Detection and Prevention of Animals in Agricultural Fields

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Abstract- In rural areas of India,destruction of crop by animals are more common . Farm owners struggle a lot for high yield in various ways .But ,their gain is curtailed due to the interference of animals and unauthorized humans. Domestic animals and wild animals cause damage to the crops either by consuming or damaging them.This results in poor yields which in turn reduces their gain , leading to frustration . Fencing the farm is not easy and affordable ,especially when field is large in area . Hence it is very much essential to monitor the boundaries of farm to detect movement of animal entries into the farm .To implement this ,An Embedded System will be designed in which Infra Red (IR) Sensors are placed at different places in the farm . When this sensors sense the movements It alerts the system and wake up cameras for capturing frames of pictures of the farm . System processes the captured frames with the data base and identify the animal based on the data . Then , Alerts will be sent to the farm owner about the presence of animals in the farm . Mean while , the another system produces sounds to prevent animal from causing trouble to the crop based on the type of animal.

Keywords- Embedded System , Monitoring , Detection , cameras ,Infra Red (IR) Sensors.

I. INTRODUCTION

An Embedded System is deployed in remote and human unattended environments for critical applications. The sensors of the Embedded System senses the information and wakes up the system. Based on the data provided by a particular sensor, camera is controlled by a servo motor towards the sensor. Then camera captures the video and retrieves set of frames of images for processing. These frames of images are compared with the data base and reports the presence of Animals in Fields to the farmer via API.

An embedded system is a controller programmed and controlled by a real-time operating system with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints. It is embedded as a part of an entire device typically together with hardware and mechanical components. Embedded systems management several devices in common use nowadays. Ninety-eight of all microprocessors are factory-made to function embedded system part.

Embedded systems are normally found in shopper, industrial, automotive, medical, commercial and military applications. Embedded systems are utilized in transportation, fire safety, safety and security, medical applications and life critical systems, as these systems can be isolated from hacking and thus, be more reliable, unless connected to wired or wireless networks via on-chip 3G cellular or alternative ways for IoT watching and management functions. For hearth safety, the systems can be designed to have greater ability to handle higher temperatures and continue to operate. In managing security, the embedded systems can be self-sufficient and be able to deal with cut electrical and communication systems.

Further, based on performance and functional requirements of the system embedded system classified into four types inside the farm such as:

1.Real time embedded systems.
2.Stand alone embedded systems.
3.Networked embedded systems.
4.Mobile embedded systems.

The crop field remote monitoring system is proposed of a sensor infrastructure which is capable of collecting information field surroundings and the field. In rural areas of India, destruction of crop by animals are more common every year. Hence, a system that monitors the intruding of animals into crop fields based on image processing is proposed. This paper introduced a method for detecting and preventing animals that enter the crop fields.

Some kinds of methods for crop diseases and pests information acquisition by remote sensing is discussed. The results shows that the system monitors agricultural fields for unauthorised entry in crop[1]. But this system cannot identify what that unauthorised entry is. A system with non-imaging sensors detect people and animals based on the observation of motion and behaviour of the person or animal[2]. This system totally depend on the non-imaging sensors whose behaviour cannot be predictable. Automated Detection and Recognition of life mistreatment Thermal Cameras[6]. In this system Thermal cameras are used for animal moment detection. It's a very costly affair for the farmers to afford a Thermal Camera.

II. LITERATURE SURVEY

1.Shobhit Kumar Nagpal, Manojkumar.P, James Sabatier,"Hardware Implementation of Intruder Recognition In a Farm through Wireless Sensor Network"

In this paper any intruder in the farm is recognized based on wireless sensor networks. It is based on RF identification. This paper cannot identify who entered the farm.

2.ThyagarajuDamarla, Asif Mehmood, James Sabatier," Detection of people and animals using non-imaging Sensors"

In this paper any intruder in the farm is detected and identified based on their heat characteristics and their behaviour. Total Dependence on sensors is not good because they do not provide accurate results.

