

Smart Crop Protection System against Wild Animal Attacks

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Abstract—This paper describes the design of SMART CROP PROTECTION SYSTEM AGAINST WILD ANIMAL ATTACKS for the protection of crops from wild animals attack. Animals are the second major threat for farmers after drought. Crops are vulnerable to animals. The wild animal's intrusion is growing rapidly. This leads to the reduction of agricultural yield, causes property damage and also loss of human life. It will be a major and common issue for farmers having agricultural lands nearby the forest area. The manual way of monitoring the animal intrusion will be a tedious process and this requires huge effort from humans, cost, and time which is cumbersome. The identifying and repelling device is used to protect the crops from animal intrusion. In addition to that, a fire sensor is used to identify the fire in the farm by which the signal is sent to owner of the farm. By these methods, the farm can be safeguard from potential damages.

Index Terms— Arduino, Camera, IoT, Sensor, Repeller, GSM Module.

I. INTRODUCTION

Agriculture is the backbone of our nation and it is one of the fundamental methods for occupation. Most of the population in the overall world depends on farming for their living. About 70% of our population rest on cultivation and much cultivation are contributed from here. Most cultivation cannot be produced only through physical activities, so it should be designed by innovative technologies [1]. One of the activities which can't be handled in physical manner is wild animal's interruption. The wild animals will be a threat for farmers throughout the nation. Animals such as rabbits, wild boars, deer, monkeys, elephants, moles, and many others would cause heavy damage to crops. The crops will be damaged by running and trampling over the field. Therefore, significant yield losses and additional financial problems are easily caused by wild animals. Another viewpoint is to consider that wild animals require a particularly cautious approach [2].

A major role was played by the technology in everybody's life. In many sectors, the demand of IoT has been in a hurry, which ultimately creates the attention of research in it. We are currently live in the 21st century; which has been a century of enormous growth in all the sectors of our life. A field which has sustained its time of technological growth is Internet of Things (IoT)[3],[4] The combination and connection of various sensors, objects or electronics items are commonly known as Internet of Things. In general IoT works interconnection of devices and humans through the internet in a distributed network. It is a combination of numerous potential as it can sense and actuate the devices through the data which is collected from sensors. It means the controller has been programmed for the same and it establishes a communication basis among other devices which presents in the IoT network by enabling them. By 2025, as per the expected and analyzed data, IoT will consist of about 75

billion devices connected by identifying its growing capacity. IoT is helping with its values of novels in various sectors such as home automation, healthcare system, supply management system etc.,. Literally, the main vision of this project is to come up with a solution to resolve this issue. [5]. In this project we proposed a method which detects the existence of an animal and provide a buzzer sound to it. And here we used camera to capture the movement of animals which will be sent to the arduino as signal. It directs the animal from the farm by producing sound based on the type of animal. Along with this, a fire sensor is added to avoid the spreading of fire from the forestry areas to the agriculture. By the help of IoT an alert will be given regarding the animal entry and the forest fire. The proposed scheme is to provide an early warning to the farmer about possible intrusion and damage by animal.

II. SYSTEM ARCHITECTURE

It is very difficult for the farmers to safeguard the field for the whole day from animal intrusion but the animals will damage the crops when they are not in the field. To overcome this issue faced by the farmers, we propose a system that will redirect the animals without any damage for crops as well as harm for animals. In addition to that the fire will be detected when it occurs. Therefore we list out the various devices that sync with one another:

A. Sensors

The PIR (passive infrared sensor) is used to sense the field area and determine whether the animal presence is there or not. It connects with arduino through these pins: VCC is connected to +5V and GND to GND. Then the Digital out Pin of the PIR sensor is attached to the digital I/O pin 8 of Arduino. The Fig.2.1.shows the connection of sensors with arduino.

Fire sensor is used to detect the fire in the farm. It has about three pins: VCC is connected to +5v and GND to GND of the power supply (can be connected to Arduino's +5V). The Digital I/O Pin 11 of Arduino is connected with Digital Output pin.

