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# Solar Based Crop Protection System.

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**ABSTRACT:**

The automated animal detection solution aims to address a significant issue in agriculture that arises when various animals damage field crops. This cutting-edge system uses technology to provide a compassionate and effective crop defence solution. Since they can't keep an eye on everything all the time, the farmer suddenly gets an electronic security system to go with their fields. Farmers are protected against animal encroachment by this system, which provides 24/7 surveillance. When the device detects a buffalo in the distance or a flock of birds approaching the crops, it instantly activates. The warning alert that the system emits acts as a constructive deterrent for animals to leave. Compassionately treating farmers and animals with respect is part of this solution. Farmers can stay informed by using instant notifications to monitor their land from any location. This system protects a farmer's investment through effective crop protection, improves agricultural sustainability, and serves as a crucial component of food security. This system's potential integration of laser fencing demonstrates its adaptability to changing farm needs. This development represents a step forward in integrating human farming practices with the natural ecosystem, resulting in harmonious interaction between local animals and rural residents.

**Keywords**: ESP 32, Solar Panel, Battery, Power Supply, LDR Sensor, GSM, Relay, Buzzer.

## 1. Introduction :

The Solar-Based Crop Protection System presents an environmentally friendly and creative approach to safeguard agricultural crops against animals through solar panel management. The solar-based system lowers costs while minimising environmental effects on operations. The detection system operates 24 hours a day to protect herds of animals including cows along with elephants. The system defends against approaching animals through the emission of benign laser beams and quiet sounds which do not result in injury.

The operation benefits from smooth performance through the combination of smart sensors connected to laser technology which a microcontroller manages. Farmers gain instant mobile notifications that let them take immediate action even when they are not at the site. The system creates a sustainable farming landscape because it does away with dangerous chemicals.

This solution protects agricultural produce and farmer earnings through its approach of promoting safety between wildlife and agricultural operations.

## 2. Literature review :

The table below provides a comparative analysis of research papers focused on Solar-Based Crop Protection System. It highlights the authors, titles, publication years, along with the advantages (pros) and limitations (cons) of the proposed methods and technologies in each study.

**Table 1 – Comparative Analysis of Research**

| Sr. No. | AUTHOR | TITLE | YEAR | PROS | CONS |
|---|---|---|---|---|---|
| [1] | Mohit Korhe, Sarthak Tokse, Shubham Shirbhate | Smart Crop Protection System | 2021 | Utilizes PIC Microcontroller for motion detection, effective for crop monitoring and protection. | Limited to motion detection, may not deter all types of animals |
| [2] | Mohini S. Lohakare, Subhash Y. Kamdi, Subroto Dutt | Smart Protection System to Manage Crop Vandalization | 2022 | Employs solar fencing, IoT monitoring, motion sensors, and GSM alerts, uses renewable energy | Requires multiple components, system complexity may affect maintenance and reliability |

| | | | | | |
|---|---|---|---|---|---|
| | | Using Renewable Energy | | | |
| [3] | B. Mono, T. Vimal Raj, R. Ramkumar, M. Vishwa, M. Srindhar | Laser Fencing in Agriculture Fields | 2024 | Uses Laser-based virtual fencing, GSM, IR sensor, IoT, and cameras, efficient day-night animal detection | System cost and power dependency could limit accessibility |
| [4] | Jaya Rubil, Shivani V, A. Josephin Arockia Dhivya | Crop Protection Methods in Agricultural Fields | 2024 | Integrates computer vision and deep learning for animal detection, uses ultrasonic repellents and mobile apps | May struggle with accuracy in complex environments, requires training data sets |

[1] The issue of crop vandalization by animals has been a persistent challenge in the agricultural sector, prompting researchers to explore various smart protection systems. In the paper "Smart Crop Protection System" (July 2021) by Mohit Korche, Sarthak Tokse, and Shubham Shirbhate, a motion detection system using a PIC Microcontroller was developed for crop monitoring and protection.

[2] Building on this concept, the paper "Smart Protection System To Manage Crop Vandalization Using Renewable Energy" (March 2022) by Mohini S. Lohakare, Subhash Y. Kamdi, and Subroto Dutt introduced a multifaceted approach including sound systems, solar fencing, IoT-based monitoring, and noise-repellent devices. It employed technologies such as Arduino, PIC Microcontroller, Raspberry Pi, and GSM modules for real-time detection and alerting farmers.

[3] Further advancing the field, the paper "Laser Fencing in Agriculture fields" (January 2024) by B. Mono, T. Vimal Raj, R. Ramkumar, M. Vishwa, M. Srindhar proposed a laser-based virtual fencing system integrated with GSM, IR sensors, solar power, IoT, and day-night vision cameras to detect and deter animal intrusions.

