Animal Human Intrusion Detection Sysytem In Agricultural Land

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Abstract- *The conflict takes many forms ranging from loss of life or injury to humans, and animals both wild and domesticated, to competition for scarce resources to loss and degradation of habitat. Invade of animals in the farmland cause great loss to farmers and also to the animal. The main aim of our project is to minimize and loss and conflict between the man and animal. The project uses image processing technique and embedded system . image processing technique is done using matlab which uses expectation maximisation for segmentation, statistical and glcm for feature extraction and classification is done using ANN classification is for finding empty land and presence of animal in the land. When the animal invade the agricultural land image is recorded and processed according to it result is serially sent to the controller broad from the control board a notification message is sent to the farmer regarding the entry of the animal in the farm land, buzzer sound and mild electric current is passed to the fence so that the animal will not come to the land and also land owner will take proper action for the animal to return in to the forest.*

Keywords- arduino, matlab, GSM

I. INTRODUCTION

Due to over population it occurs a deforestation this results in shortage of food, water and shelter in forest areas. So, Animals interference in residential areas is increasing day by day which affects human life and property causes human animal conflict but as per nature's rule every living creature on this earth has important role in eco-system.

Agriculture is the backbone of the economy but because of animal interference in agricultural lands, there will be huge loss of crops. Elephants and other animals coming in to contact with humans, impact negatively in various means such as by depredation of crops, damaging grain stores, water supplies, houses and other assets, injuring and death of humans.

Farmers in India face serious threats from pests, natural calamities &damage by animals resulting in lower yields Traditional methods followed by farmers are not that effective and it is not feasible to hire guards to keep an eye on crops and prevent wild animals. Since safety of both human and animal is equally vital. So, animal detection system is necessary in farm areas.

II. EXISTING SYSTEM

The project is used to protect the farmland from animals by using Raspberry pi. Animals like wild boars, elephants, monkeys etc…cause serious damage to crops. This project utilizes the RFID (Radio Frequency Identification Device) module and GSM (Global System Mobile) modem for this purpose. The techniques that already being used is ineffective, in this article we are presenting a practical procedure toward them off, by creating a system which studies the behavior of the animal, detects the animal and produce the different sound that irritates the animal and also alerts the authorized person by sending a message. The animal can be detected by the RFID injector (for animals), the LF tag which inject on the animal skin. After the detection the intimation is sent. More hardwares has been used in the existing methodologies it leads more cost and it may cause damage to the electric device .

III. PROPOSED SYSTEM

The main aim of our project is to minimize and loss and conflict between the man and animal. The project uses image processing technique and embedded system . image processing technique is done using matlab which uses expectation maximisation for segmentation, statistical and glcm for feature extraction and classification is done using ANN.classification is for finding empty land and presence of animal in the land. When the animal invade the agricultural land image is recorded and processed according to it result is serially sent to the controller broad from the control board a notification message is sent to the farmer regarding the entry of the animal in the farm land, buzzer sound and mild electric

current is passed to the fence so that the animal will no t come to the land and also land owner will take proper action for the animal to return in to the forest.

IV. METHODOLOGY

A. IMAGE ACQUISITION

Image of different size is collected. It can be a colour image or black and white image . The collected image is given as input and it is used for futher processing.

B. IMAGE PREPROCESSING

In preprocessing section, the input image may be in different size, cointains noise and it may be in different colour combination. These parameters need to be modified according to the requirement of the process. There are so many types of noise like salt – and – pepper noise, film grains etc., All these noise are removed by using filtering algorithms. Among the several filters, weiner filter is used. Pre-processing was done by using some algorithm. For all images the pre-processing should be done so that the result can be obtained in the better way. To find out the transformation between two images precisely they should be pre processed to improve their quality and accuracy of result.

Noise removal using filtering techniques for improve the efficiency of the process. Pre processing is a common name for operations with the images at the lowest level of abstraction both input and output is the input images. The aim of pre processing is an improvement of image data that suppress unwanted image data distortions or enhance the some image features important for the further processing.

Four categories of image pre-processing methods according to the size of pixel neighborhood that is used for the calculation of new pixel brightness:

1) Pixel brightness transformations
2) Geometric transformations
3) Pre-processing methods that use a local neighborhood of the processesd pixel,
4) Image restoration that requires knowledge about the entire image

If pre processing aims to correct some degradation in the image, the nature of a priori information is important:

1. Knowledge about the nature of the degradation; only very general properties of the degradation are assumed,
2. Knowledge about the properties of the image acquisition device, the nature of noise (usually its spectral characteristics) is sometimes known,
3. Knowledge about objects that are searched for in the image, which may simplify the pre-processing very considerably .If knowledge about objects is not available in advance it can be estimated during the processing.

