

# A SMART FARMLAND USING RASPBERRY PI CROP VANDALIZATION PREVENTION & INTRUSION DETECTION SYSTEM

Pooja G<sup>1</sup>, Mohmad Umair Bagali<sup>2</sup>

<sup>1</sup>P G Student, <sup>2</sup> Assistant Professor,

<sup>1,2</sup> Department of Electronics and Communication Engineering, School of Engineering and Technology,  
Jain University, Bangalore.

## ABSTRACT

*Crop vandalization by wild animals is a second major threat to the farmers, after drought. The aim of this project is to provide a smart solution to resolve this problem. This project is based on surveillance with an animal ward-off system employed in farmlands in order to prevent crop vandalization by wild animals. In addition to providing protection this system distinguishes between an intruder and an authorized person using RFID's, various PIR sensors are deployed in the area to detect any motion and hence turns ON a camera when movement is detected, thereby providing real time monitoring. It involves automation of certain methods used to prevent the wild animals from entering the farmlands and destroying the crops, an electronic fire cracker (for bigger animals, like elephant) and a rotten egg spray (for smaller animals like wild pigs and deer) which have been found useful to ward off the wild animals, we use Haar feature based cascade classifiers for object detection to distinguish between the animal and human. When such intrusions occur, a message will be automatically generated and the cameras employed are turned ON which capture an image and start recording the video for some time which will be stored on the SD card as well as stored on cloud i.e, dropbox, the land owner can then view the video on any smart device, as well as access it later. All the sensors and components are interfaced to the Raspberry pi board. Hence we come up with such a product that can be very useful for farmers, it prevents the loss of crops and increases the yield, also protects the farm from intruders.*

**Keyword :** - Protection; crop vandalization, animal ward-off, Dropbox ,and RFID authorization.

## 1. INTRODUCTION

Surveillance plays a major role in many fields be it at home, hospitals, schools, public places, farmlands etc. It helps us to monitor a certain area and prevent theft and also provides proof of evidence in case of occurrence of such incidents. In the case of farmlands or agricultural lands surveillance is very important to prevent unauthorized people from gaining access to the area as well as to protect the area from animals.

Various methods aim only at surveillance which is mainly for human intruders, but we tend to forget that the main enemies of such farmers are the animals which destroy the crops. The problem of wild life attack on crops i.e., crop Vandalization is becoming very common in the states of Tamil Nadu, Himachal Pradesh, Punjab, Haryana, Kerala and many other states. Wild animals like monkeys, elephants, wild pigs, deer, wild dogs, bison, nilgais, stray animals like cows and buffaloes and even birds like parakeets cause a lot of damage to crops by running over them ,eating and completely vandalizing them. This leads to poor yield of crops and significant financial loss to the owners of the farmland. This problem is so pronounced that sometimes the farmers decide to leave the areas barren due to such frequent animal attacks. This system helps us to keep away such wild animals from the farmlands as

well as provides surveillance functionality. It has been found that the odour of rotten egg helps to keep the wild pigs and deer from destroying the crops, hence the farmers manually spray the rotten egg solution on their fields, and firecrackers are used to ward off the wild elephants that destroy the crops.

The system is automated depending on the need so that there is no manual work, thereby saving time and also preventing the loss of crops.

## 2. LITERATURE REVIEW

Sneha Nahatkar et al,[1] proposed a home embedded surveillance system which evaluates the development of a low-cost security system using small PIR (Pyroelectric Infrared) sensor built around a microcontroller with ultra-low alert power. The system senses the signal generated by PIR sensor detecting the presence of individuals not at thermal equilibrium with the surrounding environment. On detecting the presence of any unauthorized person in any specific time interval, it triggers an alarm & sets up a call to a predefined number through a GSM modem. After the MCU sends the sensor signals to the embedded system, the program starts the Web camera which then captures the images which can be viewed and analyzed later.

M. Sathishkumar et al,[2] the security system is based on an embedded system along with GSM and sensor networks. The human movement is detected using the PIR sensors. The system triggers an alarm detecting the presence of person in a specific interval of time and simultaneously sends the how many persons are intruder via message to the SMS through GSM Modem. When the security system is activated, the CCTV camera is activated. This highly reactive approach has low computational requirement. Therefore it is well suited for home surveillance system. This surveillance security system implemented using PIC micro controller, camera, GSM and sensors.