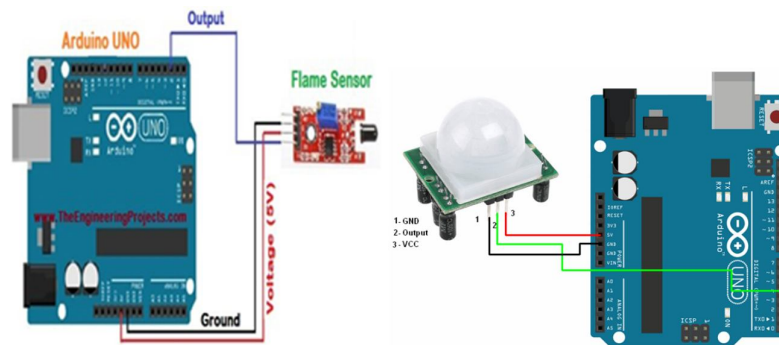


Fig.2.1.Connection of sensors with Arduino

B. Web cam

The web cam is used to capture the images of the animals as soon as the arduino sends the signal of the PIR sensor. Then the captured images are analyzed to find the animal. The python programming is used here for the identification of the animal. The HP webcam 1300 is used for the better quality and specifications. The Fig.2.2 describes the connection between web cam and Arduino.

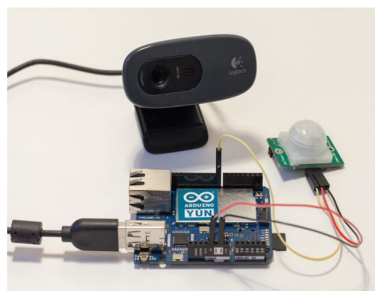


Fig.2.2. Arduino connected with camera

C. The Repeller Device

The buzzer is used as the repeller device to redirect the animal from the farm. The Buzzer circuit contains an NPN Transistor (like 2N2222 or BC548), a 1K Ω Resistor, a PN Junction Diode and a 5V Buzzer. The Buzzer is carried out through Digital I/O 12 pin of Arduino UNO. The repeller device is activated as soon as the PIR senses the intrusion and it produces the frequency to redirect the animal from the farm. The connection of the buzzer circuit with the arduino is shown in the Fig.2.3.

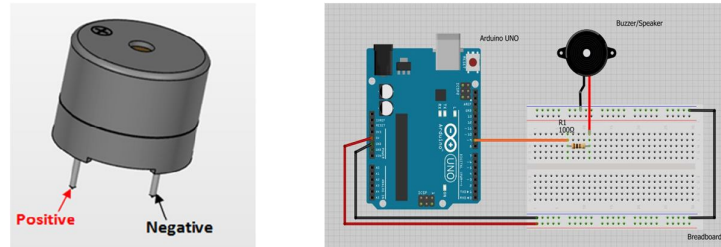


Fig.2.3. Buzzer

D. Interfacing with GSM Module

It is a hardware device and digital cellular system which is used for mobiles. This is an international standard for mobile which is extensively used for long distance communication. The GSM/GPRS module used to communicate with microcontroller or PC terminal by USART communication. The SIM900A is a readily available GSM/GPRS module, used in many mobile phones and PDAs. The module can also be used for developing IOT (Internet of Things) and Embedded Applications. The interfacing with GSM Module represented in Fig.2.4.

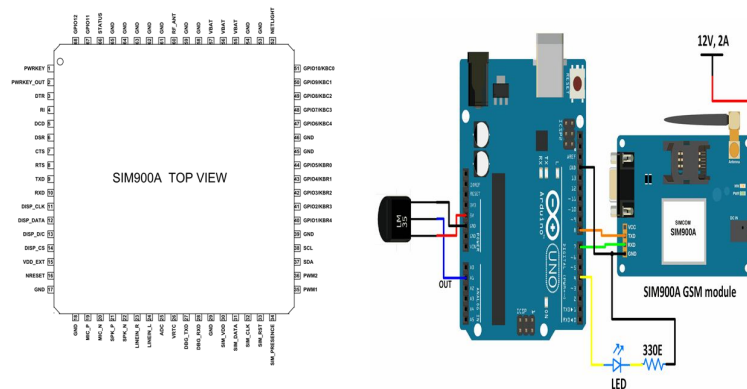


Fig.2.4. Interfacing Arduino with GSM Module

III. SYSTEM ARCHITECTURE

To overcome this issue faced by the farmers, we propose a system which will redirect the animals without any damage for crops as well as harm for animals and it is represented in the Fig.3.1. In this system of smart crop protection system against wild animal attacks the power supply for system is regulated through 5v by the rectifier circuit. The PIR sensor detects the existence of the animal and the information is sent to arduino. Then the web camera gets activated and starts capturing the images by which the type of animal can be analyzed through image processing. The image processing is done to improve the quality of it and to exactly identify which animal is entered. According to the type of animal the buzzer sound will be produced.

