

Virtual Fencing for Crop Fields

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ABSTRACT-The protection of agriculture farm from wild animals is really challenging task. In existing system, the fence is electrified to protect the farm from wild animals. But in this proposed system, IR sensor and detector based wireless sensor networks are arranged in the circumference of the farm. So, any wild animal tries to move towards the farm, the IR virtual fence detect the interference of the wild animals and threaten the animals via buzzer and virtual fire setup. In this project, the power to the electric fence is given only at interference time, so the wastage of power in the ideal condition is totally avoided. By using this system, we save the power as well as protect the agriculture farm from wild animals. In addition, alert message is given to farmers via Bluetooth when the PIR sensor detects the presence of human. The whole process is carried on using Arduino UNO which provides the following standard features: 4K bytes of flash, 128 bytes of RAM, 32 I/O lines, two 16-bit timer/ counters, a five vector two – level interrupt architecture, a full duplex serial port, on – chip oscillator and clock circuitry.

KEY WORDS: IR sensor, virtual fence, wireless sensor network, Arduino UNO, PIR sensor, Bluetooth.

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I. INTRODUCTION

Most farmers like to plan their yields before the beginning of each crop year; however, some farmers choose not to participate in the plan. Whether farmers plan their potential production or not, there are still certain expectations. While hoping for the best, farmers often face a variety of challenges and barriers that force them to constantly question their productivity and, at the end of the day, their success.

Usually, the most important thing is to protect crops from diseases, parasites and weeds, as well as protecting against adverse weather events; however, farmers are also confronted with another interesting challenge, which is usually forgotten or unconscious. Wildlife is particularly challenging for farmers around the world. Deers, boars, rabbits, moles, elephants, monkeys, and other animals can cause serious damage to crops. They can feed on plant parts, or just run into the fields and stomp on crops, damaging plants. As such, wildlife can easily cause major yield losses and other financial problems. Another consideration for protecting wildlife cultures requires special care. In other words, each farmer should be aware that animals must be protected from being killed when eating their crops.

The population of wildlife is greatly intimidated by the changing human behaviour by means of vigorous natural resource accession and topographical changes. There has also been an increase in conflicts between human beings and wildlife. As a result of this a lot of resources have been compromised and need for compensation has increased. This has created a major hurdle for effective management of resource as well as wildlife conservation. In addition, theft of farm produce and livestock and farm equipment is at rife. Hence, a system to identify the culprits and to alert the owners of presence of intruders is essential. Be it wild animals or human intruders, the proposed system provides an apt solution. Property, human lives and wildlife conservation can be achieved by means of the proposed virtual fence system. Various methods have been adopted previously to ward off wild animals and intruders in Indian farmlands. Some of them were rifle-guns, and electric fences, beehives with live bees and scarecrows, out of which, many caused large scale destruction to human as well as animal lives. As technology improved, many bloodless solutions have been realized. Among them many were ineffective as they did not take physical, technological, climatic factors into consideration. Particularly, since elephants are large in size, it is difficult to protect ourselves against them. So a psychological understanding of their behaviour is important. As a simple solution to all these problems and as an amalgamation of systems to provide a single system to protect farmlands from wild animals as well as from intruder and the concept of virtual fencing emerged.

Agriculture and animals are two crucial factors for ecological balance. Human-wildlife conflict is increasing day-by-day due to crop damage and livestock depredation by wild animals, causing local farmer's economic loss resulting in the deepening of poverty. Techniques are needed to stop the crop damage caused by animals. The most prominent technique used to protect crops from animals is fencing, but somehow, it is not a

full-proof solution. Most fencing techniques are harmful to animals. Thousands of animals die due to the side effects of fencing techniques, such as electrocution. This paper introduces a virtual fence to solve these issues.

On the other hand, data compiled by the Wildlife Conservation Society (WPSI), a non-governmental organization in India, showed that due to deliberate and accidental electrocution between 2010 and 2020, about 1300 wild animals were electrocuted across India. There are over 500 elephants, 220 flamingos, 150 leopards, and 46 tigers throughout the country.

Various reports indicate the death of animals through fences. Several types of agricultural fences exist. Successful farmers are always looking to use one of these five techniques to determine a satisfactory level of protection for wildlife crops. The result of rising global population has led to higher food production demand. Farms are always under threats of attacks from various animals, insects and birds. Due to the expansion of cultivated land into previous wildlife habitat, crop raiding is becoming one of the most common conflicts antagonizing human-wildlife relationships.

Automated systems are part of the agricultural processes leading to high yield and maintaining good quality of the crop. These systems are easily available and adaptable by the farmers. Wireless Sensors Networks (WSN) has been emerging in the last decades as a powerful tool for connecting the physical and digital world. They can be used in challenging locations where it is inconvenient for human to be present.

