IOT-Based Wild Animal Intrusion Detection System

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Abstract- In forest zone and agricultural field human animal conflict is a major problem where enormous amount of resources is lost and human life is in danger. Due to this People lose their crops, livestock, property, and sometimes their lives. So this zone is to be monitored continuously to prevent entry of wild animals. With regard to this problem, we have made an effort to develop the system which will monitor the field. That is at first it will detect intrusion around the field using sensor, then camera will capture the image of the intruder and classifying them using image processing and then Taking suitable action based on the type of the intruder. Finally sends notification to farm owner and forest officials using GSM.

Keywords---Animal detection, PIR sensors, camera, image processing, light emitter, sound generator, GSM module

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I. INTRODUCTION

India is an agricultural country. Agriculture has always been India's most important economic sector. Though most of the India's population depends on agriculture, there are still a lot many problems faced by farmers. Human animal conflict is a major problem where enormous amount of resources is lost and human life is in danger. In recent times the numbers of these kinds of conflicts are increasing. So this zone is to be monitored continuously to prevent entry of this kind of animals or any other unwanted intrusion. Human-animal conflicts arises due to encroachment and poaching, humans move into the forest to satisfy their livelihood, for claiming of land for agricultural practices and rapid industrialization causes spreading of urban ground and animals enter the nearby villages for water during the summer due to dryness in water body. Elephants or wild boar tramp the vegetation in farm land in need of nutritious food. Need of the animal or human put the other in real danger, in this process, resources are spoiled and sometimes even the life is lost. Human-elephant conflict is more in south Asia and in Africa. Usually farms are protected with electrical fence; animal which tries to enter the field suffers electrocution with intense pain cause animals to behave in abnormal manner.

Hardware requirements refer to the physical parts of a computer and related devices. Internal hardware devices include motherboards, hard drives and RAM.
- Sensors- PIR HC-SR501 Motion Sensor.
- WebCam
- Microcontroller- Arduino Uno.
- Light- Bright Light Emitter.

Software requirement is a field within Software Engineering that deals with establishing the needs of stakeholders that are to be solved by the software. The software requirement of our project is given below.
- Microcontroller- Arduino IDE.
- Image processing- MATLAB 2017a.

II. OBJECTIVE

The objective of our project is to provide protection from the attacks of the wild animals and thus minimizing the probable loss to the farmer.
- To detect intrusion around the field.
- To capture the image of the intruder and classifying them using image processing.
- Taking suitable action based on the type of the intruder.
- To send notification to farm owner and forest officials using GSM.

III. RELATED WORK

To track the location of Animal in the zoo or national parks [1] a temperature sensor and PIR sensor is used. The temperature sensor senses the temperature of each animal and PIR sensor senses the human presence inside the animal boundaries or restricted areas. If the animal is suffering from any wounds or fever, the body temperature will be automatically increased. To monitor this, temperature sensor is used. It continuously monitors the animal's temperature. If any variation in the temperature, It will be displayed on the LCD. The PIR sensor is used to monitor the human presence in restricted areas or nearby the animal boundaries. When the human presence is detected, the voice processor will give alert to the people through the pre-recorded voice. The GPS receiver send the location, animal temperature to

the controller and it is interfaced with the IOT, It will give the complete information to the website on PC or laptop.

In Animal intrusion detection system using wireless sensor networks system [2] the bird intrusion is being detected by the use of wireless sensors and buzzers which produce acoustic sounds. When a bird is being detected by the sensors in the agricultural area the acoustic sounds get activated. This sound irritates the birds. Hence when these sounds are generated the birds will fly away as they cannot accommodate to that sound. Thus the destruction caused by the birds in the agricultural fields can be avoided. These acoustic sounds that are being generated will be produced only when the birds are detected and continuous for a while until the birds are been driven away.

In [3], a simple approach where PIR sensors are placed in the place which has to be monitored? The sensor is placed in a tower arrangement. This system is one way implementation of our job. The main objective of this system is to monitor the area and find any unauthorized entry into that area. Also the end result of this system is an output which either denotes the entry of an animal or human. Even an object with similar kind of characters are not classified, because the entire system is only reliant on sensor tower which differentiates between the two classes based on the IR rays emitted by the object. Also the output data is to be continuously monitored by a human, else there will be no action taken against the intrusion. This is not an autonomous system since no corrective action is taken for the problem.

