosure for protecting the electronic components from environmental conditions.
8. The system as claimed in claim 1, wherein the data transmission unit supports multiple communication protocols, including Wi-Fi, Bluetooth, or cellular networks.
9. A method for deterring birds and monitoring bird activity using the smart solar-powered scarecrow system comprising the steps of:
    i. installing the scarecrow system at a desired location;
    ii. powering the system using solar energy;
    iii. activating the bird deterrent mechanism based on pre-set conditions or real-time data;
    iv. capturing bird activity data through the monitoring system;
    v. transmitting the data to a remote server or user device via the IoT module; and
    vi. adjusting the operation of the deterrent mechanism based on the transmitted data.
10. The method as claimed in claim 9, wherein the adjustment of the deterrent mechanism includes modifying the intensity or frequency of the visual or auditory deterrent components based on the bird activity data.

Dated this 22nd day of September 2024

Signature: 

Applicant(s)

Mr. S. Ravindran et. al.

ABSTRACT

SMART SOLAR-POWERED SCARECROW SYSTEM WITH IOT INTEGRATION FOR BIRD DETERRENCE AND MONITORING AND METHOD THEREOF

[026] The invention discloses a cutting-edge solution designed to manage and mitigate bird-related issues in agricultural and other settings. The system features a solar-powered scarecrow equipped with an IoT module, which allows for real-time monitoring and control via a mobile application or web platform. It incorporates a deterrent mechanism, including visual and/or auditory components, to effectively repel birds. The integrated monitoring system captures and analyzes bird activity data, which is transmitted to a remote server for continuous tracking. This smart system adjusts its deterrent actions based on real-time data, ensuring optimal performance and enhanced bird management. The use of solar energy ensures sustainability and independence from external power sources.

Accompanied Drawing [**Figure 1**]

Dated this 22nd day of September 2024

Signature: 

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Mr. S. Ravindran et. al.