T.Gayathri et al,[10] proposed the system for monitoring the growing status of the corn (maize) plant continuously and intimate the agriculturist using wireless sensor network (WSN). But in practice, cultivator faces too much effort in the farmland. This paper makes eases the work of the farmer in cultivated land through the usage of different kind of sensors. The two LDR sensors are interfaced with PIC16F877A microcontroller whereas its top array receives solar radiation for supply current and the bottom of the LDR array is for measuring leaf area index (LAI). The humidity sensor will compute the moisture level in the corn field, if the level decreases, then it automatically switches ON the DC motor. All the particulars of farmland are sent to the farmer through GSM and revel in the LCD screen. The temperature sensor will find the intensity of heat present in the soil. PH sensor is used to find the soil alkalinity which is essential for plant nutrition.

V Nainwal, et al,[16]Sensors are used to detect the presence of objects in the surveillance area and the information is collected over time to extract the event of interest. The information gathered by the surveillance camera i.e., video or still images could be used for further analysis and detection of the intruding object.This system does not utilize advanced techniques for alerting the owner of that area.

## 3. EXISTING SYSTEM

The existing systems mainly provide the surveillance functionality. Also these systems don't provide protection from wild animals, especially in such an application area. They also need to take actions based on the on the type of animal that tries to enter the area, as different methods are adopted to prevent different animals from entering such restricted areas. Also the farmers resort to the other methods by erecting human puppets and effigies in their farms, which is ineffective in warding off the wild animals, though is useful to some extent to ward off birds .The other commonly used methods by the farmers in order to prevent the crop vandalization by animals include building physical barriers, use of electric fences and manual surveillance and various such exhaustive and dangerous methods.

## 4. OBJECTIVES AND SCOPE OF STUDY

- I. The main objective of this project is to provide an effective solution to this problem, so that the economic losses incurred by our farmers are minimized and they have a good crop yield. It helps to save time and money by reducing the manual work that is otherwise required if the farmers themselves had to provide protection to their farmlands with their constant manual supervision. The manual work done in order to keep away the animals from the crops is automated, hence such constant supervision is a thing of the past with such smart protection

systems, which are capable of identifying and taking the required actions themselves without any human intervention.

## 5. PROPOSED SYSTEM

This system presents a method to automate the process of keeping off the wild animals from farmlands and also provide surveillance with differentiating among the authorized and unauthorized person.

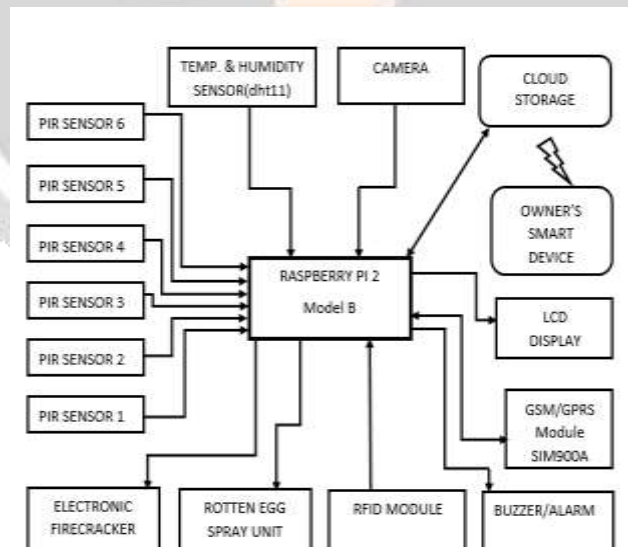
We use Passive Infrared Sensors (PIR) to detect any motion of human body, once the employed PIR sensors detect motion the cameras capture an image and start recording the video as well as the owner of the farmland gets notified about the intrusion. This information along with the captured video is stored onto cloud from where the person in charge can access it once he receives the message. We use bash scripting for uploading the video to Dropbox.

We also use RFID tags to differentiate between the authorized person and the intruders, if the person is an authorized one then no action is taken by the system.

