SMART SECURITY SYSTEM FOR FARM PROTECTION

Mini Project Report

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In

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DECLARATION

We hereby certify that the work which is being presented in this project report entitled **"SMART SECURITY SYSTEM FOR FARM PROTECTION"** in partial fulfilment of the requirements for the award of the Degree of Bachelor of Technology and submitted in the Department of Electronics Engineering of the Zakir Husain College of Engineering & Technology, Aligarh Muslim University, Aligarh is an authentic record of our own work carried out during third year(6^{th} Semester) of B. Tech. under the guidance of **PROF. EKRAM KHAN**, Chairman, Department of Electronics Engineering, Aligarh Muslim University, Aligarh.

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This is to certify that the above statement made by students is correct to the best of my knowledge.

PROF. EKRAM KHAN

(Supervisor)

Date:

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It is a fact that these little words are nothing to justify the blend of knowledge, encouragement and wishes that have been descended upon us during the course of the project

Thank you all for your valuable contributions and support.

ABSTRACT

This project report presents the design and implementation of a smart security system for farm protection. Generally, farmer faces the issue of intruders on their farms which may harm their crops that can cause significant damage to their crops and result in financial losses. In addition to theft, other issues such as animal damage, natural disasters, and equipment malfunctions can also pose a threat to farm security. Therefore, implementing effective security measures is essential for protecting farm property and ensuring the safety of crops, livestock, and equipment. Smart security systems can help farmers monitor their farms more effectively and respond to any potential threats in a timely manner. This security system utilizes motion detection and image processing. The system is comprised of a PIR sensor that is triggered by motion of living organisms, which in turn activates a web camera. The PIR sensor used in the system is a passive infrared sensor that detects motion by sensing changes in temperature. When the sensor detects motion, it sends a signal to the microcontroller, which activates the web camera.The captured images are then processed using image processing techniques to detect any unusual activity on the farm. The system also includes a notification system that alerts the farmer in real-time when any suspicious activity is detected. The system was successfully implemented and tested, and the results demonstrate the effectiveness of the system in detecting intrusions and preventing potential theft or damage. This project shows the feasibility and potential benefits of utilizing smart security systems for farm protection, providing farmers with an efficient and reliable method for monitoring their property and protecting their assets.

Overall, the system is designed to be easy to install and use, requiring minimal technical knowledge or expertise. The smart security system for farm protection provides a cost-effective and reliable solution for monitoring and protecting farm property, allowing farmers to focus on their work without worrying about potential theft or damage.

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INTRODUCTION

1.1 Overview

India has always been known for its rich agricultural tradition, dating back to the Indus Valley Civilization. Agriculture forms the backbone of India's economy, providing employment to over 50% of the country's workforce and contributing around 17% to the nation's Gross Domestic Product (GDP) [1]. It is a sector that has been the foundation of India's growth and sustenance for centuries. Farm mechanization is therefore necessary in the nation. Agriculture has been associated with the development of advances in farming technology for many years. The most frequent issue a farmer encounters is an invasion by intruders that damages their crops. As a deterrent to such actions, it is impossible to always have a guard on duty for intruders. By utilizing innovative technologies like Vision Based IoT, which integrates image processing methods into IoT, significant progress may be made towards making agriculture smarter. The most effective and creative method for creating solutions to issues in many human undertakings is the Internet of Things (IoT). In order to increase agricultural output and meet the demand for food while simultaneously addressing the workforce crisis in the industry, Internet of Things (IoT) technology is anticipated to be a key factor. Vision Based IoT focuses on combining image processing techniques with IoT technology, which can bring Smart security systems, in Agriculture into reality [2].

It is the need of the hour to arrive at a solution to detect malicious activities on the farm, identify the object causing malicious activity and notify the same to the farmers. Advancements in technology have made it possible to develop highly sophisticated security systems that can protect farms from various threats. The farmer currently employs a model that uses CCTV cameras to monitor the farm. However, because the camera is always on and uses energy, this solution is not economically viable. Therefore, we have put in place a smart security system with a PIR sensor to combat the issue of electricity waste. The PIR sensor will detect any intruder in the farm and activate the camera. By doing this, the camera will only be "ON" when someone enters the farm. The system then employs image processing techniques to identify whether the source of motion is a harmless animal or a potentially harmful human.

