



## Comparative Study on Advanced Farm Security System Using Internet of Things and Image Processing.

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**Abstract:** Internet of Things consists of two words Internet and objects. The term objects in IoT refers to various IoT devices that have unique identities and are capable of making remote sensing, performing and live monitoring of certain types of data. IoT devices enable other devices connected to the app directly or indirectly, and send data to various servers and combining IoT with Image processing in the agriculture sector can lead to a more technology driven system in terms of agriculture security which can create a Smart Agricultural Security System.

The major problem in today's agriculture sector is protecting crops from local animals and thieves because it is not possible for every farmer to barricade the entire field or stay on the field 24 hours and guard it. So, to overcome this problem there must be an automated crop protecting system which uses leading technologies like IoT and Image Processing. The advantage of using this system can help farmer to monitor the farm even if farmer is away from field by installing various sensors in farm to detect motion of local animal and sent data to farmer app directly and also farmer can see live streaming of the farm with help of camera installed in farm. This ensures complete safety of crops from animals and thieves thus increasing financial gain with a proper security surveillance system.

**Keywords** - IoT, Image Processing, Farm Security, Crop Protection, Arduino Uno.

### I. INTRODUCTION

To know whether any intruder came inside the farm or not has always being challenging task for every farmer. The proposed system gives protection to the farm as well as it sends notification alert to the farmer about intruder by using IOT devices and deep learning techniques. The proposed system is a prescient model for protection of farm. It is a system which will detect the object with the help of sensors and classify it whether it is human or animal with the help of deep learning.

#### 1.1 INTERNET OF THINGS (IoT)

Internet of Things consists of two words Internet and objects. The term objects in IoT refers to various IoT devices that have unique identities and are capable of making remote sensing, performing and live monitoring of certain types of data. IoT devices are enabled to have live data exchange with other devices connected to the app directly or indirectly, or to collect data from other devices and process data and send data to various servers. A good IoT device has a variety of areas to make connections to other devices that can be connected by telephone or wireless. The Internet of Things has a solid core of various empowering technologies - Wireless Sensor Networks, Cloud Computing, Big Data, Embedded Systems, Security Protocols and Architecture

Web Resources, Internet and Search Engines [5]. With the adoption of IoT in various places such as Industry, Homes and Cities, the great power seems to make everything smarter and smarter. Even the agricultural sector is using IoT technology these days and this has led to the creation of the “Agricultural Internet of Things (IoT)”. The IOT-based IoT system is considered to be an IoT gadget focused on Live Monitoring of Environmental data on the protection of the farm from animals and theft and other types depending on the sensors connected to it. The system provides a “Plug & Sense” concept where farmers can directly farm by demonstrating the installation of the System on the field and accessing Live Data feeds on various devices such as Smart Phones, Tablets etc.

## 1.2 IMAGE PROCESSING

Image processing is defined as the technical analysis of a picture by exploitation advanced algorithms. Different operation is performed on image in image processing such as feature extraction, aliasing, image enhancement, contrast enhancement, etc. In manner to perform such operation firstly an image needs to be given as input to computer but the computer read the image as matrix of different number where for each color in image have different value. There are lots of application of image processing in different areas such as Automobile Industry, Healthcare industry, Defense, etc. The proposed system uses image processing for Agriculture Sector and does classification of image with the help of TensorFlow library. In TensorFlow to classify image model firstly need to extract features of images like group of pictures, pointes, pixels of object that need to be classify. The proposed system does classification between animals and human beings.

## II. LITERATURE SURVEY

M. Jaya Prabha, R. Ramprabha, [1] In the proposed system mainly use of 3 IOT devices – IR sensor, Ultrasonic sensor and GSM module. Other than that, there is Microcontroller (Arduino Uno), DC gear engine, voice module, and so on. At some distance people or any animal roams around the farm, intentionally or unintentionally they need to hurt the farm then there IR sensor identifies movement around the farm. In the wake of getting an introductory information signal from IR it will provide for the microcontroller for additional preparation and the system will enact promptly it will be on the APR board. There is an ultrasonic sensor which is mounted on the DC engine to turn 360 degrees, so that flying creatures can be identified. They are used to terrify animals by causing sound to redirect it heading which is coming towards the yield. Microcontroller is used for perusing the contributions from IR and ultrasonic sensor. GSM module is use for settling on decision to farmer. It alarms the farmer that a few animals, flying creatures or any individual attempts to go into the farm.

