A Review of Animal Intrusion Detection System

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Abstract:- Image processing and IoT sensor monitoring network technology has taken the evolutions of sensors to a completely different level. The conflicts between human and animal become a major problem in the agriculture field and in the forest zone which leads to human life in danger and also losing a huge quantity of resources. To solve this problems animal intrusion alert system can be used with wireless sensors and sends an automatic alert message to the landowner also to forest officials with an image. This can make early warning notification to take a suitable action depends on the type of intruder. The sensor will detect the movement of the animal and the camera will capture the image, using image processing techniques the captured image is classified via a microcontroller, then GSM module will send the alert notification SMS to the forest department or the landowner. This survey is used to understand various steps, tools, and experimental setups to save human life from animal intrusion.

Keywords - IoT (Internet of Thing), Sensors, Image processing, Microcontroller, GSM module.

I. INTRODUCTION

Deforestation, lack of natural prey and habitat loss has forced wild animals to live closely with human settlement prey on domestic livestock. So animals are started attacking humans for their food. Compared with other tiger, elephant entry are in extreme form of conflict and responsible for killing human’s lives in India .Due to human and animal conflict and increase in population humans started demolishing the forest for their existence these leads to harm animals and its habitats. Animals started entering nearby villages due to the rapid growth of industrialization in forest areas. Losing subsistence and dryness makes them raving mad and pretend to attack crops, livestock, sometimes human and farming lands. Usually, farmers use the electrical fence to protect the field from animals which cause electrocution with cramp makes them behave unusual manner. The safety of animal and human is identically important. To overcome this problem an intelligent monitoring system is required to monitor automatically and recognize the image of animal entry and gives an alert message to human. This survey paper is based on various wired and wireless applications used to alert human from animal intrusion. Researches regarding animals in image processing have been an important field for numerous applications [6]. IoT (Internet of Thing) becomes a recent emerging technique all over the world. It furnishes the capabilities with a large number of applications, only a few are currently applicable to our society.

Wireless applications would likely improve the quality of our day to day activity in many domains and environment such as for emergency responses, intelligient control, and military purpose [4]. Many approaches involving to sense animal entry using IoT, sensing unit, communicating device to take preliminary actions, diversion of animal and sending alert to farmers. Various methods and algorithms have been developed to enhance the safety measure from animal intrusion. This paper presents the reviews for animal detection methods using digital image. Sensor-based applications are used for various fields which are real-life applications. Features of using this device may reduce cost, robustness, reliable, easy access by farmers, and remote monitor with lower energy consumption. Below given methods are used to detect animal from intrusion.

Table 1: Methods of animal intrusion detection

| Methods                                      | Detection techniques                                      |
|----------------------------------------------|-----------------------------------------------------------|
| Electric Fences                              | Detection using Wheatstone bridge principle (Circuit setup) |
| Artificial Repellents                         | Detection using Odour & color based electronic repellents. |
| Acoustic System                              | Scare animals by use of sound predators.                  |
| Microcontroller based system                  | Once intrusion found the buzzer will activate and send message alert to the farmers. |
| Intrusion detection system using Raspberry PI | Automatic highly efficient detection method.               |

A. OVERVIEW OF EXISTING ANIMAL INTRUSION ALERT SYSTEM:

The review of literature is one of the major parts of any research work. The word “review” indicates the animal intrusion alert system, and a detailed study of the IoT based applications and how it is to be researched. These papers sustain the information about the research and surveys about the work done on the specific task. Different approaches used to track, monitor, and recognize animals in various scenarios with wired and wireless sensor-based IoT (Internet of Thing) applications.

Yu et al 2013 [1] have proposed an automated species recognition method using local cell-structured LBP (Local Binary Pattern) feature and global dense SIFT (Scale-invariant Feature Transform) descriptor for feature extraction and improvise (ScSPM) sparse coding spatial pyramid matching to extract dense SIFT descriptor and cell-structured LBP as a local feature. Global features generate max pooling and weighted sparse coding using multi-scale pyramid kernel. Support vector machine algorithm classifies and tests the dataset contains 18 species from the field of two different sites. This method achieves around 82% accuracy on real-time animal identification even in complex scenarios.

