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Virtual Fencing in Agricultural Field

Ms. Sahana K, Mr. Shashank K P, Ms. Ambika D Suryavanshi,
Prof. Pushpalatha H P, Mr. Siddanagouda
Department of Electronics and Communication Engineering.
NIE Institute of Technology, Mysuru, Karnataka, India

Abstract: *Internet of Things (IoT) is an ecologically associated with physical object that is accessible through the internet. IoT has an assortment of utilizations to be specific in smart agriculture, smart healthcare, smart retail, smart home, smart city, energy commitment, poultry and cultivating, smart water management, and for modern reason. In agriculture field, human-animal clash is a significant issue where monster measure of assets is evaporated, and human life will be in danger. Because of this farmer lose their harvests, animals, property, and at the times of their lives. So, this zone is to be checked consistently, to forestall section of wild creatures. Concerning this issue, this Project proposes a framework which will monitor the field. That is by identifying the intruder around the field by utilizing sensor, at that point camera will bind the picture of the intruder and classifies the image by using the image processing and machine-learning tool and afterward the appropriate activity will be upheld by the Esp-32 dependent on the kind of the intruder. At last the notification is sent to the farm owner*

Keywords: Energy harvesting, clean and green energy, and piezoelectric and pyroelectric technology.

I. INTRODUCTION

Agriculture is one of the significant parts for advancement of the nation's economy. Agriculture is the fundamental thing for food and crude material to survive on the earth. The agri- business assumes a huge function in giving huge scope for work. Agriculture improvement is a requirement for the advancement of nationsThe eventual aim is to build an enhanced world for human beings, where the objects around us recognize our desire and hence act accordingly without any precise instructions. Internet of things is a mixture of software and hardware technologies including embedded devices which allows to offer facilities and services to anyone, anytime, anywhere using any network. The connectivity then helps us to obtain extra data from different places, confirming many ways to increase efficiency and progresses the security and safety. Internet of Things is ground-breaking administrations that can help organizations to improve their presentation through examination and security to give better result. Agriculture is the main source of occupation of several individuals around various portions of the world. Sadly, farmers are yet reliant on conventional methods that have developed several years back. Because of this the yield of harvests are getting low. Additionally, numerals of elements that add to the yield of harvests creature interruption is likewise one with them. In current years wild animals are specific test for the farmers everywhere on the world, animals like wild pigs, elephant, tiger and monkeys and so forth cause serious harm to crop by animals running over the field and stomp on over the harvests. It makes the budgetary issues for the farmers. In this venture an observation camera and vibration sensors are utilized. The farmer can see and check the interruption of animal in his agriculture field, without his physical presence in the field. The farmer can check it from a far off zone with a notice through his advanced mobile phone.

II. METHODOLY AND IMPLEMENTATION

The beneath figure-1 shows the framework design of the projected framework, the PIR sensor (movement identification sensor or vibration sensor) has been kept in the farm on corners, if the animals go into the agriculture farm the PIR sensor recognizes the intruders and sends the data to the ESP32-CAM, the ESP32-CAM sends an acknowledgement to the camera to catch the picture of the intruder, the caught picture is directed to ESP32, at that point the ESP32 sends it to the cloud and by utilizing FCM (fire based cloud machine) sends the notification to farmer/client. At the point when cloud get the picture it update the image to the AI (ML) and picture handling module which contains the Yolo system is structure which as a portion of the prepared informational collection, the ML module contains a portion of the

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preparation informational index, it contrasts the acquired information and prepare the information when it coordinates then it sends the outcome to the cloud and that has been forwarded to the ESP32-CAM, at that point the ESP32- CAM plays out the necessary activity i.e buzzer which makes a competed sound and LED lights which is a gunfire light to frighten the animals to run off from farm/field. The below figure shows the information dataflow diagram of the proposed framework, the movement sensor detects the interloper that is entering into the farm and sends the data to the ESP32-CAM and afterward the camera catches the picture, the caught picture is send to the ESP32-CAM, at that point the ESP32-CAM transfers the picture into the cloud, the cloud sends it to the module and further more FCM (Fire based cloud machine) is utilized to send the notice to farmer/client through the telegram

