Intrusion Detection and Prevention for Agricultural Land

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Abstract— The coexistence of humans and wildlife has become increasingly complex due to habitat encroachment and urbanization. As a result, mitigating conflicts and ensuring the safety of both humans and animals has emerged as a critical challenge. This research paper proposes a novel Smart Intrusion Detection System (SIDS) specifically designed to address the issue of wildlife intrusion into agricultural fields.

The system incorporates various sensors, including thermal imaging, motion detection, and acoustic sensors, strategically deployed to detect the presence of wild animals in real time.

Furthermore, the SIDS incorporates a smart alerting mechanism that promptly notifies relevant authorities and residents upon intrusion detection. The basic ideology behind this project is" Prevention is far better than Cure" thus, predicting the presence of animals near the crop fields and alerting the farmer to protect their crops.

Keywords—— Animal detection, Prevention, Sensor, Intrusion, Crops

I. INTRODUCTION

Agricultural lands play a crucial role in ensuring food security and sustainable development. However, the vulnerability of these lands to various forms of intrusion poses significant challenges to crop security and productivity. Unauthorized access by humans, livestock, and wildlife can result in crop damage and huge economic losses for farmers. Traditional approaches to agricultural security were limited to physical barriers and manual surveillance which involved huge labour. Hooliganism of crops is becoming more prevalent in agricultural states, such as Uttar Pradesh, Rajasthan, Punjab, Bihar, Tamil Nadu, etc. Elephants, buffaloes, blue buck, monkeys, and deer invade the field and destroy the crops. Thus, with the help of an Arduino-based detection system, we can identify various types of animals restricting them to enter our agricultural fields, thus protecting our crops without harming them.

II. OBJECTIVE

Electrical fencing is one of the most used methods for protecting crops from wild animals; in some areas, farmers burn elephant dung or other materials to generate thick smoke to restrict animals from entering the crop fields, which results in air quality issues. But with the use of smart intrusion detection systems, manual labor can be avoided. The objective of this project is to make sure that the interference of animals is restricted in the field so that damage to the crops can be eliminated. We also have to keep in mind that animals don't get harmed in the process and crops can be saved, so it could be a win-win situation, thus reducing human labor and using technology to enhance the use of technological advancements in agriculture.

III. SCOPE

This system aims to prohibit domestic animals from accessing the farmlands. It also protects crops from animal damage. It is used to detect animal interference, warn the farmer and protect the crops from wild animals by using various types of sensors. The Arduino module is used to submit a prior warning to the farmer. When the sensor is activated, a buzzer sound is generated, resulting in wild animals fleeing from the field's entrance. The biggest benefit of this project is its low-consumption model.

IV . Methodology

Arduino Uno Board is the core component of this project. The infrared sensor, sound sensor, and piezoelectric sensor are interfaced as input to the board. Within the range of 10 meters, these sensors sense the movement of animals trying to enter the field. When movement is detected in this area, the led and buzzer goes to high mode. In some cases, water from the water sprinkler is generated. The infrared sensors are the radiation-sensitive component that detects the radiation from the intruder which is reverted to the sensor from which the distance of the intruder is detected. The sound sensor used in the project converts sound waves to electrical signals. It
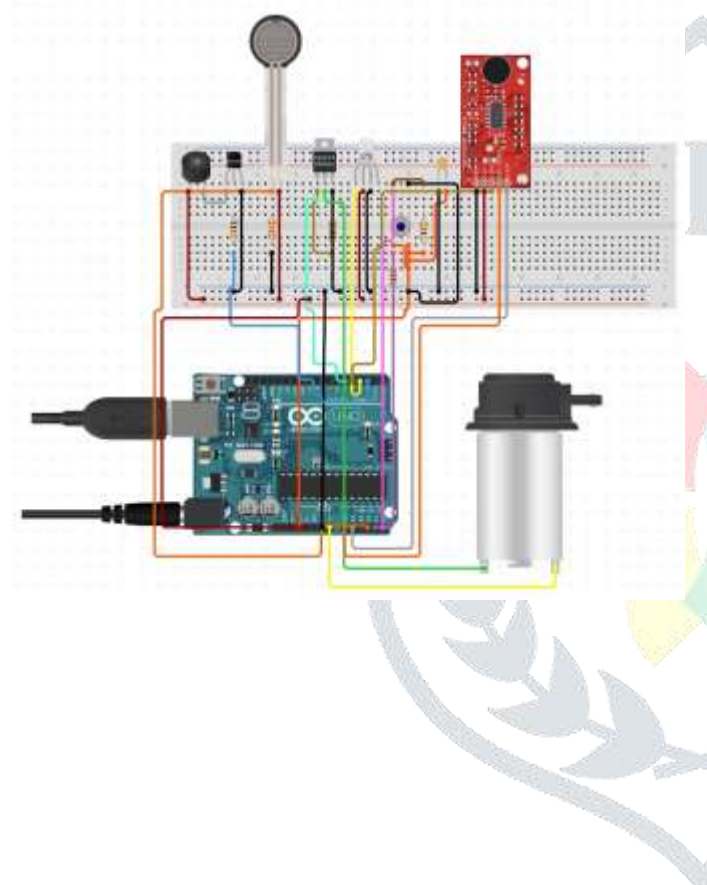
detects the sound produced by the animal and then matches it with the data given in the Arduino code.