3.Vikhram.B , Revathi.B, Shanmugapriya.R, Sowmiya.S, Pragadeeswaran.G," Animal Detection System in Farm Areas"
This paper describes the process of detecting animals based on PIR sensor and ultra sonicsensor.Alerts are sent via GSM but it cannot tell which animal entered the farm.
4. S. Santhiya, Y. Dhamodharan, N E. Kavi Priya, C S. Santhosh, M.Surekha,"A SMART FARMLAND USING RASPBERRY PI CROP PREVENTION AND ANIMAL INTRUSION DETECTION SYSTEM"
This paper cannot be implemented in a random environment.Itcn be implemented for a particular steady environment.
5. J. Kuklyte, K. McGuinness, R. Hebbalaguppe, C. Direkoglu, L. Gualano, N. E. O'Connor," IDENTIFICATION OF MOVING OBJECTS IN POOR QUALITY SURVEILLANCE DATA"
This paper describes the surveillance of an area in poor quality environment. System can detect animals in dark and poor environment.
6. Peter Christiansen , Kim Arild Steen, Rasmus NyholmJørgensen and Henrik Karstoft," Automated Detection and Recognition ofWildlifeUsingThermal Cameras"
This paper proposes a system in monitoring the forest environment based on thermal cameras. But it is a costly affair.
7. *Wayne Wolf,BurakOzer,TiehanLv,"* Smart Cameras as Embedded Systems*"*

III. PROPOSED WORK

As mentioned in previous section a lot of work has been done related to crop monitoring, paddy growth monitoring etc. However, there is no work in the literature that deals with Intrusion detection in the fields which is also a very important aspect in monitoring. Hence, an attempt is made in this paper to handle this. Depending on the area and the boundary of the farm, IR sensors are to be placed inside the farm with sufficient spacing and angle. Sensors are placed in such a way that it is able to sense the moment of animals or humans. The sensors are connected to the RaspberryPi and the RaspberryPi continuously receives the sensor information and checks the signal to detect the crossing of animals or humans. The RaspberryPi is programmed in an event driven mode so that when ever an animal is detected by the sensor, sensor activates the camera which is connected to a servo motor . The servo motor rotates to a particular angled IR sensor and starts capturing the live video. Based the program given it converts the video in frames of pictures and compare them with the database and detects the animal along with its name based on image processing. As an immediate action this signal is sent to the buzzer to produce sound in order to make the animal afraid and get away from the farm.

In the meanwhile, message will be sent via APIs to the owner of the farm and also the message will be forwarded to forest department if the detected animal is a wild animal.

To minimize the hardware cost ,free from communication problems and decrease the system complexity we go for API method instead of GSM. And also an automatic alarm system is also designed. A 5V voltage is required to power all the these components.

The entire system consists of different blocks namely.

1. RaspberryPi Model B Board
2. IR Sensors
3. Servo Motor
4. Buzzer
5. Adopter for Power Supply
6. Pi Camera

The block Diagram of the proposed system will be as follows.

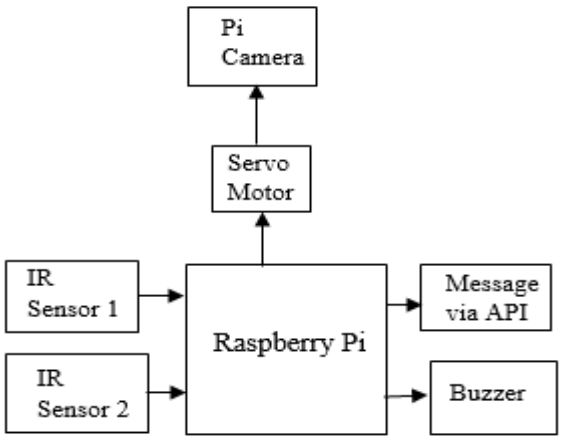

Fig.1: Block Diagram of Proposed Work

IV. PROJECTIMPLEMENTATION

Whenever an object is detected by the sensor, the sensor communicates with the raspberry pi controller and sends the analog data. Based on the given data Raspberry pi activates the camera and the servo motor. Servo motor works on based on the input provided by a particular sensor and camera continuously captures the live video.