Ramaprasad, S Ram prasad, Rajendra Prasad P., [2] has proposed a system in such way that the crops in the farm are going to be monitored as well as it is going to be protected from different disasters. Also, Smart Irrigation of the crops taking place. For this different IOT Technologies has been used. They implemented this smart irrigation system by using Arduino microcontroller and some IOT sensors such as soil moisture sensor, DHT11 sensor and IR sensor. Soil humidity sensor is utilized to estimate the measure of water content in the dirt. DHT11 sensor is utilized to calculate the humidity and temperature of the of the field. IR sensor is utilized to give the gate crasher alert to the farmer. The data from the different sensors is sent to the Arduino. Arduino imparts the control sign and orders to the GSM module and Wi-Fi module dependent on the data got from the sensors. GSM module is utilized to send the SMS to the farmers versatile about the field conditions. Wi-Fi module is utilized to send the continuous information of the field to the IoT which is a cloud stage.

Anjana M, Charan Kumar A, Monisha R, [3] The proposed system describes about irrigation, monitoring and protection of crop in greenhouse either manually or automatically in all different seasons. For that different IOT sensors, motors, and some technologies have been used. In automatic mode IR sensor is used to detect animals and sends notification to farmer using telegram app using internet services. Sensors are present in the greenhouse measures the parameters like moisture in the soli, temperature, humidity and presence of rain etc. Sends these deliberate values to the microcontroller. Microcontroller checks for the limiting conditions. In the event that the deliberate value arrives at this limit esteem, at that point it takes controlling tasks. To protect the crops during rainy season the rain sensor will sends the signal to microcontroller about the appearance of rain then the roof top of the greenhouse will be actuated by the device according to the calculated value of the sensor.

Rashmi R. Agale, D. P. Gaikwad, [4] In proposed scenario there has been use of many components for protecting the crops from animals, birds and outside attacker. This so many components are at the end are controlled by an IOT device and Raspberry pi. Irrigation of the crops takes place because of different sensors such as moisture, humidity, temperature, float. In proposed system, basic sensors and electronic devices are used so that sensor information is analysed to activate electronic devices. Raspberry pi used as a server to analyse data and send information to user. The proposed system considers level of water in tank and soil moisture level for automated irrigation. And for security there is use of buzzer and scare crow which work when PIR sensor detects object. This

system can be implemented in small agricultural land such that it will be beneficial to small farmers.

Laxmi S. Shabadi, Hemavati B. Biradar, [5] In the proposed work, they introduced web based smart cultivating framework with security. In this work they are thinking about four boundaries in which they are planned to get the data from field and development to that, planning security system with current structure. The information can be got from the field through various sorts of sensors and raspberry pi go about as a worker which will settle on choice and start controllers. Different sensors will detect the current updates about the field and send it to raspberry pi which will examine the information, which actuators can be started dependent on their individual sensor regards. If temperature is high more than the limit value, motor of sprinkler begins to gracefully water to the field. At that point the information taken by the raspberry pi will be sent to the Things Speak in which the information will be spoken to in graphical description, so farmer can get to it and can get data about varieties happened in the field.

Stefano Giordano, Ilias Seitanidis and Mike Ojo, et. al., [6] proposed a system describing the development of the Internet of Things application for crop protection to prevent animal intrusions in the crop field. A repelling and a Surveillance system are provided to prevent potential damages both from wild animal attacks and weather. They presented an integrative approach in the field of Internet of Things for smart Agriculture based on low power devices and open source systems. In their future work, they will extend the current functionalities of their system and investigate the chance of incorporating the features of their system to other sectors.