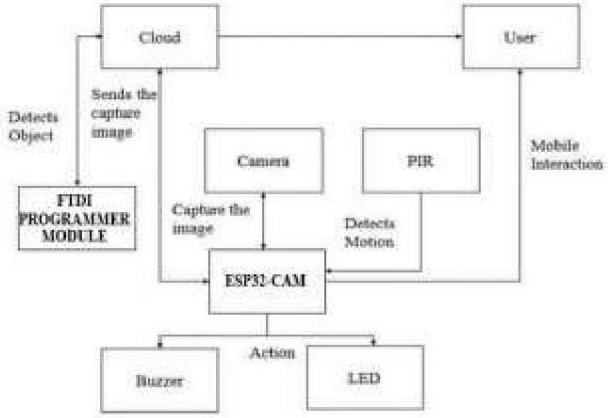

Figure 1. Block Diagram of the Proposed System

2.1 Software Components: IDE Software:

The code that you write inside the Arduino IDE. The Arduino code that you write is called a sketch. The Arduino code itself is basically a derivative of the C and C++ programming languages, but with some Arduino-specific functions and structure. So if you program an Arduino, you're basically programming in C and C ++ programming languages. So those are the three components that basically make up what" Arduino is", and roughly what it does. And Figure 2 as shown below

Figure 2. IDE Software

2.2 Design and Implementation

These components include the PIR sensor, ESP32-CAM, buzzer, LED, and FTDI Programmer Module. The PIR sensor is connected to the ESP32-CAM, which is a microcontroller with built-in Wi-Fi and Bluetooth capabilities. The PIR sensor detects motion within its field of view and sends a signal to the ESP32-CAM when an animal enters the virtual fence. The ESP32-CAM then triggers an alert by activating a buzzer and an LED. The buzzer emits an audible sound, while the LED provides a visual indication that an animal has been detected. The alert can also be sent to a farmer or

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landowner via Wi-Fi or Bluetooth, allowing them to take appropriate action. The FTDI Programmer Module is used to connect the ESP32-CAM to a computer, allowing the code to be uploaded to the microcontroller via a USB connection. The module has several pins that are used to connect it to the ESP32-CAM, and it also has built-in voltage regulator that ensures that the microcontroller is supplied with a stable voltage.

The implementation of the system involves the following steps:

Hardware setup: The first step involves setting up the hardware components required for the system. This project works by detecting the presence of animals in a designated area using a PIR sensor and triggering an alert using an ESP32-CAM microcontroller, buzzer, and LED. Here is a detailed working of the circuit: When an animal enters the virtual fence, the PIR sensor detects its motion within its field of view and sends a signal to the ESP32-CAM microcontroller.

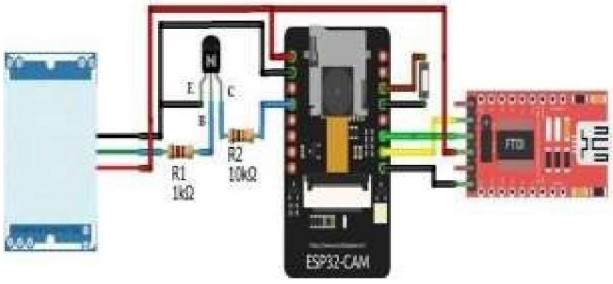

Figure 3. Circuit diagram

The ESP32-CAM microcontroller then activates the buzzer and LED to trigger an alert. The buzzer emits an audible sound, while the LED provides a visual indication that an animal has been detected. In addition to triggering the alert, the ESP32-CAM can also send a notification to a farmer or landowner via Wi-Fi or Bluetooth. This allows them to take appropriate action, such as checking on their crops or livestock. The FTDI Programmer Module is used to connect the ESP32-CAM to a computer, allowing the code to be uploaded to the microcontroller via a USB connection. Overall, project provides an effective solution for monitoring and protecting crops and livestock in an agricultural field. The use of the PIR sensor and ESP32-CAM microcontroller allows the system to detect the presence of animals in real-time and trigger an alert, while the FTDI Programmer Module simplifies the process of programming and updating the system with result observed.