In this approach [4] a GPS tracking device is to be placed in the leader of the group of animal. A virtual border is created around the protective zone. These signals are to be continuously monitored in a base station and when the leader crosses the border an alert message is generated. Note that here the leader of the group is assumed to lead a batch of animals and also these animals always approach human area in groups. This is not the case with most of the animals. The group may be split; the animals may not follow the animal which was identified as the leader; also finding the animals 'leader is a tedious task.

In this approach [5] a Wireless Sensor network is formed by implementing motion sensors at various locations around the field. Continuously motion data is communicated to the Co-ordinator through Radio-frequency transceiver. On detecting motion, alert message is delivered to the farm owner.

IV. PREPARE YOUR PAPER BEFORE STYLING

In the proposed project, PIR Sensors and camera act as first round of security where the animal movement is detected using the sensor and the sensor in turn triggers the camera to take the picture of the animal and transmit the image for processing via microcontroller i.e., through WSN. The microcontroller transmits the image from the camera to the PC in the command centre where the image processing and classification of animal is done. Once the animal is found to

be a threat the PC will send the signal to the repellent system via microcontroller to take appropriate action.

Input
Along the borders of the farm the PIR Sensors and the camera is pole mounted. The number of sensors are relatively twice of that of camera. The sensors have a range of about 30 meters and that of camera is 50 meters. The camera is powered by battery and solar panel. Once an animal is been detected by the sensor, it gives the signal to the camera via microcontroller that takes up the image of the respective scope of area in which the signal has come from. The camera will then send the image for processing and classification of animal whether it is threat or not.

Processing
The image that is sent by the camera is received by the PC for classification of animal. Database is created and the set of sample images are stored in it. The program consists of functions such as indexImage, imageSet and retrieveImage. The ImageSet is used to hold a collection of images. indexImage is used to create an image search index. indexImage is used with the retrieveImage function to search for images. The captured image is given as query image to the processing system. The retrieveImage function takes two arguments, a query image and the image stored in the database. The resultant is the indices corresponding to images within image Index that are visually similar to the query image. The image IDs output contains the indices in ranked order, from the most to least similar match. The value match range is from 0-1.If the value is 0, then the image is not matched. If it is 1, then the query image is same as that of the stored image. If the value is found between that of 0-1, then the query image falls under the category of the stored image i.e., the contents in the query image are same as that of the stored image. If the name of the image matches with that of the regular expression of the image then the animal is elephant otherwise it is a leopard. If the score is in the range of 0.1 to 0.9, then the image is matched with that of the stored image. Once the wild animal is identified then the resulting repellent system is applied. If the animal found is an elephant then the Bright light is emitted. If it is found to be a Leopard, then the irritating loud noise is used. Consequently a SMS is sent to the forest officials and also to the field owner as alert information. If the detected object is not a threat then no SMS is sent. By this way false alarm can be prevented.
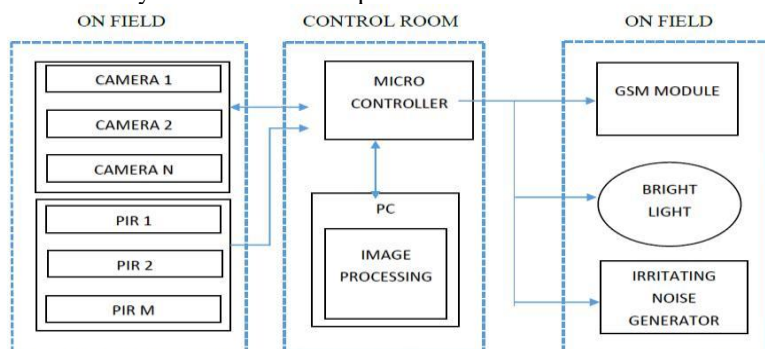