G. Naveen Balaji, V. Nandhini, S. Mithra, et. al., [7] have designed a method for efficient crop monitoring for agricultural field. With the application of IOT the data's can be stored and retrieved from anywhere. The different sensors used are temperature and humidity sensor and soil moisture sensor. The information collected by the sensors is sent to the Arduino microcontroller ATmega328 and displayed on an LCD display. A web page is made and therefore the information collected by the sensors are updated periodically in it through Wi-Fi. A GSM module is interfaced with the microcontroller through which the message about the farm condition is sent to the Farmer and in this proposed work the sensor part is limited only for monitoring of crops hence in future it can be automated for irrigation and the system can be enhanced with security of farmland under video surveillance which prevents it from obtrude intrusion.

Prathibha S R, Anupama Hongal, Jyothi M, et. al., [8] proposed a system where CC3200 is the main block of this proposed system consisting of microcontroller, network processor and WiFi unit on the same die. It is portable, low power for battery, secure and fast connection. Environmental conditions variations will affect the general yield of the crop. Monitoring the condition of the crop field is very much necessary so sensors are used. Temperature infrared thermopile sensor is used, it has built in digital control and math engine. It senses the temperature values in real time and a humidity sensor tracks the relative moisture of air within the farming field Camera module is interfaced with CC3200 camera booster pack via PCB using MT9D111 camera sensor. This is wont to capture current images of the actual field those images are sent to the farmer through GPRS.

Dr M Suchithra, Asuwini T, Charumathi M C, et. al., [9] the proposed system comprises of sensors that sense the field parameters and the values are validated and later sent to the WI-FI module and from WI-FI module the validated data are sent to the farmer's mobile using cloud services. The farmers are also notified by SMS if the field needs care. Also an algorithm is developed with threshold values of temperature, humidity, moisture and fertility that are programmed and controlled by node MCU to manage water quantity. Farmer can automate the motor from anywhere within the world. The system can further be improved by incorporating new self-learning techniques which could be deployed in the cloud to understand the behaviour of the sensing data and can take autonomous decisions. The other problem farmers are facing is the crop destruction by the wild animals. So, the longer term work includes the planning of the system which will monitor the farm by installing sensors at the boundary of the farm and camera module which can take a snapshot once the sensor detects the doorway and transmit the important time pictures by integrating it with other information.

S. Santhiya1, Y. Dhamodharan, N E. Kavi Priya, et. al., [10] a model used to protect the farm from animals using the Raspberry pi has been proposed. The project uses the RFID (Radio Frequency Identification Device) module and the GSM (Global System Mobile) modem for this purpose. The forest manager and the farmers will receive these SMS containing the area where the animals are watching. Already used methods fail, in which case an article introduces a visual process to expel them, by creating a system that analyses the animal's behaviour, detects the animal and makes a distinct noise that annoys the animal and warns the authorized person to send a message. The animal can be infected by the RFID (animal) vaccine, an LF marker that is injected under the animal's skin. After detection the intimacy is sent. The project is mainly dedicated to the expulsion of animals from the forest through the three stages of smuggling, annoying noise and smoke through the fog machine. The scope of the future is a project in which to find the location of animals using RFID injector and GPS.

Amit Nerurkar, Swapnil Sonawane, Rugved Deolekar, et.al., [11] proposed a system with simple idea of automating the plant irrigation system. In this proposed system, they have mainly focused on improving the existing plant irrigation system and farmland security. They propose to protect the farm by installing PIR sensors diagonally in the middle in an attempt to cover the entire radius of the field. Every living being naturally emits a radiation which can be intercepted using a PIR Sensor. Once an intruder enters the farm, the PIR sensor will sense a change in the value of infrared radiations and immediately a buzzer would be triggered on. Subsequently, the lights would be switched on. Hence, the intruder would be alarmed and the farm would be protected. Additionally, an automatic SMS would be sent to the farmer's cell phone using a SIM900A GSM module which is attached to the Arduino Uno. These measures would ensure that the intruder has left the field and the farmer is notified for the same.