II. OBJECTIVES

The main objective of the project is to provide a system which will help in detecting and diverting the animals that intrude into the crop field. The farm intrusion detection system can be installed at the nodes in the crop field. The nodes in the crop field are equipped with IR sensors, PIR sensor, vibration sensors, sound generating devices, light flashers, fan and Bluetooth module. The IR sensor is used to detect the intrusion of animal into the crop field and the vibration sensor is to detect the vibration caused by movement of animals. The PIR sensor is used to detect the presence of human beings. The response of these sensors can be viewed in LCD display. The presence of humans can be indicated to the farmers in the crop field through a smartphone app via Bluetooth and GPS. The output is given in the form of sound and virtual fire.

By this system we can increase the crop yield in the farm areas near to the forest and we can reduce the human-animal conflict.

III. EXISTING SYSTEM

[1] Human-wildlife conflict (HWC) is a term that is commonly used by conservationists and wildlife managers to describe problematic situations between wild animals and people. The conflict emerges when wildlife and humans' requirements overlap, with consequential costs to people and wild animals. Wildlife species negatively impact upon the food security and livelihood of affected people, while people become hostile towards wildlife around their communities. Wildlife species, such as elephants, lions, crocodiles and hippo's invade human settlements and raid crops, cause damage to personal belongings, injure or kill livestock and can even injure or kill people.

[2] Fences are made out of strong (artificial) material and erected to create a physical blockade between elephant habitat and human settlements. In southern Africa, trial and error has led to the design of most effective and efficient fences.

Non-electric fencing: Strong, non-electrified fences have been used successfully to restrict elephant movements in many parts of Africa and Asia. These fences are usually built with wooden or steel poles driven vertically into the ground. Heavy gauge wire or cable is strung between the poles and drawn tight. While these fences do meet with some success, they can be expensive to erect and maintain.

Electric fencing: Electric fences come in a variety of designs, and have been used to protect small farms, enclose entire wildlife reserves, or deflect animals away from specific areas. Elephant fences are usually high-voltage and incorporate a number of design features, including extra pole wires, to protect them from elephant attacks. Elephants are notorious at seeking out the weak points of fences. The materials, installation and maintenance costs make electric fencing impractical for applications in poorer developing countries unless funded by international aid agencies. In addition, equipment such as solar panels, energizers, batteries and wire are all desirable materials, and there is a high risk of theft.

Single-strand fencing Electric fencing: These kinds of fences can be adapted to rural conditions, and by cutting down on building costs, can become more affordable. For example, it is possible to construct a fence with just a single live strand and hang it from bush poles instead of metal stanchions. This cuts costs considerably, but

there is still a need for insulators, solar panels and batteries. In South Luangwa, Zambia, small community plot fencing failed because despite community ownership, there were problems maintaining the fence in a working state.

The electric fence used to protect the crop field will be sometime hazardous to both human and animals. Vision based surveillance system will fails to capture the animals when they are hidden through bushes. In case of human encountering the animal there may be a high probability of loss of life. The proposed system will be a multi sensor-based approach, which is highly efficient in detecting animal movement. Virtual fire only intimidates the animals, thus harming none. Safety is ensured to both human and animal.

IV. PROPOSED SYSTEM

4.1 DESCRIPTION

The Virtual Fencing for Crop Fields is a device which can be used to detect the intrusion of animals into the crop field and helps to divert them but threatening with various responses. This System consist of three different sensors namely PIR, IR, vibration sensor. These sensors are connected to the Arduino Uno. The output can be viewed in the LCD display (16*2). This system also consists of Bluetooth module which will help to give an alert message to the farmer in the field in case of any unusual enter of humans into the field. The alert message is given through an app that works on GPS. Buzzer and virtual fire circuit turns on by the detection of animals.