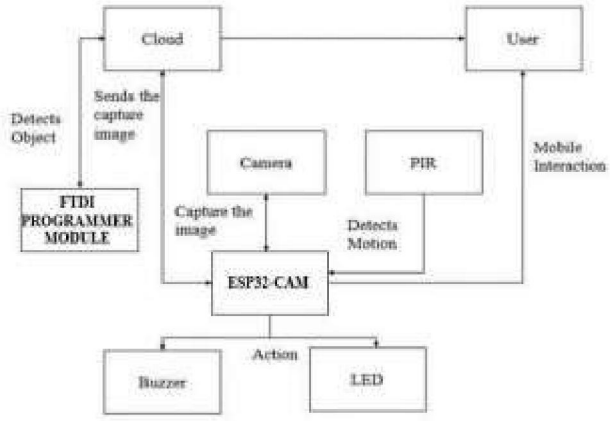

Figure 1. Block Diagram of the Proposed System

Algorithm:

Start

check the reading of PIR sensor if PIR Value == 1

intruder = true

else PIR Value == 0 intruder = false

if PIR value == 1

camera will capture the image and saves it in the drive Notify by generating sound through buzzer

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LED will blink
Stored image will be sent through telegram or mail to the owner
else if PIR Value == 0 The module will be on sleep
6.END

2.3 Flow chart:

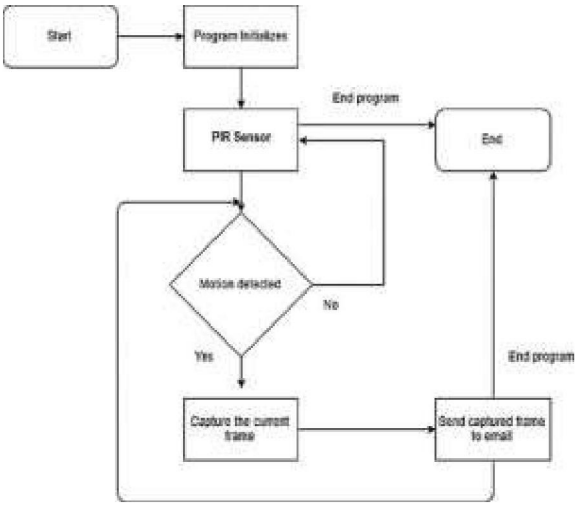
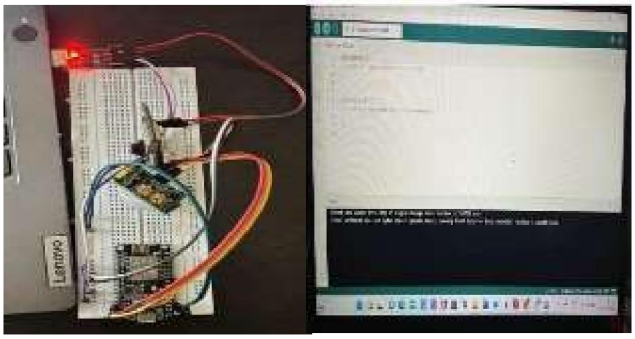


Figure 4. Flow Chart

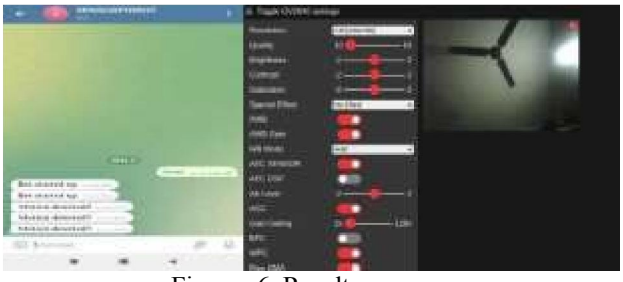
Activity of the project:



Figures 5. Activity of our Project

III. EXPERIMENTATION AND RESULTS

The Virtual Fencing Using Yolo Frame Work In Agricultural Field project presented promising results, demonstrating the feasibility and effectiveness of the virtual fencing system for monitoring and protecting crops and livestock in agricultural fields. The system was able to detect and alert the farmer in real-time when animals entered the virtual fence, allowing them to quickly respond and prevent damage to crops and livestock.