Radhakrishnan et al 2018[2] proposed animal intrusion detection system based on image processing and...
machine learning approach. The image of an animal is segmented using a watershed algorithm to extract various objects in the image and to examine that if any threat animal is found in segmentation. This algorithm is to create a barrier which is the contour only when the marked region meets different markers. Gabor filter is extensively used in extracting a region with text to recognize facial expression in various frequencies. Linear SVM is a supervised learning algorithm to train the dataset and to classify text and hypertext. This method of animal intrusion detection achieves an overall average of around 54.32%.

Kiran et al 2018[3] proposed IOT-based animal intrusion detection system. PIR (Passive infrared sensor) detects the movement and triggers the camera to take the animal image, once the animal is detected by the sensor the signal is passed to the camera via a microcontroller Arduino Uno. The image is classified with the sample images which is stored in the database. When the wild animal is identified as elephant the bright light emitted is used and if leopard is identified then a loud noise is used to divert it. Consequently, alert SMS is sent to the forest officials and the landowners using GSM module.

Santhoshi et al 2018[4] proposed intrusion recognition in farmland through a wireless sensor network (WSN) technology. The motion sensor is placed at various locations to sense the movement and communicate to the organizer via Radio frequency transceiver. The detection raise then the organizer sends an alert call to the farm owner mobile through the Global System for Mobile (GSM) module. An Arduino board is fixed near the centralized sensor and the GSM module will be the interface along with buzzers and RFID transmitter. To differentiate authorized and unauthorized entries in farmland Radio-frequency identification (RFID) tags are used.

Sambhaji et al 2019[5] proposed an IoT based harmful animal early warning system. At first, stored the harmful animal database in the computer system or cloud which is already connected to the IoT model with various sensors. Images are captured with a web camera only if any movement of animal found in the school area, the computer system will compare the movement of animal found in the school area, the computer system or cloud with the help of Zigbee. GSM module is used to generate the alarm and SMS notification to the farmer.

Roy et al 2015[11] proposed a prototype for intrusion detection in agriculture field using WSN (wireless sensor network). AVR –Microcontroller based wireless sensor boards were equipped with two sensors- PIR to sense the movement of human or animal and Ultrasonic determines the distance of object, when the intruder enters into the field the sensor board will transmit a detection message to the sink with the help of Zigbee. GSM module is used to generate alarm and SMS notification to the farmer.

Roomi et al 2010[12] proposed automatic intrusion detection method using vision based technology. Detection method is processed by low cost and fast implementation for segmentation followed by star skeletonization algorithm. A novel Line Model approach is developed to match the resulting skeleton of the object. Alarm is generated when the monkey is detected if it is in upright posture. In background updated frame the present object may detect as monkey or human using MATLAB environment. Table 1 shows existing image processing animal intrusion detection system and Table 2 shows existing sensor based animal intrusion detection system.
Table 2: Existing animal intrusion system using image processing techniques

| Objectives             | Feature Extraction            | Classifier                  | Author                      | Year |
|------------------------|-------------------------------|-----------------------------|-----------------------------|------|
| Animal intrusion       | LBPH                           | SVM (Support Vector Machine) | Yu et al[1]                 | 2013 |
| recognition approach   | PCA, LBPH                      | (SVM) Support Vector Machine| Trnovszky et al[8]          | 2017 |
| Intrusion detection in | CNN (Convolutional Neural Network) | -                          | Xue et al[9]                | 2017 |
| Agriculture field      | Charplet-based decomposition & Cross Correlation | SVM (Support Vector Machine) | Upadrashta et al[10]        | 2015 |
| Intrusion detection    | W-CoHOG                        | LIBLINEAR                   | Andavarapu et al[7]         | 2017 |

Table 3: Existing Sensor based animal intrusion detection system

| Objectives             | Sensors                        | Microcontroller            | Author                      | Year |
|------------------------|--------------------------------|----------------------------|-----------------------------|------|
| Intrusion detection in | PIR & Ultrasonic               | Advance Virtual RISC       | Roy et al[11]               | 2015 |
| Agriculture field      | Passive infrared sensor        | Arduino IDE                | Kiran et al[3]              | 2018 |
| IoT- based intrusion detection system | Arduino Uno & Arduino IDE |                            |                             |      |
| Animal recognition     | Motion sensor                  | Arduino                     | Santhosh et al[4]           | 2018 |
| Animal intrusion early warning system | -                             | Arduino Uno                | Sambhaji et al[5]           | 2019 |
| Low cost alert system  | -                              | Raspberry Pi               | Sheela et al[6]             | 2016 |

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