

Animal Intrusion Detection and Prevention System

Shivam Kumar Chauhan¹, Abhishek Sharma², Mrs. Avinash Kaur³

Students of Computer Science and Engineering, Lovely Professional University, Delhi-Jalandhar G.T.Road, Phagwara, Punjab, India

Associate Professor, Department of Computer Science and Engineering, Lovely Professional University, Delhi-Jalandhar G.T.Road, Phagwara, Punjab, India

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Abstract-The main aim of the project is to detect animals trespassing any farm land or areas which are inhabited by human beings. As many Indians are associated with agricultural activities ranging from small gardens to acres of land, the human and animal encounter has always been a bone of contention. This project will be able to mitigate any human and animal encounter in the above specified areas. In this project we have used various sensors to detect the presence of animals near the farms or human habitats which include PIR sensor, IR sensor, and Ultra Sonic sensor. A camera module to see the image of animal. A LCD display to print the message. Arduino Uno a microcontroller which will integrate these modules. A buzzer to create noise. With the help of image processing and ML (Machine Learning) we will be able to identify the respective animal and produce noise of variable frequencies disturbing to that particular animal.

Keywords: PIR sensor, IR sensor, Ultra Sonic sensor, LCD display, Arduino Uno, Image Processing, ML (Machine Learning)

I. Introduction

India being the second most populous country in the world and majority of its food demands are met by agricultural activities which is the most important industry in the Indian economy. Approximately 60 percent of the Indians work in this industry. With the increase in urbanization and destruction of forest lands (due to deforestation) the animals lose their habitat and thus arises the problem of human animal conflict. The major brunt of this problem is faced by farmers, people living in villages and human settlements in the vicinity of forests. Animals such as deer, wild boar, bison, elephants, etc. are the most prominent animals seen in farm lands damaging crops. It is not easier for farmers or a common man to directly confront these animals or fend off their misadventure which could be dangerous to both the animal as well as the person. There are several preventive measures such as Electric fence, Bee fences to ward of elephants, spraying smell of raw egg along the border of the farm land, etc. As all of them have some weaknesses hence an animal intrusion detection system is a necessity.

II. Related work

A. Electrical fence: an electric fence is wire covering a periphery with electricity gushing through it. It acts as a deterrent to both animals as well as human beings. The electric charge can be regulated through applying potential of varying values. The shock produced can be cause effects ranging from discomfort to death. Most electric fences are used today for agricultural fencing and other forms of animal control Electric fences are designed to create an electrical circuit when touched by a person or animal. A component called a power energizer converts power into a brief high voltage pulse. One terminal of the power energizer releases an electrical pulse along a connected bare wire about once per second. Another terminal is connected to a metal rod implanted in the earth, called a ground or earth rod. A person or animal touching both the wire and the earth during a pulse will complete an electrical circuit and will conduct the pulse, causing an electric shock.

The effects of the shock depend upon the voltage, the energy of the pulse, the degree of contact between the recipient and the fence and ground and the route of the current through the body; it can range from barely noticeable to uncomfortable, painful or even lethal. Permanent electric fencing is used in many agricultural areas, as construction of electric fences can be much cheaper and faster than conventional fences. The risk of injury to livestock (particularly horses) is lower compared to fences made of barbed wire or certain types of woven wire with large openings that can entangle the feet.

Its disadvantages include the potential for the entire fence to be disabled due to a break in the conducting wire, shorting out if the conducting wire contacts any non-electrified component that may make up the rest of the fence, power failure, or forced disconnection due to the risk of fires starting by dry vegetation touching an electrified wire. Other disadvantages can be lack of visibility and the potential to shock an unsuspecting human passer-by who might accidentally touch or brush the fence.



B. Bee fences to ward of elephants project REHAB(Reducing Elephant-Human attacks using Bees):

A pilot project launched in Kodagu entails installing bee boxes along the periphery of the forest and the villages with the belief that the animal will not venture anywhere close to the bees and thus avoid transgressing into human landscape. This idea stems from the elephants proven fear of the bees. An initiative of Khadi and Village Industries Commission (KVIC), Project RE-HAB intends to thwart elephant attacks in human habitations using honeybees. The biggest advantage of Project RE-HAB is that it dissuades elephants without causing any harm to them. It is extremely cost-effective as compared to various measures such as digging trenches or erecting fences. Its disadvantages are that it is only restricted to elephants and humans can also become targets of the bees.

III. Literature review

Researches regarding animals in image processing have been an important field to numerous applications. Many algorithms and methods have been developed by human being in order to have a better understanding on animal behavior. Besides, these applications also can act as a warning system to human being from intrusion of dangerous wild animal for early precaution measures. These applications can be narrowed down to three main branches, namely detection, tracking and identification of animal.