When an animal or human enters the detection range of the PIR sensor, it triggers an alert that activates the webcam to capture an image of the scene. The captured image is then processed using advanced algorithms to detect whether it is a harmless animal or a potentially harmful one.

To accurately identify the source of motion, the image processing algorithm analyzes various features such as the shape, size, and movement patterns of the object in the image. If the algorithm determines that the source of motion is a harmless animal, the security system does not trigger any further action. However, if the algorithm detects the presence of a human, the system

can alert the farm owner or security personnel and activate additional security measures to prevent any potential harm.

The security system can also be configured to store the images captured by the webcam for future reference and analysis. This data can help farm owners to identify potential threats and patterns of activity in the area, allowing them to take necessary measures to protect their crops, livestock, and property.

Hence, the smart security system for farm protection works in three phases, namely motion detection, event capture, object identification, and event notification[2].

1) Motion Detection Phase: This is the first phase of the system where the motion sensors installed on the farm detect any movement or motion within the coverage area. These sensors can be infrared or microwave sensors that trigger an alert when they sense any movement. The motion detection phase helps to detect any intrusion or unauthorized access to the farm.

2) Event Capture and object Identification Phase: Once the motion sensors detect any movement, the system captures the event by activating the cameras installed on the farm. These cameras record the event and capture images or videos of the object or person who triggered the motion sensor. The system analyses the images or videos captured by the cameras to identify the object or person and classify them as a potential threat or not. This phase helps to reduce false alarms and improve the accuracy of the system.

3) Event Notification Phase: Once the system identifies a potential threat, it sends an alert to the farm owner or the security personnel in charge of monitoring the farm's security. The alert can be in the form of a notification on a mobile app, email, or text message. The event notification phase helps to take immediate action and prevent any security breach from occurring.

Overall, the integration of PIR sensors, webcams, and image processing algorithms in farm security systems has revolutionized the way farms are protected. With advanced technology, farmers can now rest assured that their farms are secure from various threats, and potential damages can be prevented before they occur.

1.2 Organization of the Report:

Chapter 1: Introduction

The first chapter of the report provides an introduction to the research topic, which is the development of a security system for farm environments. This chapter includes a motivation for the work and problem formulation, highlighting the need for an advanced security system that can detect potential threats and protect the farm from harm. Additionally, the chapter provides an overview of existing technologies and their shortcomings in providing an effective security solution. The proposed solution is then presented along with its advantages, providing a roadmap

for the rest of the report. Finally, the chapter concludes with an organization of the report, outlining the main chapters and their content.

Chapter 2: Background and Literature Review

This chapter provides a comprehensive background and literature review on the topic of security systems for farm environments. The chapter begins with an introduction to the theories required to understand the proposed security system, including an overview of PIR sensors and image processing techniques. The chapter then moves on to a detailed review of existing literature, analyzing the strengths and weaknesses of various security systems, including CCTV cameras and traditional motion sensors. This chapter includes a detailed explanation of the hardware and software components of the system, including PIR sensors, webcams, microcontrollers, and image processing algorithms.

Chapter 3: Design of Proposed System

The third chapter of the report focuses on the design of the proposed security system. The chapterdiscusses the overall architecture of the system and the various modules that are included.

Chapter 4: Implementation of the System

The fourth chapter of the report provides a detailed explanation of the implementation of the proposed security system. This includes a discussion of the hardware and software components of the system and how they were integrated to create a working prototype. The chapter also includes a description of the testing and validation procedures that were used to evaluate the performance of the system.

Chapter 5: Results and Discussions

The fifth chapter of the report presents the results of the testing and validation of the proposed security system. This includes a discussion of the performance metrics that were used to evaluate the system, such as detection accuracy and response time. The chapter also includes a comparison of the results with existing security systems and a discussion of the strengths and weaknesses of the proposed system.