V. RELATED WORK

A. Expectation maximization

The EM algorithm is an efficient iterative procedure to compute the Maximum Likelihood (ML) estimate in the presence of missing or hidden data. In ML estimation, we wish to estimate the model parameter(s) for which the observed data are the most likely. Each iteration of the EM algorithm consists of two processes: The E-step, and the M-step. In the expectation, or E-step, the missing data are estimated given the observed data and current estimate of the model parameters. This is achieved using the conditional expectation, explaining the choice of terminology. In the M-step, the likelihood function is maximized under the assumption that the missing data are known. The estimate of the missing data from the E-step are used in lieu of the actual missing data. Convergence is assured since the algorithm is guaranteed to increase the likelihood at each iteration.

B. Feature extraction

1. Statistical features:

Statistics is the study of the collection, organization, analysis, and interpretation of data. It deals with all aspects of this, including the planning of data collection in terms of the design of surveys and experiments. This is the meaning of statistics. Statistical feature of image contains

- Mean
- Variance
- Skewness
- Standard deviation

2. GLSM:

Texture Analysis Using the Gray-Level Co-Occurrence Matrix (GLCM). A statistical method of testing texture that considers a spatial relationship of pixels is the gray-level co-occurrence matrix (GLCM), also known as the gray-level spatial dependence matrix.

For statistical confidence in the estimation of the joint probability distribution, the matrix must contain a reasonably large average occupancy level. Achieved either by

(a)Restricting the number of amplitude quantization levels (causes loss of accuracy for low-amplitude texture),
(b) Using large measurement window. (causes errors if texture changes over the huge window). Typical compromise: 16 gray levels and window size of 30 or 50 pixels on each side. Now we can analyze

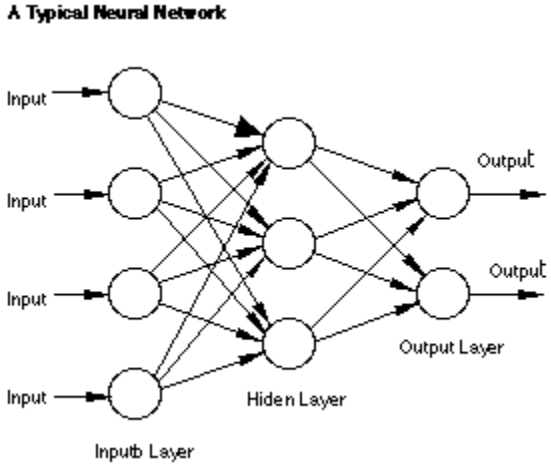
- maximum probability entry
- element difference moment of order k: P i P j (i − j) k cij This descriptor has relatively low values when the high values of C are near the main diagonal. For this position operator, high values near the main diagonal would indicate that bands of constant intensity running "1 pixel to the right and 1 down" are likely. When k = 2, it is called the contrast:
- Contrast = P i P j (i − j) 2 cij
- Entropy = − P i P j cij log cij This is a measure of randomness, having its highest value when the elements of C are all equal.
- Uniformity (also called Energy) = P i P j c 2 ij (smallest value when all entries are equal)
- Homogeneity = P i P j cij 1+|i−j| (large if big values are on the main diagonal)

The gray-level co-occurrence matrix can reveal certain properties about the spatial distribution of the gray levels in the texture image. For example, if most of the entries in the GLCM are concentrated along the diagonal, the texture is coarse with respect to the specified offset.

C. CLASSIFICATION

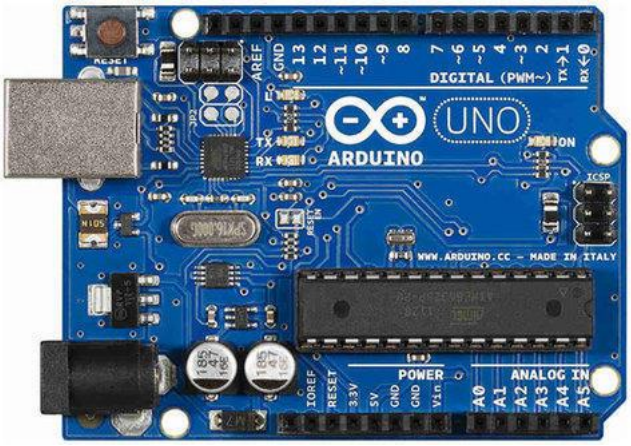
1. Neural Network:

We use the Machine learning method Artificial Neural Network for classifying the age based on extracted features. A neural network has several inputs, hidden, and output nodes. Each node applies a function some data (could be softmax, linear, logistic), and returns an output. Every node in the proceeding layer takes a weighted average of the outputs of the previous layer, until an output is reached. The reasoning is that multiple nodes can collectively gain insight about solving a problem (like classification) that an individual node cannot. The cost function differs for this type of model -- the weights between nodes adjust to minimize error.