## 3. Problem Statement :

"India's economy relies heavily on agriculture, yet a significant challenge faced by farmers is the constant threat of animals encroaching on farmland and damaging crops. Despite advancements in other sectors, there is a noticeable lack of efficient, affordable, and accessible system that can actively prevent such intrusions in real-time. To address this gap, we propose a highly responsive and intelligent crop surveillance system, designed to not only detect but also deter animals before they cause any damage. This smart system combines the power of multiple modern technologies including motion sensors, a laser boundary, a microcontroller, a GSM communication module, and even the potential integration of solar power and night vision capabilities for uninterrupted 24/7 operation. The crop mechanism begins when any intruding animal crosses the laser-defined perimeter, triggering infrared or motion sensors that immediately relay data to the microcontroller. Acting as the brain of the system, the microcontroller analyses this input and simultaneously activates a buzzer to startle the animal while also triggering the GSM module to send out an SMS alert and place an automated phone call to the farmer, ensuring instant awareness of any branch. In addition, the Light Dependent Resistor (LDR) sensor plays a vital role in differentiating between day and night, allowing the system to adjust its response mechanisms accordingly, such as enabling infrared lights or night vision cameras during dark hours for better visual monitoring. Solar panels could provide sustainable energy, allowing the entire setup to remain eco-friendly and functional even in remote areas with limited electricity. Overall, this integrated system serves as a proactive and technologically advanced solution to a long-standing issue, reducing the risk of crop loss, improving agricultural productivity, and ensuring peace of mind for farmers who can now monitor and protect their land remotely and efficiently."

## 4. Objectives :

1. To develop an automated system that protects crops from pests and animals using laser deterrence.
2. To reduce manual labor and human intervention through real-time detection and automated response.
3. To utilize solar energy as a renewable power source, ensuring eco-friendly and continuous operation.
4. To enhance crop yield by preventing damage caused by intruders.
5. To design a cost-effective and energy-efficient solution suitable for rural and off-grid agricultural areas.

## 5. Discussion :

To keep pests and animals out of crop fields, this system uses controlled laser beams that flash in specific patterns or at intervals. These lasers scare off birds and small animals without harming them. Because the system runs automatically and continuously, it provides reliable protection–especially in large or remote areas where constant monitoring isn't practical. By adding sensors, the system becomes even more efficient. It can detect movement or

intrusions and only activate the lasers when needed. This saves energy and reduces unnecessary use. The lasers are low intensity and non-lethal, so they're safe but still effective making them a solid alternative to using chemicals or building physical barriers. In the big picture, this kind of innovation supports sustainable farming. It cuts down on labor, lessens environmental harm, and fits right in with growing push for smart, eco-friendly agriculture.

## 6. Conclusion :

The automated animal detection system gives farmers the ability to fight crop losses from animals while maintaining high standards of compassion and sophistication. This electronic device operates as a field monitor along with sound emissions to repel buffalo and birds in non-harmful ways. The system alerts farmers quickly so they can take action immediately, although they are not physically nearby. This system helps farmers work without manual surveillance and it protects their crops and ensures animal welfare. Using this method eliminates dangerous techniques from farming by establishing a secured food supply and environment-friendly agricultural practices. The system delivers adapted features that match new demands in the agricultural sector especially through its laser fencing tool. The technological solution creates a connection between modern agriculture with natural ecosystems while maintaining this beneficial relationship.

**REFERENCES:**

[1] M. Jaya Prabha et al, Smart Crop From Advanced Animals International journals of Engineering and Technology (UEAT)ISSN:2249, issue – 4 April, 2023 PP(2264-2267)

[2] Sonal D. Khandare, et al. "A Review on solar power fencing based on GSM technology for agricultural International journal for engineering applications and technology." Vol 3 issue 9, 2017, PP (1-4) ISSN:2321-8134

[3] Atchaya. V, et al, "Implementation of crop Protection System again wild animal attack" Department of ECE Senguinhor Tirachengodw, International journal of Advance Technology in Engineering and Science." Vol 7 issue 2, February 2019 PP (21-28) ISSN 2348-7550

[4] Omkar Kekre et al, "Ethical crop protection" Department of Electronics Engineering Nagpur, International Research Journal of Engineering and Technology, Vol 07 Issue 05, May 2020 PP (1176-1178), ISSN:2195 0056

[5] Srikanth N. et al, "Smart crop protection system from animal and fire using Arduino Assistant Professor and UG student dept. of ECE, RYMEC Ballari." International Journal of Engineering research in Electronics and communication. Vol 6 issue 4, April 2019, PP (17-21) 2394-6849

[6] Rahman F., Islam J., Rahman F., & others (2024). A solar-based comprehensive agriculture system featuring smart irrigation, weather station and disease detection. Proceedings of the 2024 International Conference on Power control and Energy Systems. IEEE. https://ieeexplore.ieee.org/abstract/document/10653592/

[7] Bhosale A. S. & Patil A. (2021). Design and development of solar-powered pest control system using ultrasonic sound. International Reasearch journal of Engineering and Technology, 8(5), 1421-1425. https://www.irjet.net/archives/V8/i5/IRJET-V8i5309.pdf

[8] Satpute A. V. & Kadam S. V. (2020). Smart agriculture using solar energy. International Journal of Scientific & Engineering Research, 11(2), 1003-1007. https://www.ijser.org/onlineResearchPaperViewer.aspx?Smart-Agriculture-Using-Solar-Energy.pdf

[9] Yadav A. K. & kumar A. (2020). Solar-powered agricultural pest control system. International Journal of Engineering Applied Sciences and Technology, 5(3), 41-45. https://ijeast.com/papers/93-100.pdf

[10] Raut R. M. & Padole P. (2019). IoT and solar-based insect trap for precision farming. Journal of Emerging Technologies and Innovative Research, 6(5), 457-461. https://www.jetir.org/papers/JETIR1905D93.pdf