Ethical Crop Protection

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Abstract - The problem of wild animals raiding crops is increasing day by day and has become a very common issue for farmers. Due to this problem sometimes the farmers decide to leave the area barren rather than growing crops in it. Various methods are currently followed to scare the animals away. But not all are efficient. In this project we try to propose an efficient solution in which the animal can be detected by using PIR, Accelerometer sensor and Thermal Camera Sensor. After detection the sensors will send signals to the controller and controller will actuate lights and create a noise which will scare away the animals.

Key Words: IOT in Agriculture, Thermal Imaging, Wildlife-friendly farming

1. INTRODUCTION

Wild animals pose a challenge for farmers throughout India. Animals such as deer, wild boars, rabbits, elephants, monkeys, and many others cause serious damage to crops. They damage the crops by feeding on them or by just running over the field and crushing the crops. Therefore, wild animals easily cause significant yield losses and financial loss to the owners of the farmland. Another aspect is to consider that wild animal crop protection requires a particularly cautious approach i.e. while implementing crop protection, every farmer should be aware and take into consideration the fact that animals are living creatures and need to be protected from any potential harm.

The project utilizes PIR, accelerator and thermal camera modules to identify moving animals. The PIR can detect moving animals in the range of 5-6 meters and Accelerometer sensor can detect moving animals once it touches the wires around the field and thermal camera can detect wild animals through thermal imaging upto 7 meters. Sensors will sense and send a signal to the controller. Controller will receive the signal and actuate flash lights and create irritating sound for animals.

2. LITERATURE SURVEY

Some farmers use fencing while some prefer using natural protection measures instead of mechanical or chemical protective practices. There are various ways to protect crops from wild animals, including:

1. Agricultural fences
   - Wire fences
   - Plastic fences
   - Electric fences
2. Natural repellents
   - Smoke
   - Fish or garlic natural emulsion
   - Chilli peppers
   - Lavender and beans
   - Egg based repellent
3. Chemical repellent
4. Biophysical barriers
5. Electronic repellent

These existing systems that the farmers use are not effective and accurate. These systems are ineffective in warding off the wild animals, but also cause harm to wild animals which is not at all ideal. Many wild animals are killed due to the use of these methods.

Wild Animals	Number	Per cent
Rats	19	31.67
Monkeys	40	66.67
Porcupine	16	26.67
Wild Boar	47	78.33
Barking Dear	31	51.67
Parakeets	23	38.33
Langur	13	21.67

Figure-1: Field survey of animals involved in Crop Damage in 1 hectare [5]

3. PROPOSED METHOD

We are proposing a three layer wild animal detection system. First layer will be of PIR sensors, the second layer will be wired fence with accelerometer modules attached to the fence and the final layer will be of thermal camera deployed approximately in the centre of the field.
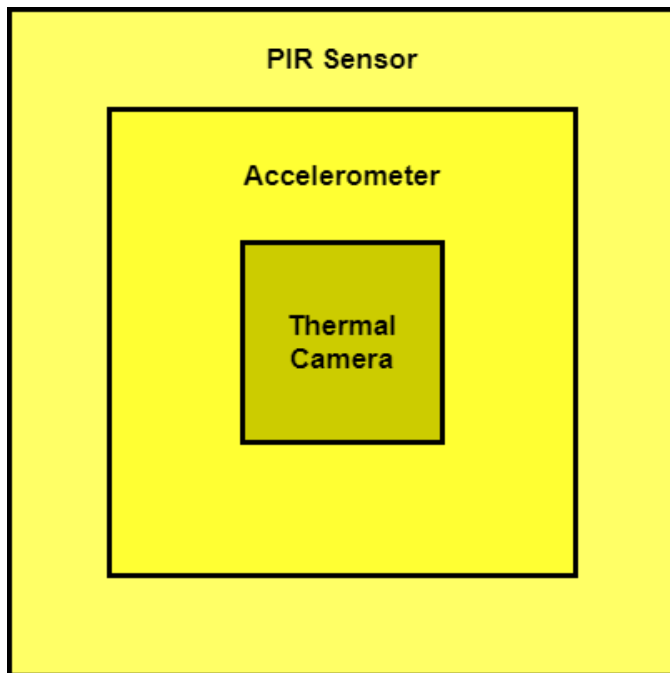
Fig -2: Actual Field Deployment Diagram

PIR

PIR sensors detect infrared radiation emitted by or reflected from objects. Because of this property of detecting infrared rays they are used to motion detection of objects. They are small, inexpensive, low-power, easy to use properties also they don't wear out. The PIR sensor was the preferred sensing modality due to its passive nature, relatively low cost, wide commercial availability and the ability to operate in the absence of visible light. The PIR detects objects upto the range of 5-6 meters. The Raspberry Pi senses the signal generated by a PIR sensor detecting the presence of objects not at thermal equilibrium with the surrounding environment. On detecting the presence of any wild animal in any specific time interval, it sends the signal to the Raspberry Pi module.