VI. WORKING

1. Arduino(ATMEGA328p)



The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode. Revision 3 of the board has the following new features: 1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible with both the board that uses the AVR, which operates with 5V and with the Arduino Due that operates with

3.3V. The second one is a not connected pin, that is reserved for future purposes. Stronger RESET circuit. Atmega 16U2 replace the 8U2.

Memory:

The ATmega328 has 32 KB (with 0.5 KB used for the bootloader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

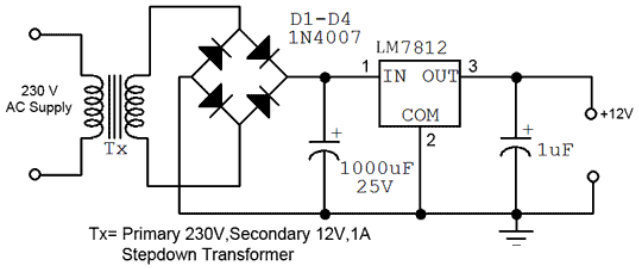
Communication:

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but) not for serial communication on pins 0 and 1).

A Software Serial library allows for serial communication on any of the Uno's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the documentation for details. For SPI communication, use the SPI library.

Power supply:

A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of equipment, while others are built into the load appliances that they power.



Its contain a step-down transformer, rectifier, filter capacitor, and a bleeder resistor. This type of power supply, because of simplicity, is the least costly and most reliable for low power requirements. The main disadvantage is that the output voltage is not constant. It will vary with the input voltage and the load current, and the ripple is not suitable for electronic applications. The ripple can be reduced by changing the filter capacitor to an LC (inductor-capacitor) filter, but the cost becomes more.

2. Input Transformer

The input transformer is used to convert the incoming line voltage down to the required level of the power supply. It also isolates the output circuit from the line supply. Here we are using a step-down transformer.

3. Rectifier

The rectifier used to convert the incoming signal from an AC format into raw DC. Please refer these links, Different types of rectifiers available are half wave rectifier and full-wave rectifier.

4. Voltage Regulator

A linear regulator has an active (BJT or MOSFET) pass device (series or shunt) controlled by a high gain differential amplifier. It compares the output voltage with a precise reference voltage and adjusts the pass device to maintain a constant level output voltage. There are two main types of linear power supplies

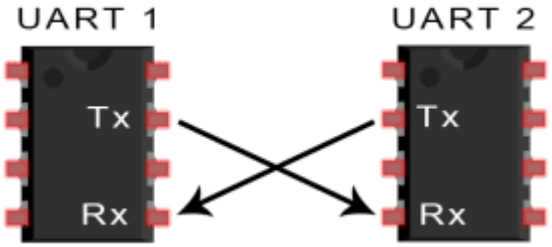
5. Filter Capacitor

The pulsated DC from the rectifier is fed to the smoothing capacitor. It will remove the unwanted ripples in the pulsated DC.

6. UART

In UART communication, two UARTs communicate directly with each other. The transmitting UART converts parallel data from a controlling device like a CPU into serial

form, transmits it in serial to the receiving UART, which then converts the serial data back into parallel data for the receiving device. Only two wires are needed to transmit data between two UARTs. Data flows from the Tx pin of the transmitting UART to the Rx pin of the receiving UART



The UART that is going to transmit data receives the data from a data bus. The data bus is used to send data to the UART by another device like a CPU, memory, or microcontroller. Data is transferred from the data bus to the transmitting UART in parallel form. After the transmitting UART gets the parallel data from the data bus, it adds a start bit, a parity bit, and a stop bit, creating the data packet. Next, the data packet is output serially, bit by bit at the Tx pin. The receiving UART reads the data packet bit by bit at its Rx pin. The receiving UART then converts the data back into parallel form and removes the start bit, parity bit, and stop bits.