Whereas if the person is an unauthorized one the alarm or buzzer is turned ON to notify other people about the intrusion. Before which the system determines if the unauthorized person is an animal or human intruder based on Haar feature based cascade classifiers.

If found to be an animal, the system then checks for the number of PIR sensors that have gone HIGH, if fewer number of sensors are high it denotes a smaller animal and all or more than half the sensors that turn high denoted it is a bigger animal and hence necessary action is employed to keep them away from destroying the crops.

In order to automate the animal ward off system discussed, we take a decision based on the number of sensors that have gone high. The basic working principle is, if fewer numbers of sensors are able to detect the motion then it denotes an animal smaller in height such as a wild boar, deer etc., and we immediately turn on the rotten egg spray unit, which helps to keep away the pigs. Similarly if more than half or all of the employed PIR sensors have gone high it is naturally because of a huge animal such as the elephant which is another major threat to such farmlands, we initiate the electronic firecrackers to turn ON, the loud noise which in turn helps to ward off the bigger animals.



**FIGURE 1:** BLOCK DIAGRAM OF THE PROPOSED SYSTEM USING RASPBERRY PI

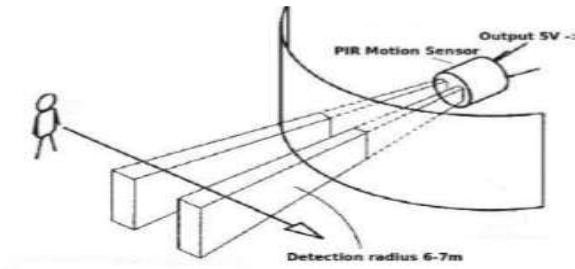


FIGURE 2: PIR MOTION SENSOR RANGE

### 6. DATA and METHODOLOGY

The proposed system uses a Raspberry Pi board which forms the main heart of the system, the different sensors and camera are interfaced to the board. As soon as the PIR sensors go High on detecting motion within a range of 10 meters, the camera will be turned ON which first captures an image and then starts recording the video for about five to six minutes, which will be stored onboard as well as cloud, simultaneously a message will be generated automatically to the registered number using a SIM900A module to inform about the intrusion along with the details of the temperature and humidity obtained by interfacing dht11 temperature and humidity sensor. If the motion detection is due to an authorized person with a valid RFID, who is mostly a farm worker, his attendance gets recorded automatically. Whereas if the motion detection is due to that of an unauthorized person without the valid RFID tag, the system further processes the image and video using Haar feature based Cascade Classifiers for object detection, and decides if the entity is an animal or human intruder. If found to be human after processing the available information the system raises an alarm, to notify people about the intrusion. But if the intruder is an animal, the system decides what action has to be taken based on the number of PIR sensors that have gone high. We employ six PIR sensors; if sensors one to three from ground level are High then we classify it as an intrusion due to smaller animals like deer or wild pig and hence turn ON the DC motor which controls the nozzle of the rotten egg spray unit. If any of the PIR sensors above sensor three go high or even if all the sensors from bottom to top go High then we initiate the electronic firecrackers, but automatically turning it ON. These sensors are mounted vertically either on a pole at the fencing, access points or in a watch tower employed in that area.



FIGURE 4: THE PROTOTYPE OF THE PROPOSED SYSTEM

PIR SENSORS					
PIR-P1	PIR-P2	PIR-P3	PIR-P4	PIR-P5	PIR-P6
Conditions to Turn ON Rotten Egg Spray Unit			Conditions to Turn ON Electronic Firecracker		
1	0	0	X	X	X
1	1	0	X	X	X
1	1	1	X	X	X
X	X	X	1	0	0
X	X	X	1	1	0
X	X	X	1	1	1