Chapter 6: Conclusions and Future Scopes

The final chapter of the report provides a summary of the research findings and draws conclusions about the effectiveness of the proposed security system. The chapter also includes a discussion of the limitations of the system and suggestions for future improvements. The future scopes of the research are also discussed, highlighting the potential for further development and enhancement of the proposed system.

This chapter highlights the need for an advanced security system that can detect potential threats and protect the farm from harm, and provides an overview of existing technologies and their shortcomings. The proposed solution, which utilizes PIR sensors and image processing techniques, is presented along with its advantages. The chapter concludes with an organization of the report, outlining the main chapters and their content.

CHAPTER 2

BACKGROUND AND LITERATURE REVIEW

To understand the work on the smart security system for detection of intruders we need to be familiar with the following theories: PIR Sensor, Raspberry Pi, Web Camera, Computer Vision, Machine Learning, Internet of Things(IoT).

The following section outlines the hardware and software components proposed for the system.

- **Hardware:**
  - Raspberry pi 4
  - Web Camera
  - PIR Sensor
  - SD Card
  - Breadboard
  - Jumper Wires
  - USB Cable

- **Software:**
  - VNC Viewer
  - Putty
  - Open CV
  - Python
  - YOLO V5

2.1 Hardware Description

The primary component is the Raspberry Pi board as shown in fig 2.1, which is a compact computer designed to inspire learners to be creative. It features an Advanced RISC Machines (ARM) processor and a Broadcom BCM 2835 System on chip multimedia processor[2]. In this proposed system, the Raspberry Pi board will be used to connect and govern the PIR sensor and web camera. The Raspberry Pi Model 4 has 40 pins, including 5v, GND, 3.3v, 26 GPIO pins, and 2 ID-EEPROM pins, which provide connectivity to input/output (I/O) devices.We program the Raspberry Pi to process the data from the sensors and trigger an alarm or buzzer or send an alert to our Smartphone when an intruder is detected. A SD Card is required for the storage in Raspberry. The Operating system and all files are stored in this SD card.

Fig 2.1: Raspberry Pi 4

PIR sensor as shown in fig. 2.2, are based on the principle of detecting the infrared radiation emitted by objects in their field of view. The sensor consists of a pyroelectric material that generates a voltage when exposed to infrared radiation. The sensor is designed to detect changes in the infrared radiation pattern in its field of view, caused by the motion of an object. When an intruder moves in the farm, it is detected by the PIR sensors. The difference in the signals generated by the sensors is amplified and processed by the sensor's electronics to generate a trigger signal that is sent to the processing module. We can also adjust the sensitivity and time of PIR sensor by sensitivity Adjust Knob and Delay Time Adjust. For our system we set it to minimum value for making its more sensitive and less delay. Whenever motion is detected web camera is triggered by the PIR sensor for capturing the image of the farm and it will take further actions.

Fig 2.2: PIR Sensor

A Webcamera as shown in fig. 2.3 can be a useful tool for setting up a security system for farm protection from intruders. By connecting a webcam to a Raspberry Pi, we created a surveillance system that can help farmers tomonitor their farm in real time.We configure the software to capture images or record videos when motion is detected. We can also set up email alerts or notifications to be sent when motion is detected. Mount the webcam in a suitable location that provides a clear view of the farm that we want to monitor. But we have to make sure the webcam is secure and protected from weather conditions.

Fig 2.3: Web Camera

2.2 Software Description

VNC viewer is a software tool that allows remote access to a desktop environment on another computer. With VNC viewer, we can remotely connect to the desktop environment of a Raspberry Pi that has OpenCV installed, and we use OpenCV to perform object detection and intrusion detection tasks. This allows us to monitor the farm for intruders from a remote location, without physically being there. With OpenCV, we program the Raspberry Pi to detect the intruders such as harmful animals, humans(farm owners) and trigger an alarm or alert when an intruder is detected.To use VNC viewer and OpenCV for intrusion detection on a Raspberry Pi, we installed and configured both tools on the Raspberry Pi, and then use programming languages Python to write scripts and connect a web camera to the Raspberry Pi to capture video or image feed for intruder detection.