There are three different frequencies according to the animal specified:

The frequency produced for Squirrels, Rats, Birds, and Rabbits is about 40 kHz, for Cats, Cows, dogs, and buffalos is about 3 kHz and for Large dogs, Deer's, Elephants, and Foxes is up to kHz. In addition to this system, a flame sensor is used to detect the fire in the farm and the Arduino signal activates the smoke machine which reduces the fire in the farm. In both cases, a message will be sent to the farmer through GSM Module to know about issue happening in the farm [7].

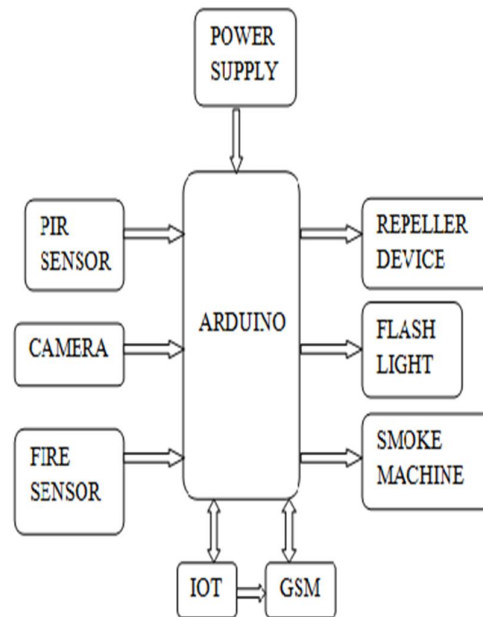


Fig 3.1. Block Diagram

IV. RESULTS

The proposed system is displayed below in Fig.4.1. The efficiency of the system is high in protecting the crops from animals. Precise detection of animals is attainable using image processing the captured image and through that, the sound is produced by the buzzer. This system is implemented for the purpose to avoid the intrusion of animals in the absence of human monitoring. The intervention of humans is required in the time of switching the system. It can fit in any suitable place by its adaptable capability. The efficiency of the cost is maintained as all the components which are used in this system both environment and human friendly [8].

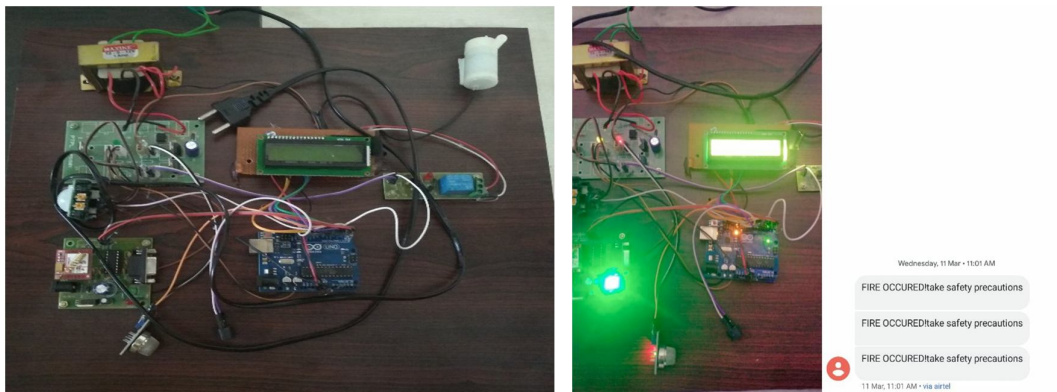


Fig.4.1. Prototype of the proposed system

V. CONCLUSION

The concepts of smart agriculture have always been a great service to our nation. The growth of Internet of Things (IoT) had give rise to new ideologies in terms of smart protection system in agriculture. In this paper, we address the issue of crop damage caused by animals and how our system protects the crops. It is an IoT based smart crop protection system from wild animals attack. This design will not be dangerous to animals and human beings in any situation. The efforts made in this paper are indented to improve the technologies in agriculture which ultimately help farmers efficiently and effectively.

It can also be extended as an overall system of IoT in agriculture which includes humidity, mechanical, dielectric soil moisture, electrochemical sensors etc...and that will be an easy one to uplift the farmers by helping them with the issue what they are going through now. Therefore the enhancement of farmers can be done through the engineers as the source of responsibility.

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