Accelerometer sensor

We used the accelerometer because it is very useful in detecting the vibrations of the fence wires. The accelerometers are used to detect the movements caused in the fence around the field whenever the wild animals touch the fence wires. The accelerometer detects wild animals upto 20 metre maximum. Thresholds are fixed for the accelerometers for each of the three axes gx, gy, and gz. It has 3 axes gx, gy, gz, whenever there is a small vibration due to contact and there are variations in the continuous running values which is obtained from the

sensor, and if these values cross the threshold values it sends a signal to the Raspberry Pi module. In this way the accelerometer detects the wild animals entering the farmland.

Thermal Camera

The thermal camera we are proposing is Adafruit AMG8833 IR Thermal Camera. It can measure temperatures ranging from 0°C to 80°C (32°F to 176°F) with an accuracy of +- 2.5°C (4.5°F). It can detect a human from a distance of up to 7 meters (23) feet. We designed a thermal feature extraction algorithm for the classification of objects. We choose thermal signature for classification as it represents heat characteristics of the animals and to a certain extent is invariant to scale, translation and posture. The thermal signature was parameterized using the discrete cosine transform to calculate a feature vector used for further classification. Animals were distinguished from non-animals by using a k-nearest-neighbor classifier with an accuracy of 82.7%. On detecting the animal using thermal imaging, it sends an alert to the Raspberry Pi module.
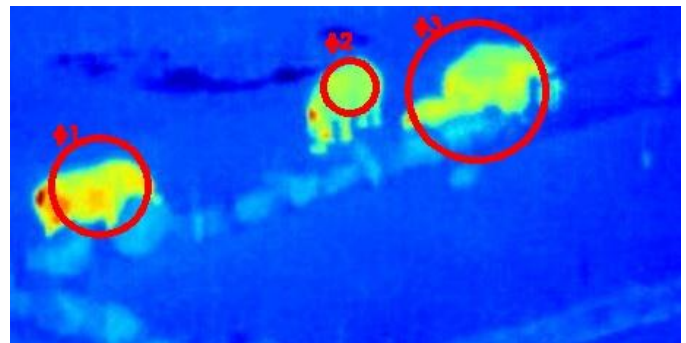

Fig -1: Wild Boar Detection using Thermal Imaging

Raspberry Pi

Our system consists of three sensors to sense the animal movements. Sensors will continuously monitor the field. If it detects an animal, the sensor will send the signal to the Raspberry Pi module. Once the Raspberry Pi module gets the signal it will actuate a combination of sounds and bright lights which will scare away the wild animals.
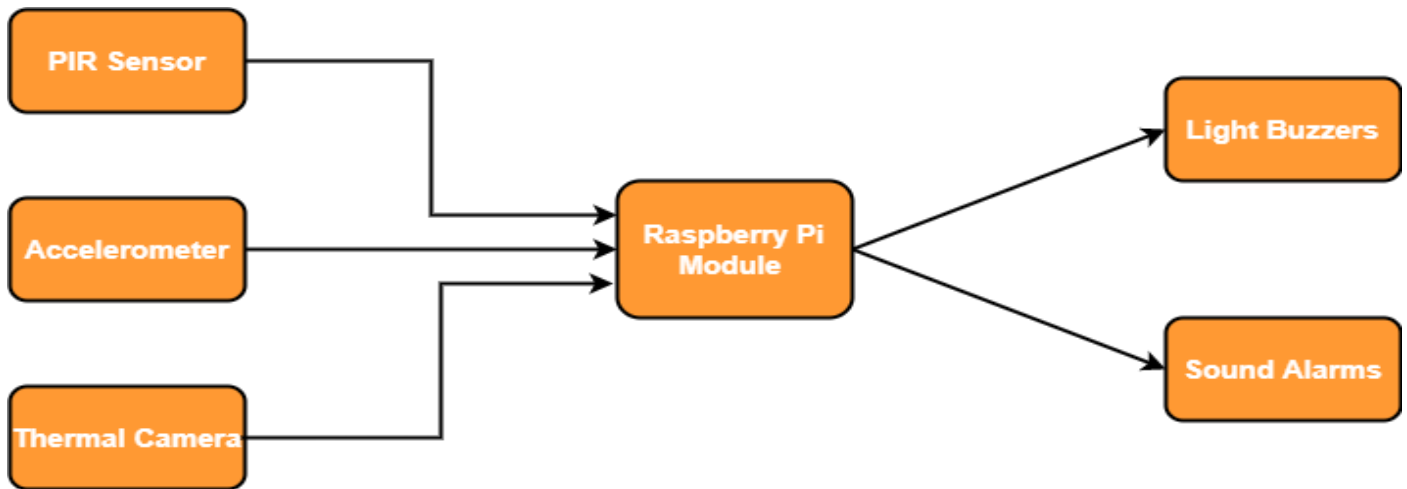
Fig -4: Block Diagram of Proposed System

4. CONCLUSION

In this paper, we presented an integrative approach in the field of Internet of Things for ethical crop protection based on low power devices. The goal of this work is to provide a repelling and monitoring system for crop protection. We have a triple layer protection system which makes our system highly reliable, uses less power and modules are easily available in the market at low cost. In the future we plan to make our system more cost effective, accurate and efficient.

5. REFERENCES

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