This camera live video is given as an input to the raspberry pi controller for processing of the given data.

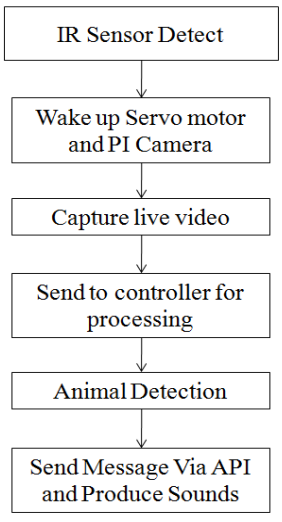

Fig.2: Flowchart of the Proposed System

Based on the training and database provided to the system it identifies the animal and simultaneously produces sounds based on the class of animal and at the same time message will be sent to the owner or farmer and further also to the forest department if it a wild animal.

Fig.3: Experimental setup of the proposed work

Thus we can prevent and eradicate the animal intrusion based on the proposed system.

V. SYSTEM COMPONENTS

A prototype model of the proposal has been designed and implemented with number of components to form a intelligent embedded system. The IR sensor is used to sense the motion of the animals and humans. Whenever an obstracle comes in the range of the sensor, it detects and sends the analog signal to the controller.

1. Raspberry Pi 3 Model B :

Raspberry pi may be a tiny credit-card sized laptop capable of playacting varied functionalities like in police investigation systems, military applications, etc. The various functionalities of the elements area unit given below the varied elements of Raspberry- Pi area unit

• Mount Rushmore State Card Slot is employed to put in OS/booting/long term storage .The total memory of the SD card is about 16GB.

• Micro USB Power Port provides700mA at 5A. RCA Video Out is connected to show if HDMI output isn't used. It is primarily wont to carry audio and video signals. They are otherwise called as A/V jacks

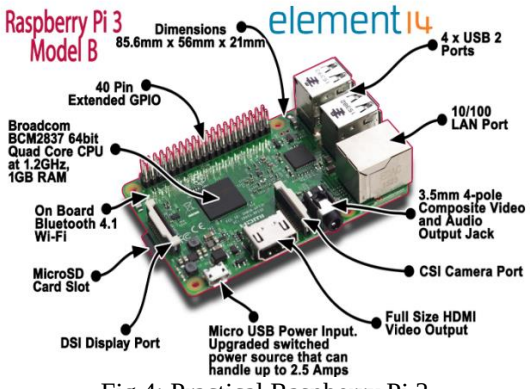

Fig.4: Practical Raspberry Pi 3

.• Audio Out Digital audio is obtained if HDMI is employed to get stereo audio. Here analogue RCA connection is used. • local area network Port is employed to attach to the net. It additionally plays a task in change, obtaining new software system easier.

• HDMI OUT (High Definition transmission Interface) is employed with HDTVs and monitors with HDMI input. Also HDMI-HDMI is used here.

• BROADCOM BCM 2835: it's otherwise outlined as System on chip .It is a 700 megacycle per second Processor. It has a Video core IV GPU. GPIO permits US to regulate and move with globe.

	Raspberry Pi 3 Model B
Introduction Date	2/29/2016
SoC	BCM2837
CPU	Quad Cortex A53 @ 1.2GHz
Instruction set	ARMv8-A
GPU	400MHz VideoCore IV
RAM	1GB SDRAM
Storage	micro-SD
Ethernet	10/100
Wireless	802.11n / Bluetooth 4.0
Video Output	HDMI / Composite
Audio Output	HDMI / Headphone
GPIO	40

Table.1: Raspberry Pi Specifications

2. IR Sensor

The IR sensor module consists mainly of the IR Transmitter and Receiver, Opamp, Variable Resistor (Trimmer pot), output LED in brief.