Figures 6. Result

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The PIR sensor used in the system proved to be an effective and reliable method for detecting the presence of animals, while frame work provided accurate and the fast object detection.

The system was also customizable ,allowing farmers to define the size and shape of the Virtual Fencing according to their needs. in agriculture land aims to enhance livestock management, protect crops, reduce costs, promote animal welfare, and leverage data-driven decision making for improved agricultural practices. At last it send the notification and using IP address we can watch the live video in farmer's or land owner's mobile.

3.1 Objective

- The primary objective of the proposed work for the project Virtual Fencing in Agricultural Field is to develop a robust and accurate virtual fencing system that can effectively contain and manage livestock without the need for physical barriers.
- Secondly, the project will develop software that can receive signals from PIR sensors and alert the animals via their collars when they are approaching the virtual fence boundary.
- Thirdly, the proposed work will address environmental factors that could affect the virtual fence's effectiveness. Virtual fencing can help protect crops from damage caused by livestock. By setting up virtual boundaries around crop fields, farmers can ensure that livestock are kept away from these areas, minimizing the risk of trampling, grazing, or destruction.
- Fourthly, the project will evaluate the performance of the virtual fencing system by conducting field tests in real-world agricultural settings. The system's accuracy, reliability, and effectiveness will be measured against traditional physical fencing systems, and any necessary improvements will be identified and addressed.

3.2 Advantages

- The proposed system also has the advantage of being cost- effective and easy to deploy, as it only requires a camera and a mobile device for monitoring.
- In addition, the study highlights the potential benefits of virtual fencing in agricultural fields, such as reducing the cost and environmental impact of traditional fencing methods.
- The use of virtual fencing can also increase the flexibility of livestock management
- It allows for better grazing management by confining animals to specific areas of the field.
- The system's accuracy, cost-effectiveness, and ease of deployment make it a promising solution for livestock management in large agricultural fields.

3.3 Disadvantages

- The study also discusses the limitations of the proposed system, such as the need for a stable internet connection and the reliance on clear weather conditions for optimal performance.
- The system may also require regular calibration and maintenance to ensure accurate detection and tracking of animals.

IV. CONCLUSION

The conclusion of the study highlights the effectiveness of the proposed system in providing virtual fencing for livestock in agricultural fields.

The system can detect animals at a distance of up to 100 meters from the camera, making it effective for use in large agricultural fields. The system's performance was evaluated by conducting experiments in a real-world environment, and the results showed that the system can accurately detect and track animals, even in complex scenarios where multiple animals are present in the field.

The study concludes with some recommendations for future research to improve the proposed system. One suggestion is to explore the use of different machine learning models and frameworks to improve the accuracy and performance of the system. Another recommendation is to investigate the use of additional sensors, such as PIR or environmental sensors, to enhance the system's functionality and provide more precise information about animal behavior in the field.

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The paper also emphasizes the importance of considering the ethical implications of virtual fencing in agricultural fields. Virtual fencing may alter the natural behavior of animals and affect their well- being, so it is essential to ensure that the system is designed and implemented in a way that minimizes any negative impact on the animals. The study concludes by highlighting the potential for virtual fencing to transform livestock management in agricultural fields. By replacing traditional fencing methods with virtual fencing, farmers can reduce their costs and improve their grazing management practices. Virtual fencing can also reduce the environmental impact of traditional fencing methods by minimizing the use of non-renewable resources and reducing soil erosion.

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