VII. GSM

GSM (**Global System for Mobile communications**) is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile devices such asmobile phones and tablets. It was first deployed in Finland in December 1991.[2] As of 2014, it has become the global standard for mobile communications – with over 90% market share, operating in over 193 countries and territories

2G networks developed as a replacement for first generation (1G) analog cellular networks, and the GSM standard originally described a digital, circuit-switched network optimized for full duplex voice telephony. This expanded over time to include data communications, first by circuit-switched transport, then by packet data transport via GPRS (General Packet Radio Services) and EDGE (Enhanced Data rates for GSM Evolution, or EGPRS). Subsequently, the 3GPP developed third-generation (3G) UMTS standards, followed by fourth-generation (4G) LTE Advancedstandards, which do not form part of the ETSI GSM standard.

VIII. SOFTWARE

1. MATLAB

The name MATLAB stands for MATrix LABoratory. MATLAB was written originally to provide easy access to matrix software developed by the LINPACK (linear system package) and EISPACK (Eigen system package) projects. MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming environment. Furthermore, MATLAB is a modern programming language environment: it has sophisticated data structures, contains built-in editing and debugging tools, and supports object-oriented programming

MATLAB (matrix laboratory) is a fourth-generation high-level programming language and interactive environment for numerical computation, visualization and programming. MATLAB is developed by MathWorks.

It allows matrix manipulations; plotting of functions and data; implementation of algorithms; creation of user interfaces; interfacing with programs written in other languages, including C, C++, Java, and FORTRAN; analyze data; develop algorithms; and create models and applications.

IX. LITERATURE SURVEY

1. Animal Detection System in Farm Areas

The main aim of our project is to protect the crops from damage caused by animal and also divert the animal without any harm. Animal detection system is designed to detect the presence of animal and offer a warning. In this project we used PIR and ultrasonic sensors to detect the movement of the animal and send signal to the controller. It changes the animal by evolving sound and signal further, this signal is transmitted to GSM and which makes an alert to farmers and forest department immediately.

2. Boon Tatt Koik and Haidi Ibrahim," A Literature Survey on Animal Detection Methods in Digital Images", International Journal of Future Computer and Communication, Vol. 1, No. 1, June 2012.

The role of WSN in border surveillance as in most WSN application focus on an operation from numerous sorts of sensors, such as aseismic, camera, thermal camera, and

motion detectors. Some advanced WSN process this information and send an abstracted alarm or aggregate data to the management center, in which it takes the suitable defense action. There are more researchers from completely different organizations have instructed solutions for border surveillance issues.

3. **GophikaThanakumar," An Automatic Detection System for Entry of Wild Animals", Computers and Electronics in Agriculture, August 2016.**

The proposed system is a smart border surveillance system which can prove to be helpful for our border security forces. It is able to provide round the clock video surveillance at the places where human deployment is not possible due to geographical, climatic or some other reasons. Multiple pyroelectric infrared sensors (PIR) are disguisedly installed on the border fencing which monitor the border area for any intrusion.

4. **D. Tahmoush and J. Silvious," Modelled gait variations in human micro-Doppler", 11th *International Radar Symposium (IRS),* 2015.**

This will save the farm owner of the stress of going to the farm immediately after receiving an alert since an ordinary alarm will chase many animals away.

5. **G. Vellidis, M. Tucker, C. Perry, C. Kvien, C. Bednarz, "A real-time wireless smart sensor array for scheduling irrigation", Computers and Electronics in Agriculture, Volume 61, April 2008.**

Animals interference in farms is increasing day by day which causes loss of crop yield and human life. Elephants and other animals entering fields will impact negatively in different means such as by depredation of crops, damaging grain stores, water supplies, injuring and death of humans. Here we are proposing an idea using WSN technology where motion sensors are used. A system is implemented to detect intrusion of animals in farms using wireless sensors and buzzers which detects the animals and produce acoustic sounds. At different locations around the farm, motion sensors are placed where certain distance is maintained between them and one of the motion sensors is made for centralized from where we can operate all other sensors.

X. FUTURE ENHANCEMENT

Image Processing Toolbox provides a collective set of reference-standard algorithms and workflow application for image processing, analysis, visualization, and algorithm development. You can perform image segmentation, image enhancement, noise reduction, geometric transformations, image registration, and 3D image processing. Image Processing Toolbox application leads to automate common image processing workflows. It can interactively segment image data, compare image registration techniques, and batch-process large data sets. Visualization functions and apps makes the explore images, 3D volumes, and videos; adjust contrast; create histograms; and manipulate regions of interest (ROIs).

XII. CONCLUSION

This project is used to protect the farmland from wild animals and also to protect the animals from great affect using arduino and MATLAB. It can also exhausted by improving technologies and methodologies occurred in this project for heavy blowing wind and some destructions to the materials used in this project.it can also be improved by using Rasberry Pi with a camera and a different sensors interfaced to the board.