FIGURE 5: TRUTH TABLE

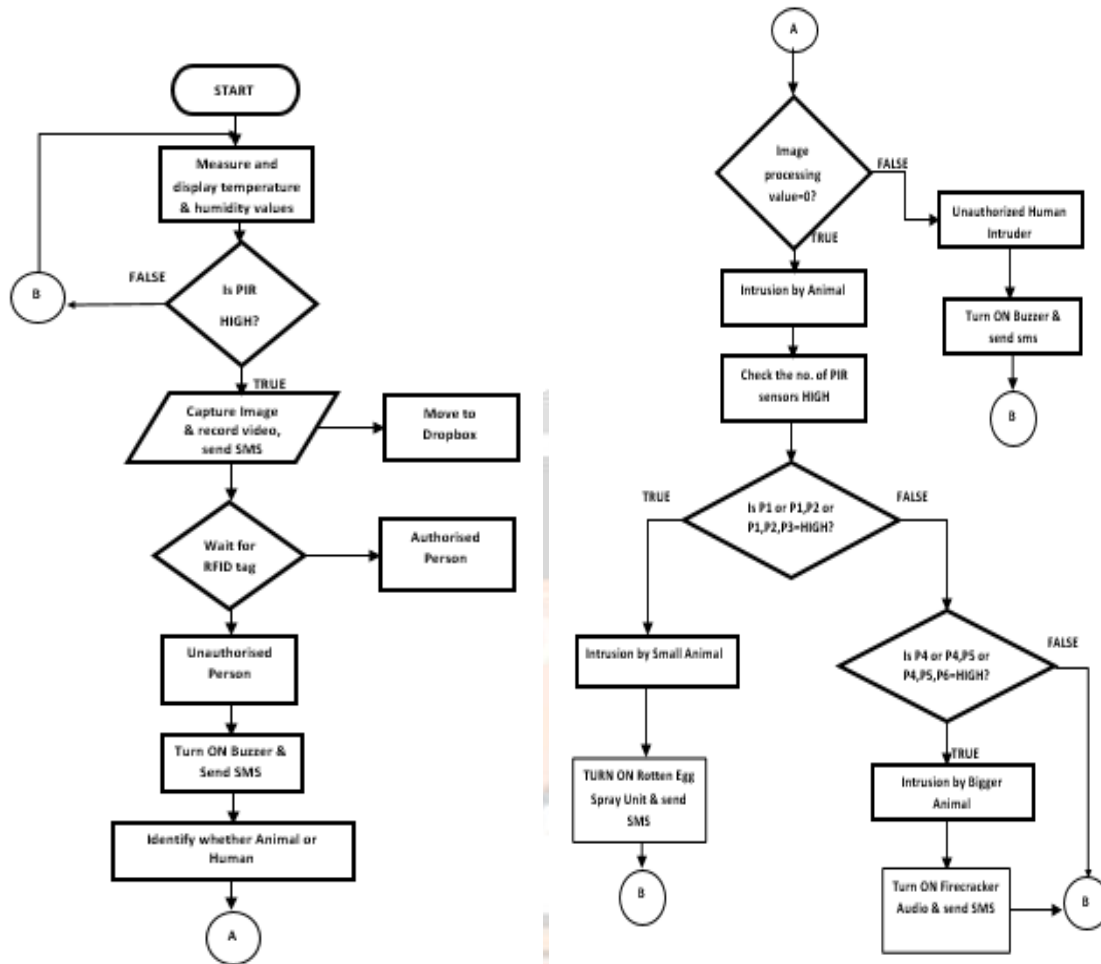


FIGURE 3: FLOWCHART OF THE PROPOSED SYSTEM

## 6. MERITS AND FEATURES OF THE PROPOSED SYSTEM

- II. Such a system requires no human supervision, hence saves a lot of time and energy. The system works in real time to detect the animals in the field, in addition the farmers can access the view of their fields remotely.
- III. The system causes no harm to the animals or humans; it has a very low power requirement and can also run on a battery thus reducing the hazards of electric shocks.
- IV. It is a highly flexible system although mainly aimed at crop protection it can be used as a remote monitoring and a standalone system, and can also be installed in godowns, shops, and places prone to robbery etc.
- V. It is also a highly economical system. It is an effective ,accurate and adaptive system as it can be trained to detect and differentiate among various kinds of animals that serve as a major threat to such areas, this feature makes it highly adaptable to the local sites of deployment, it can be trained to detect monkeys at some place whereas at some other place we can program it to detect stray cows, buffaloes etc., Thus the system is not limited to the detection of any particular type of animal, thereby making it suitable for different areas of our country.