Figure 1: Block diagram of intrusion detection system

Output

Once the animal is classified to be a threat, necessary actions are. SMS notification will be sent to the farmer and the forest official regarding the location of the animal and what type of animal has been trying to intrude the farm. Along with the SMS notification, repellent system of Bright light and irritating loud noise is used simultaneously with interval of 4 seconds is used upon the animal. The repellent system works continuously for better effectiveness in scaring away the animal.
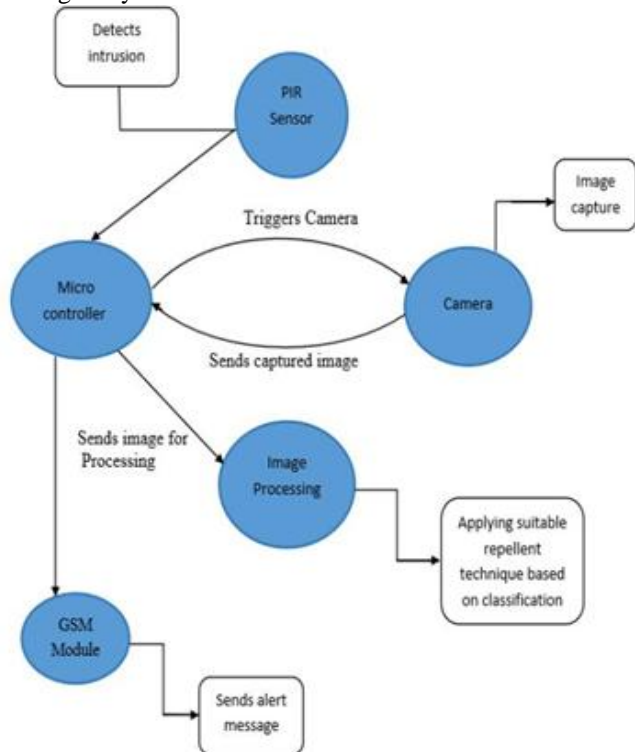

Figure 2: Flow diagram of intrusion detection system

V. EXPERIMENTAL RESULTS

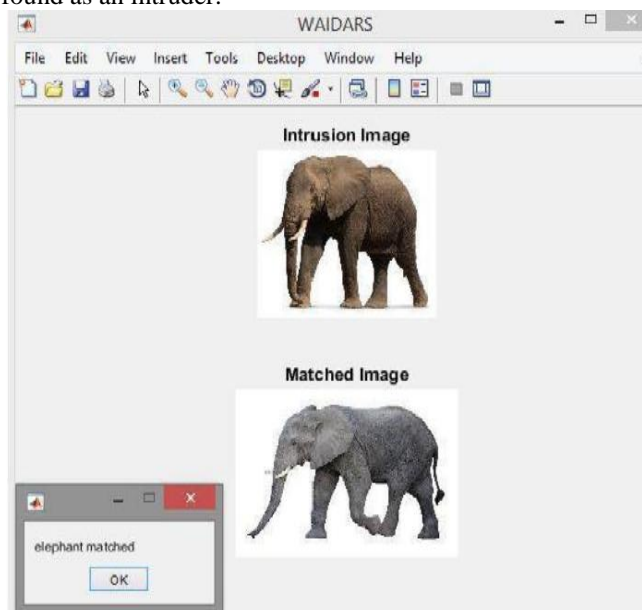Figure below shows simulation result when elephant is found as an intruder.

Figure 3: when the elephant detected as intruder

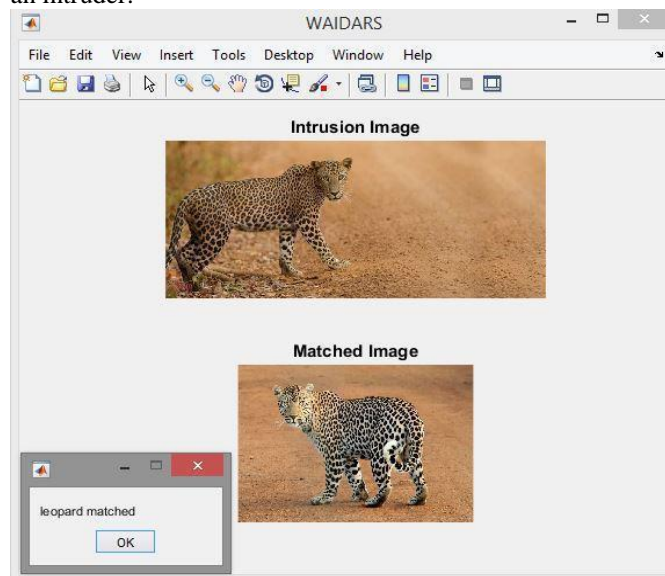Figure 4 shows simulation result when leopard is found as an intruder.

Figure 4: when the leopard is detected as intruder

VI. CONCLUSION

The animals, many of which are already threatened or endangered, are often killed in retaliation or to prevent future conflicts. So this zone is to be monitored continuously to prevent entry of wild animals.

With regard to this problem, proposed system is developed which will monitor the field using sensor and camera and captured image of the intruder will be classified using image processing so that suitable action can be taken.

VII. REFERENCES

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