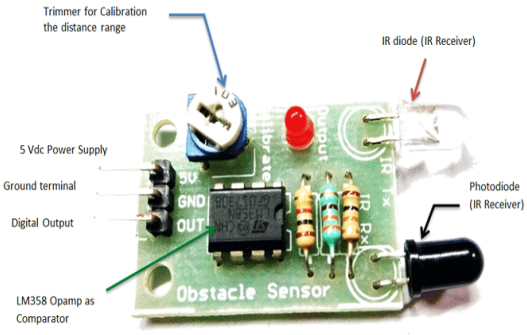

Fig.5: PracticalIR Sensor Module

(A) IR LED Transmitter :

IR light-emitting diode emits lightweight, within the vary of infrared. IR lightweight is invisible to North American nation as its wavelength (700nm – 1mm) is way beyond the visible radiation vary.

(B) Photodiode Receiver :

Photodiode acts because the IR receiver as its conducts once lightweight falls on that. Photodiode may be a semiconductor that includes a tangency, operated in Reverse Bias, means it start conducting the current in reverse direction when Light falls on it, and the amount of current flow is proportional to quantity of sunshine. This property makes it useful for IR

detection. Photodiode looks like a LED, with a black colour coating on its outer side, Black colour absorbs the highest amount of light.

Main Chip	LM393
Operating Voltage Range	3.6~5 VDC
Average Current Consumption (mA)	0.06
Detection Angle	35 °
Distance Measuring Range	2 ~ 30cm
Dimensions (mm) LxWxH	48 x 14 x 8
Weight (gm)	5

Table 2 : IR sensor specifications

(C) LM358 Opamp :

LM358 is Associate in Nursing Operational electronic equipment (Op-Amp) is employed as voltage comparator within the IR detector. the comparator will compare the threshold voltage set using the preset (pin2) and the photodiode's series resistor voltage (pin3).

(D) Variable Resistor :

The variable resistor used here is a preset. It is used to calibrate the distance range at which object should be detected.

3. Servo Motor :

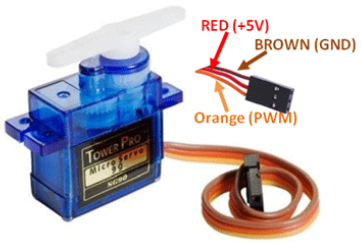

Fig.6: PracticalServo Motor

Tiny and lightweight with high output power. Servo will rotate about one hundred eighty degrees (90 in every direction), and works just like the standard kinds but smaller. You can use any servo code, hardware or library to control these servos. Good for beginners UN agency wish to create stuff move while not building a motor controller with feedback & gear box, especially since it will fit in small places. It comes with a three horns (arms) and hardware.

Modulation	Analog
Speed	4.8V: 0.12 sec/60°
Weight	0.32 oz (9.0 g)
Motor Type	3-pole

Table 3 : Servo Motor Specifications

Position "0" (1.5 ms pulse) is middle, "90" (~2ms pulse) is middle, is all the way to the right, "-90" (~1ms pulse) is all the way to the left.

4. Pi Camera :

The Raspberry Pi Camera Module v2 may be a prime quality eight megapixel Sony IMX219 image sensing element bespoke add-on board for Raspberry Pi, that includes a hard and fast focus lens

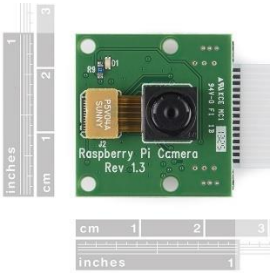

Fig.7: PracticalPi Camera

Sensor Resolution	2592 × 1944 pixels
Sensor image area	3.76 × 2.74 mm
Pixel size	1.4 µm × 1.4 µm
Optical size	1/4"

Table 4 : Pi Camera Specifications

It's capable of 3280 x 2464 picture element static pictures, and conjointly supports 1080p30, 720p60 and 640x480p60/90 video. It attaches to Pi by approach of 1 of the little sockets on the board side and uses the dedicated CSi interface, designed particularly for interfacing to cameras.