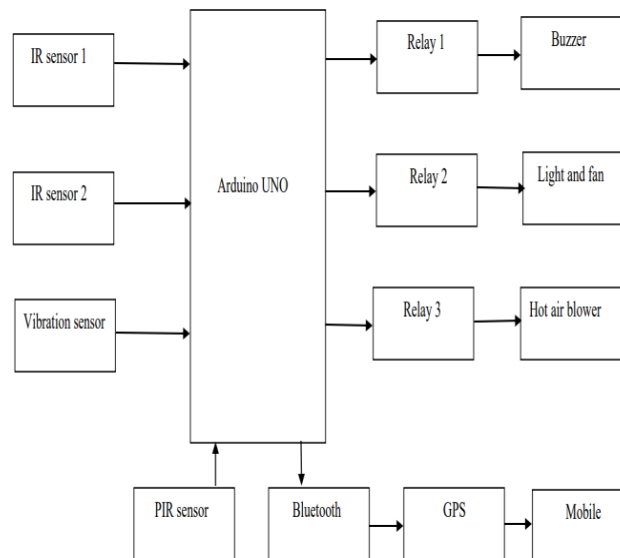


Fig.1 Block diagram of proposed system

4.2 WORKING

First the IR sensor1 and IR sensor2 is implemented to detect the motion of animals by infrared radiation emitted by the animals and then the vibration sensor is used to detect the vibration produced by movement of the animals. These inputs are processed in the Arduino UNO and by result the relay turns on. The relay act as an electrical switch, when the sensors detect the animal, the relay closes and the buzzer and the light and fan circuit which is employed for the virtual fire effect turns on and these response helps to threaten the animals. The PIR sensor employed will detect the presence of human and helps to alert the farmer by an alert message.

This can alert the person whose device is connected to the system and helps them to monitor. The Virtual Fencing for Crop Fields is important has it helps as to monitor the farm fields by detecting the intrusion of animal in the fields. The alert message is provided when there is an unwanted entry of humans into the fields. So, this system helps as to increase the crop field by detecting and diverting the animals. The alert message is given through app that works in Bluetooth.

The 230v is given to the system and the stepdown transformer, step down the voltage to 15v. A bridge rectifier is used to convert the AC voltage to DC voltage. A capacitor filter is used to remove the ripples in the DC voltage. Two voltage regulators of 12v and 5v are used. The 5v is provided to the sensors, Arduino Uno, buzzer, virtual fire circuit and LCD display. 12v is provided to the relay and Bluetooth module.

All the sensors are placed on the nodes in the agriculture fields. The output of the sensor is spread into the Arduino uno where the data is processed. The LCD display shows the response of IR, PIR, and Vibration sensor. The Bluetooth module is connected to the Arduino uno and the data is processed. An app is provided which workson Bluetooth and GPS. So alert message is sent to the farmer by providing the number in the app.

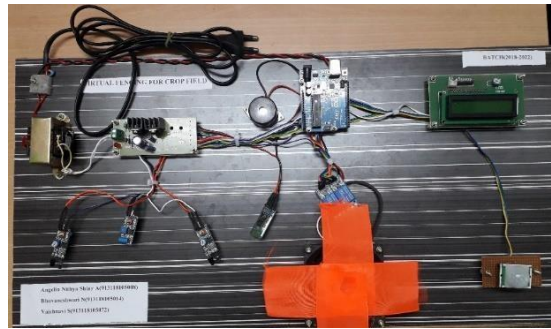


Fig.2 Proposed prototype

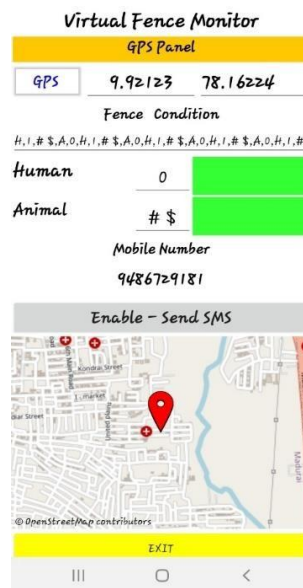


Fig.3 virtual fencing monitor app

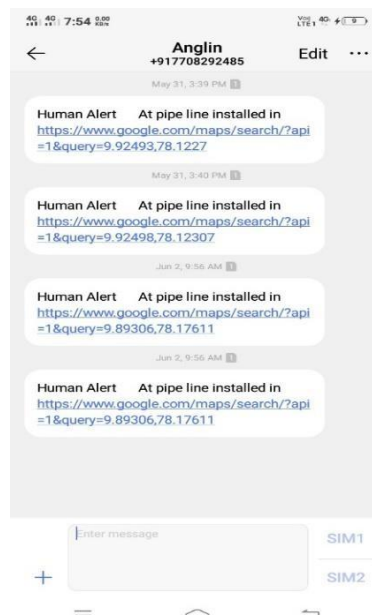


Fig.4 Human alert message

4.3 ADVANTAGES

- It improves the productivity through optimized management.
- More profitable farms.
- Designed for animals' welfare.
- It reduces the time spent to put and maintain fences.
- Safety is ensured to both human and animal.
- Fully automated system, doesn't consume any man hour.
- The system is used to protect the agriculture form from wild animal is really challenging task.
- We save power.

4.4 APPLICATIONS

- It initiates public concern for the potential welfare impacts on animals due to aversive nature of using electrical stimulus.
- It can also be used in military and security system.
- It helps to remotely map and control livestock grazing.

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