Machine learning is a subset of artificial intelligence that involves training computer algorithms to learn from data. We developed an intelligent system that can detect and classify intruders based on the images captured by the camera and take the action depending on the matching of the image in the dataset.We have classified our dataset in two classes: Farm Owners, Intruders-Animals (Cow,Dog).

The Internet of Things (IoT) is a system of interconnected devices that can communicate with each other over the internet. Understanding IoT concepts such as data transmission and communication protocols is essential for developing a smart security system that can be remotely monitored and controlled. Whenever malicious activity is detected in the farm the e-mail is sent to the registered email id and SMS is sent to the farm owners or the user to the registered number with the help of GSM module 800L.

2.3 Prominent works

Although various IoT-based security devices have been developed by researchers, very little work has been reported in connection with agricultural farm land security[2]. However, some prominent works available in the literature are as follows:

A smart farm security system built using image processing techniques with an alarm mechanism [3]. The system is based on an Arduino micro-controller, which is used to detect motion in farmland and capture the scene image. However, the processing of the image for the detection of malicious activity is not done in the Arduino micro-controller. Instead, the captured image is sent to a server, where MATLAB is installed, and the processed results are sent back to the Arduino. The results include switching on the alarm for alerting the farmer. However, the process of sending an image to the server is time-consuming and unreliable since there is no provision to do image processing at the source side.

In a study conducted by Raj G Anvekar[4], they presented a security system that utilizes IoT technology to create a low-cost, low-power, and unobtrusive home security system. The system is designed to detect motion and identify and authenticate strangers using a USB webcam as a capturing device. An electric door strike is used as an actuator to enhance security. In addition, the messaging service Telegram is used to alert the user of any security breaches.

Snowber Mushtaq[5] introduced a method that utilizes image processing techniques to identify disease-affected areas in plants and provide targeted treatment in the form of the appropriate pesticide, rather than treating the entire plant. The method involves capturing photos of the plant from different angles, and then analyzing the images one by one to identify any instances of virus or bacterial attacks. The implementation involves using Python and OpenCV, and employs Deep Learning techniques for data representation. The system is powered by a Raspberry Pi processor.

Another work by D. S. Salunkhe[6], proposes a security system for agricultural fields using wireless sensor networks and image processing techniques. The system comprises of multiple wireless sensor nodes placed in the field, which are used to capture images and detect any motion. The captured images are sent to the base station, where image processing techniques are used to detect any malicious activity. The results are then transmitted to the farmer via SMS.

Hence the above mentioned works shows that the security system using raspberry pi helps people feels safe about their homes and farm effectively whether they are away from them. Here it has provided utmost security so it is quite difficult to any intruder to enter the home without the concern of the owner. If any intruder is detected, the buzzer will turn on and the owner is notified via email.

CHAPTER 3

DESIGN OF THE PROPOSED SYSTEM

The need for enhanced security measures in farm environments cannot be overstated. Agricultural lands are vulnerable to a wide range of threats, including theft, vandalism, and animal predation. These threats can cause significant losses to farmers, and thus it is imperative to have a reliable security system in place to protect farm properties.
One promising approach to farm security is the integration of a PIR sensor, webcam, and image processing algorithms. Such a system can detect the presence of living beings, identify them as either harmless animals/humans or potentially harmful ones, and activate additional security measures if necessary.

3.1 Overview

The proposed security system consists of several components. The first component is a PIR sensor that is strategically placed in the farm environment. When the sensor detects motion, it sends a signal to the control unit(Raspberry pi), which activates a webcam. It will then do image processing and will notify the farm's owner accordingly.