## 7. LIMITATIONS AND FUTURE SCOPE

VI. The system presently uses two mechanisms to ward off the animals namely the rotten egg spray and electronic firecrackers; it can further be implemented with more methods and also can be trained to identify different kinds or species of animals.

VII. Also, we can employ a network of such system throughout the farmlands using wireless sensor networks, with a main decision making or control unit. The system can also be trained and designed based on the area where the farmland is located by taking into account the different animals that pose a threat to the crops in that particular area.

Watch towers can be employed throughout the area to monitor such intrusions and to prevent them.

## 8. CONCLUSIONS

VIII. The problem of crop vandalization by wild animals has become a major social problem in the current time. It requires urgent attention and an effective solution. Thus this project carries a great social relevance as it aims to address this problem. Hence we have designed a smart embedded farmland protection and surveillance based system which is low cost, and also consumes less energy. The main aim is to prevent the loss of crops and to protect the area from intruders and wild animals which pose a major threat to the agricultural areas. Such a system will be helpful to the farmers in protecting their orchards and fields and save them from significant financial losses and also saves them from unproductive efforts that they endure for the protection of their fields. This system will also help them in achieving better crop yields thus leading to their economic wellbeing.

IX.

## 9. ACKNOWLEDGEMENT

I would take this opportunity to thank all those who helped me complete my project on time.

## 10. REFERENCES

- [1]. Ms. Sneha Nahatkar, Prof. Avinash Gaur, Prof. Tareek M. Pattewa “Design of a Home Embedded Surveillance System with Pyroelectric Infrared Sensor & Ultra-Low Alert Power” International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) Volume 1, Issue 3, September 2012.
- [2]. M. Sathishkumar<sup>1</sup>, S.Rajini “Smart Surveillance System Using PIR Sensor Network and GSM” International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 4 Issue 1, January 2015.] S. Sivagamasundari, S. Janani, “Home surveillance system based on MCU and GSM”, International journal of communications and engineering, 2014, volume 06– no.6.
- [3]. Padmashree S. Dhake, Sumedha S. Borde, “Embedded Surveillance System Using PIR Sensor”, International Journal of Advanced Technology in Engineering and Science, www.ijates.com Volume No.02, Issue No. 03, March 2014.
- [4]. Sudhir G. Nikhade, “Wireless Sensor Network System using Raspberry Pi and Zigbee for Environmental Monitoring Applications”, 2015 International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM), Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, T.N., India. 6 - 8 May 2015. pp.376-381.
- [5]. Pramod P. J, S. V Srikanth, Vivek N, Mahesh U Patil, Sarat Chandra Babu N, “Intelligent Intrusion Detection System (In2DS) using Wireless Sensor Networks”, Proceedings of the 2009 IEEE International Conference on Networking, Sensing and Control, Okayama, Japan, March 26-29, 2009.

- [6]. Serkan Akbas<sup>1</sup>, Mehmet Akif Efe<sup>2</sup>, Suat Ozdemir, "Performance Evaluation of PIR Sensor Deployment in Critical Area Surveillance Networks", 2014 IEEE International Conference on Distributed Computing in Sensor Systems.
- [7]. R. Hariprakash, S. Ananthi ,K Padmanabhan, An Economical Wireless Network Monitored Scheme for Camera Based Intrusion Detection at Unattended Sites,2011 International Conference on Computer Applications and Industrial Electronics.
- [8]. Srinivasa Reddy Gudibandi M.Tech Student, JNTUA, Anantapuramu, A.P, India, Mr. M. Amarnath , "Design of Smart Surveillance System using PIR and Ultrasonic Sensor", International Journal & Magazine of Engineering, Technology, Management and Research, November 2015.
- [9]. Sang Gi Hong, Young Bag Moon, Nae Soo Kim USN/IoT Convergence Research Division, Electronics and Telecommunications Research Institute Daejeon, Republic of Korea, Window Energy Detection for Unmanned Surveillance with PIR Sensor, 2012 IEEE 11th International Conference on Trust, Security and Privacy in Computing and Communications.
- [10]. T.Gayathri, S.Ragul, S.Sudharshanan, Corn farmland monitoring using wireless sensor network, International Research Journal of Engineering and Technology (IRJET), e-ISSN: 2395-0056, Volume: 02 Issue: 08 | Nov-2015.