Animal detection based researches are useful for many real life applications. Animal detection methods are helpful on the research related to locomotive behavioral of targeted animal and also to prevent dangerous animal intrusion in residential area. There are a few branches of research related to animal detection.

Methods of Animal Detection in Image Processing Field: Introduction

Researches in regards to creatures in picture handling have been a significant field to various applications. Numerous calculations and strategies have been created by individual to have a superior comprehension on creature conduct. Plus, these applications additionally can go about as a notice framework to individual from interruption of perilous wild creature for early safeguard measures. These applications can be limited to three primary branches, in particular recognition, following and ID of animal.

Animal identification based investigations are helpful for some genuine applications. Creature identification strategies are useful on the examination identified with train conduct of focused creature and furthermore to forestall hazardous creature interruption in neighborhood. There are a couple of parts of exploration identified with creature detection.

Researches on Animal Detection by Human Eyes: Early investigations on creature location are to see how quick natural eyes can identify the presence of creature in characteristic scene. Creature recognition by natural eyes has been

considered as the most dependable identification strategy whenever seen from the computational perspective. This is on the grounds that the picture structure in characteristic pictures is intricate

Despite the fact that human discovery is compelling and accomplish good level, natural eyes can without much of a stretch get drained causing diminishing of adequacy. Moreover, natural eyes can't work 24 hours per day to perform creature location. These blemishes can be controlled by applying PC vision in picture preparing for creature discovery.

Reference: [1] M.F. Thorpe, A. Delorme, and S. T. C. Marlot, "A limit to the speed processing in ultra-rapid visual categorization of novel natural scene," *Cognitive Neuroscience*, pp. 171-180, 2003

Animal Detection Using Face Detection Approach: This technique particularly critical in circumstance whereby video man isn't reasonable to introduce at the account scene for wellbeing issue or video man may frighten away some tentative creature away. The creature faces are estimated by using face location strategy with various neighborhood contrast design of radiance channel to recognize the picture district of creature faces.

Reference: [2] T. Burghardt and J. Calic, "Real-time face detection and tracking of animals," 8th Seminar on Neural Network Applications in Electrical Engineering, pp. 27-32, 2006.

Animal Detection Based on Segmentation Method: The possibility of limit division is basic, which pixel of dim that more noteworthy than edge are set to white that is force 255 and those not exactly the edge worth will be set to dark that is power 0. It is hard to choose the edge precisely as the foundation picture occasionally changes. Thusly, extraordinary proper limit ought to be picked for various foundation scene.

Reference: [3] C. Peiji, "Moving object detection based on background extraction," *Computer Network and Multimedia Technology (CNMT)*, 2009.

IV. Working

A. PIR Sensor: Passive Infra-Red sensors can detect movement of objects that radiate IR light (like human bodies). Therefore, using these sensors to detect human movement or occupancy in security systems is very common. Initial setup and calibration of these sensors takes about 10 to 60 seconds. The HC-SR501's infrared imaging sensor is an efficient, inexpensive and adjustable module for detecting motion in the environment. The small size and physical design of this module allows it to easily use in the project. The output of PIR motion detection sensor can be connected

directly to one of the Arduino (or any microcontroller) digital pins. If any motion is detected by the sensor, this pin value will be set to “1”. The two potentiometers on the board allow us to adjust the sensitivity and delay time after detecting a movement.

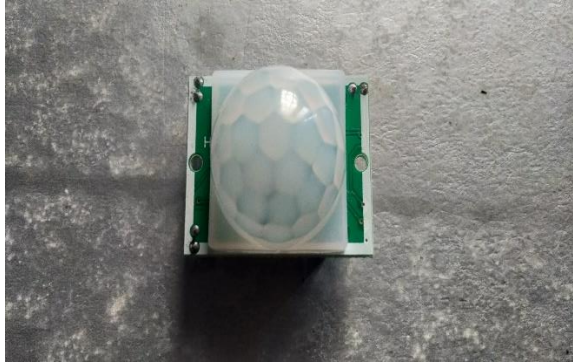


Fig 1. PIR Sensor

B. Ultra Sonic Sensor: This module is used to measure the distance of the target from the sensor. This module consists of two drums, one of which is an emitter that emits ultrasound and other is receiver which receives the reflected ultrasound from the object. The emitter drum emits ultrasound when we trigger the module using the trig Pin by sending a 10 microsecond’s high pulse. As soon as the ultrasound is emitted through the emitter the module makes the echo Pin high. Emitted ultrasound travels forward till it gets reflected by object and then travels backward. The reflected ultrasound is detected by the receiver. When the reflected ultrasound is received by the receiver, echo Pin is made low. Now we have the time take by the ultrasound to reach the object and again reach the source which is also equal to the duration for which the echo Pin was high. This time is stored in the microcontroller. Therefore travel time of ultrasound between just sources to object is half the time take to travel source-object-source we know that:

Distance=Speed x Total Time
 But time take to travel distance is half of total time:
 Distance= (Time/2) x Speed



Fig 2. Ultra Sonic sensor

C. LCD Display: This module is 16*2 (16 column and 2 row) LCD display which will print the output message

produced by the different modules. There are several types of display compatible with Arduino viz. 1. TFT LCD display, 2. TFT LCD touchscreen display, 3. 16*2 character LCD display 4. 5110 LCD display, etc. In this project we have used 5110(16*2) LCD display.



Fig 3. LCD display

D. Arduino: Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on a computer, used to write and upload computer code to the physical board. The Arduino IDE is used to program the Arduino board and uses a simplified version of C++ language. Due to its easy programmable language and wide applications it has been used in myriads of projects.



Fig 4. Arduino

In this project we have used PIR sensor (an IR sensor can also be used to detect motion) to detect motion of a target and an ultrasonic sensor to detect the range of the target from the sensor. A camera module (ESP32 camera module or a laptop camera) to detect the face of the animal using machine learning algorithms. And finally a 16*2 LCD display to project the output messages.

Connection

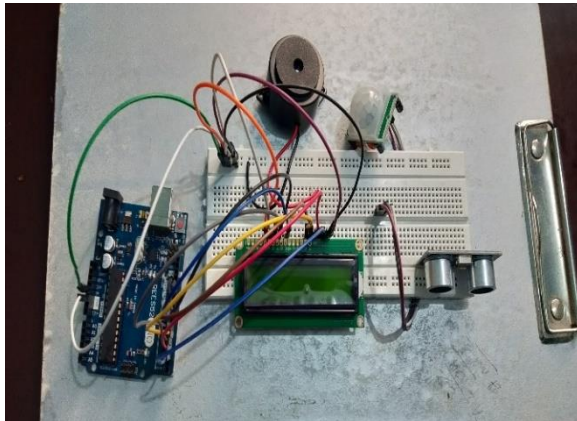


Fig 6. Connection

Data Flow Diagram

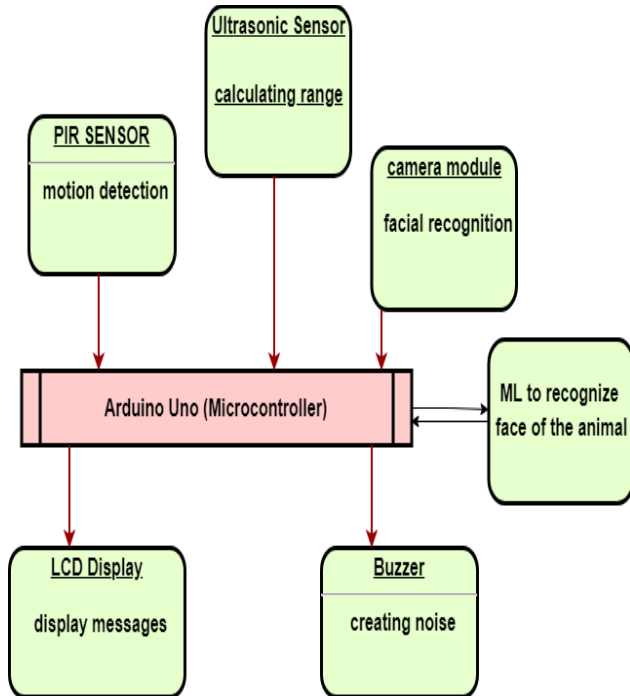


Fig 5. DFD of the project

V. Conclusion

All over the globe and mostly In India not only farmers but also common man face a threat from wild animals which can cause a severe damage to their crops and sometimes their lives too. With the human and animal conflict both of them endanger their lives. This project prevents such human animal encounter and wards off animals from the farm lands,

human settlements or any place where the sensor is placed. It detects animals using machine learning and wards them using a buzzer which creates noise acting as a deterrent to the animals. It is cost effective and is made using some of the very sophisticated sensors. This concludes the efficacy of the project and its advantage to the farmers.

VI. Future enhancement

There is a lot of scope for enhancements in the project. The sensors can be upgraded to wireless ones and a more sophisticated microprocessor can be used. More sensors can be added to the project which could inform the farmer about the temperature, humidity, rain, etc. Moreover, instead of displaying messages on the LCD display we can directly send SMS or text message to the user using a GSM module which will make the farmers more proactive and informed.

VII. References

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