Another sensor used in the proposed system is a piezoelectric sensor which senses the amount of pressure produced by the animal around the agricultural land. The intrusion is made by animals, these sensors get activated resulting in turning on the LED and the buzzer producing a cracker sound and bright light which scares the animals preventing their entry into the farmland.
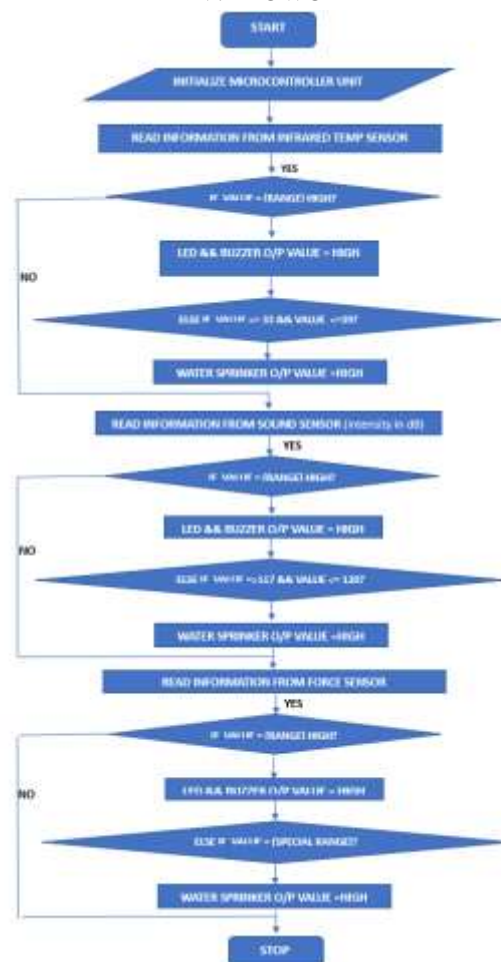
A water sprinkler is used to restrict elephants and blue cow entry into the field.

The proposed system is classified into three parts-

Arduino part, Sensor part, Alarm part. One infrared temperature sensor, one sound sensor, and one piezoelectric sensor(FSR) make up the sensor portion which aids in the detection of animals near the crop area. The LED, buzzer, and water sprinkler come under the alarm part.

V. FLOWCHART

VI. HARDWARE

The Arduino UNO, also known as AT mega 328p, is the core component. It's an 8-bit RISC microcontroller with high performance and low power consumption. The infrared temperature sensor MLX90614 is used to detect the body temperature of the animals. The sound of the animals is detected by REES52 sound sensor. A piezoelectric sensor also known as FSR or Force Sensitive Resistor is used to detect pressure exerted by animals.

Generic LED and high-pitch buzzers are used as an output to prevent intrusion.

VII. RESULT

The first infrared temperature is placed at a distance of 2-5cm(app.), The second piezoelectric sensor(force sensor) and sound sensor are placed at ground level to detect the animals like elephants, blue buck, etc., when the intruding animal is detected, all these sensors detect sound produced in dB, body temperature radiated by animals, pressure exerted by animals respectively.

Once the animals are detected, an artificial crack sound is produced by a buzzer to make the animals runway from the field preventing damage to crops. No external power supply sources are required as they all can operate using Arduino.

VIII. CONCLUSION

The protection of agricultural lands from intrusions is vital for ensuring crop security, maximizing crop yields, and promoting sustainable food production. This research paper

has explored the development and implementation of an Intrusion Detection and Prevention (IDP) system specifically designed for agricultural environments. This system does not wait for farmers to reach the field and prevent the animals from damaging the crops. Instead, a buzzer sound and LED bright light are used to prevent the animals from entering the fields

IX. FUTURE SCOPE

Machine learning algorithms can be used to detect different types of animals using a dataset. Detection of every type of animal along with their voice can be obtained in further study work. Optical fiber sensors can be used as a power efficiency measure when we are using machine learning concepts.

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