Dugyala Karthik, R. Ramesh Babu, et. al., [12] have proposed a system on smart crop protection with help of image capture. System is work as there are different type of IoT sensors are connect with raspberry PI model such as PIR, ultrasonic sensor, etc for detection of motion if any motion is detected then raspberry PI checks for an presence of animal in image and if found then it will triggered buzzer to alert people and also streams real time video in browser with help of internet. Components which are used in the system are power supply, raspberry PI, PIR sensor, buzzer, etc. Application of these system can also be used in offices and homes security, jewellery shop, bank, etc.

Sweksha Goyal, Unnathi Mundra, Prof. Sahana Shetty, et. al., [13] proposed the system using IoT for farmers. This system is considered all the three factors i.e. monitoring, irrigation and security. Here different sensors are placed in the farming field which help to get data from that data water pumps, sprayer, etc are activated when they are needed. They also used moisture sensor in warehouse where all crops are stored for detection of humanity in room according to that heater or cooler gets turn on and off not only these the motion detector sensor is also placed so that if person tries to steal something from warehouse then by motion detection alarm gets triggered to inform the farmer.

Reshma S, Ramya J, Swathi S, Srinidhi B M, Sindhu R N, et. al., [14] proposed system on Smart Farming using IoT. The proposed system focuses on intelligent, dynamic and automated irrigation system for the agriculture crops. The system focus on controlling the irrigation process and preservation of water resources automatically by Raspberry Pi. soil moisture sensor, Rain water sensor, Temperature sensor and Infrared sensor are used for irrigation of farm according to that farmer can get better decision about water level farmer can do it manually or set it to automatic. They also created an android application which is used for monitoring of farms so if someone tries to enter the farm then with help of IR sensor motion is detected and farmers get notified and buzzers also get triggered.

M Prabhavathi<sup>0</sup>, A Kiranmai, et. al., [15] proposed system designs a security system for farm protection which prohibits the entry of animals into the farm and create an alert system. This is done with the help of motion detection sensors and for monitoring of the field they use a camera and if sensors detect something then buzzer or alarm is triggered and SMS is sent to the farmer using GSM or Wi-Fi module. Here, Temperature Sensor LM35, Moisture sensor are used because It is utilized to detect the dampness in the field and exchange it to microcontroller keeping in mind the end goal to make controlling move of exchanging water pump ON / OFF. The Table 2.1 is a summary of a research proposed system on Farm Security Systems and methods. It states the different techniques and advantages.

### III. ANALYSIS

The Following table is a summary of various research paper on Farm Security.

TABLE 1: ANALYSIS TABLE

Sr. No	Paper Name	Advantages	Limitations
01.	Smart Crop Protection System from Animals [1]	System offers a warning and divert the animal using sound signal without any harm. flying creatures also can be detected in the farm using this system.	There is no use of LED light and Camera for capturing the image of animals and human beings.
02.	Intelligent Crop Monitoring and Protection System in Agricultural fields Using IoT [2]	Production in an Agriculture sector will increase by using this irrigation system. Field information can be monitored by the farmer through mobile using GSM module.	Any intruder detected by IR sensor, but there is no classification of such intruder whether its animal, flying creature or any person.
03.	IOT in Agricultural Crop Protection and Power Generation [3]	Crop safety from excessive rain because there is automatic roof overlaying facility. Solar power generation and rainwater harvesting as technology method is implemented	There is no use of Ultrasonic sensor, GSM module, for sending field information, Camera for detection any intruder.
05.	Design & Implementation of IOT based Smart Security and Monitoring for Connected Smart Farming [5]	Different values are taken by the raspberry pi and it will be sent to the Things Speak (cloud) in which the data will be represented in graphical representation, so that user can access it and can get information about variations happened in the field.	No image processing technique is used in this system. No use of a LED light for night vision
06.	IoT Solutions for Crop Protection against Wild Animal Attacks [6]	Development of Internet of Things application for crop protection to prevent animal intrusions in the crop field. A repelling and a monitoring system are provided to prevent potential damages in Agriculture, both from wild animal attacks and weather conditions.	There is no used of camera for live streaming of the farm such that when the animals approach the farm, the buzzer get triggered to warn the animals but no used of image capturing system to send the live images.
07.	IOT Based Smart Crop Monitoring in Farm Land [7]	Various sensors are used to monitor and collect information about the field conditions. Collectively the about the farm condition is sent to the farmer through GSM technology.	No security system presents to protect the Farm Land from animals and theft, no used of camera. Only message is sent about farm condition related to soil moisture etc
08.	IOT Based Monitoring System in Smart Agriculture [8]	The feature of this proposed system includes monitoring temperature and humidity in agricultural field through sensors using CC3200 single chip. Camera is interfaced with CC3200 to capture images and send that pictures through MMS to farmers mobile using Wi-Fi.	No use of image classification algorithm to classify image capture by the camera. No use of PIR Sensor for motion detection of animals.