VI. EXPERIMENTAL RESULTS

The experimental results of the proposed work are shown below.

Fig. 8 shows that the system has detected the animal correctly and if the result is stable it performs the corresponding task.

Fig.8: Practical Output

Fig. 9 shows that when ever an animal is detected and result is stable the system sends the text message to the farmer via API.

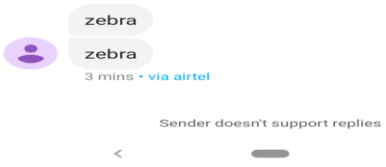

Fig.9: SMS Alert Via API

VII. CONCLUSION

In rural parts of India, farmers encounter severe threats like reparation done by animals, natural disasters and thefts resulting in poor yields. Hence, to overcome this issue an Embedded system based monitoring system is proposed. This proposal is capable of detecting animal intrusions in the farm. A prototype model is designed, developed and tested and it is found to effectively monitor the movement of animals and humans in the farm and inform the farm owner. The benefits of the model arecost effective, simple and easy to implement .

VIII. FUTURE SCOPE

This proposed work tries to detect and prevent animals based on the database provided to the system and the accurate output results will depend on stability of the system and animal.Proposed system cannot act accordingly if it encounters two detections simultaneously.Accurate output results depend on animals nature and surrounding environment. So, there is scope of developing a system which even works in dynamic and unsteady environment which can increase the accuracy of the system further.

IX. REFERENCES

[1]. ThyagarajuDamarla, Asif Mehmood, James Sabatier," Detection of people and animals using non-imagingSensors" ,Proceedings IEEE , 2011.

[2]. Vikhram.B , Revathi.B, Shanmugapriya.R, Sowmiya.S, Pragadeeswaran.G," Animal Detection System in Farm Areas", IJARCCE, Vol. 6, Issue 3, March 2017.

[3]. S. Santhiya, Y. Dhamodharan, N E. Kavi Priya, C S. Santhosh, M.Surekha,"A SMART FARMLAND USING RASPBERRY PI CROP PREVENTION AND ANIMAL INTRUSION DETECTION SYSTEM",IRJET,Volume: 05 Issue: 03 | Mar-2018.

[4]. J. Kuklyte, K. McGuinness, R. Hebbalaguppe, C. Direkoglu, L. Gualano, N. E. O'Connor," IDENTIFICATION OF MOVING OBJECTS IN POOR QUALITY SURVEILLANCE DATA", CLARITY: Centre for Sensor Web Technologies,Dublin City University, Ireland.

[5]. Shobhit Kumar Nagpal, P. Manojkumar, " Hardware Implementation of Intruder Recognition In a Farm through Wireless Sensor Network", Proceedings IEEE , 2011.

[6]. Peter Christiansen , Kim Arild Steen, Rasmus NyholmJørgensen and Henrik Karstoft," Automated Detection and Recognition of Wildlife Using Thermal Cameras", Sensors 2014,www.mdpi.com/journal/sensors.

[7]. Wayne Wolf, BurakOzer, TiehanLv," Smart Cameras asEmbedded Systems*".*

[8]. Che YogYeo,S.A.R.Al-haddad,CheeKyunNg,"Animal Voice Recognition For Identification Detection System",Proceedings IEEE , 2011.

[9]. Ruifernands, Joao N.Matos, Tiago Varum,"Wifi Intruder Detection",Proceedings IEEE , 2014.

[10]. Johannes karlsson,Keni Ren and HaiboLi,"Tracking and identification of animals for a digital zoo",Proceedings IEEE , 2010.

[11]. Ming Kai Hsu, Kenneth Byrd, Ting N .Lee,CharlesHsu, HaroldSzu," Dual IR Spectral Video Inspection of Concealed Live Animal".

[12]. JasonParham,JonathanCrall,DanielRubenstien,JasonHolmberg,TanyaBerger,"An Animal Detection Pipeline for Identification",Proceedings IEEE , 2018.