<b>09.</b>	Monitoring of Agricultural Crops Using Cloud and IOT with Sensor Data Validation [9]	The proposed system comprises of sensors that sense the field parameters such as temperature, humidity, moisture and fertility in the farm. The sensed values are validated and later sent to the WI-FI module and from WI-FI module the validated data are sent to the farmer's mobile or laptop using cloud. The farmers are also notified by SMS if the field needs a care.	No security method presents for protection of crop from wild animals and theft. No camera module is used to take the snapshot of the farm and send to the farmer.
<b>10.</b>	A Smart Farmland Using Raspberry Pi Crop Prevention and Animal Int rusion Detection System [10]	The animal can be detected by the RFID injector (for animals), the LF tag which inject under the animal skin. After the detection the intimation is sent and buzzer is triggered. This project is mainly contributed to repellent the animals to the forest by using three stages are intimation, irritation noise and smoke by fog machine.	No use of camera for Image classification algorithm to classify image and take snapshot of the farm when the animals or theft enter the farm.
<b>11.</b>	Automated Irrigation and Crop Security System in Agriculture using Internet of Things [11]	Protect the farm by installing PIR sensors diagonally in the middle in an attempt to cover the entire radius of the field. An automatic SMS would be sent to the farmer's cell phone when motion is detected in farm.	No used of camera and mobile application for live streaming and image classification
<b>12.</b>	Smart Crop Protection System with Image Capture Over IoT [12]	Unlike the other systems here if there is any motion is detected by sensors then it doesn't trigger the buzzer directly. Here, first it will check for the animal in image, if detected then it will trigger buzzer.	In this process only neighbours will be alerted and there is no image capture of the thief to trace him later.
<b>13.</b>	Smart Agriculture Using IoT [13]	The main advantage of these proposed system is, this proposed system takes care of all major factors of agriculture i.e. monitoring, irrigation and security.	To give security alerts to farmers there is only an alarm system. No message is sent to farmers via phone in case farmers are away from their warehouse.
<b>14.</b>	Smart Farming Using IoT [14]	The system's purpose in proposed system is mainly focused on an irrigation process and preservation of water resources with the help of a water-flow mechanism using IoT.	If motion is detected by sensors then there is no video streaming and image classification on application for farmers.
<b>15.</b>	Smart Security for agriculture using IoT [15]	Detection of rodents can be done with the help of IoT sensors and live streaming of field is done for monitoring of field.	There is no classification of image done to notify farmer that someone entered in human or animal.

#### IV. CONCLUSION

In this paper there is detailed study of several farm protection technique is done. The study consists of few papers which discuss the techniques of various IOT devices for storing the data, sending the messages, real time streaming and many more. From this survey we conclude that, there are some limitations in each paper. This limitation leads to damage of crops in the farm. Through sensors agriculture is connected to IOT which create a connection between farm field and the farmer. So the damaging to the crops is going to get decreased when limitation in each paper is get fulfilled. Every limitations of the paper can be overcome by introducing image processing techniques with IOT to easily identify thief and alert the farmers.

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