The image processing unit uses sophisticated algorithms to analyze the image and detect whether the source of motion is a harmless animal or human or a potentially harmful one. The algorithms analyze various features such as the shape, size, and movement patterns of the object in the image. Based on this analysis, the system can determine whether the presence of a human poses a threat to the farm or not.If the system detects a potentially harmful human or animal, it can activate additional security measures, such as sending an alert to the farm owner or security personnel. The system can also trigger alarms or buzzers, turn on lights, or activate other deterrence measures to prevent any potential harm.

The system can be designed to store the images captured by the webcam for future reference and analysis. This data can help farm owners to identify potential threats and patterns of activity in the area, allowing them to take necessary measures to protect their crops, livestock, and property. Overall, the proposed security system can provide a reliable and effective way to protect farm properties from various threats. By integrating PIR sensors, webcams, and image processing algorithms, farmers can rest assured that their farms are secure and that potential damages can be prevented before they occur.

3.2 Block Diagram

The block diagram shows the main components of the smart security system for farm protection as shown in fig 3.1.

- PIR SENSOR: The PIR sensor used in the system is a passive infrared sensor that detects motion by sensing changes in temperature. It is a low-cost, low-power sensor that is easy to install and maintain.

- Microcontroller (Raspberry pi): The microcontroller is the central component of the system, which receives signals from the PIR sensor and controls the web camera. The microcontroller also runs the image processing algorithm that analyzes the images captured by the camera.
- Web Camera: The web camera is used to capture images of the area where motion is detected by the PIR sensor
- Notifier: The notification system sends alerts to the farmer's mobile phone when the image processing algorithm detects any suspicious activity. The farmer can then view the images in real-time and take appropriate action.

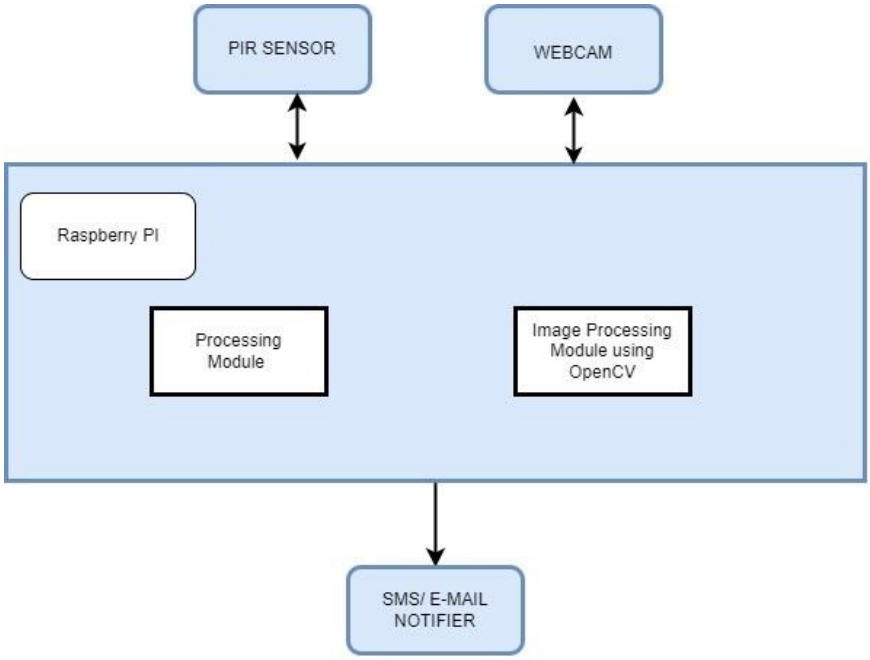

Fig 3.1: Block diagram of Proposed System

3.3 Flowchart of the Proposed System

The flowchart of the proposed system is shown in fig 3.2. We can see that initially, the system is started and it waits until the PIR (Passive Infrared) sensor detects motion. Once motion is detected, the system proceeds to activate the webcam and captures images of the scene. The images are then processed to identify individuals as either intruders or owners. If an intruder is found, the system notifies the owner through email and SMS. However, if no intruder is detected, no action is taken, and the system returns to the initial state and waits for the PIR sensor to detect motion again. This process repeats continuously as long as the system is powered on.

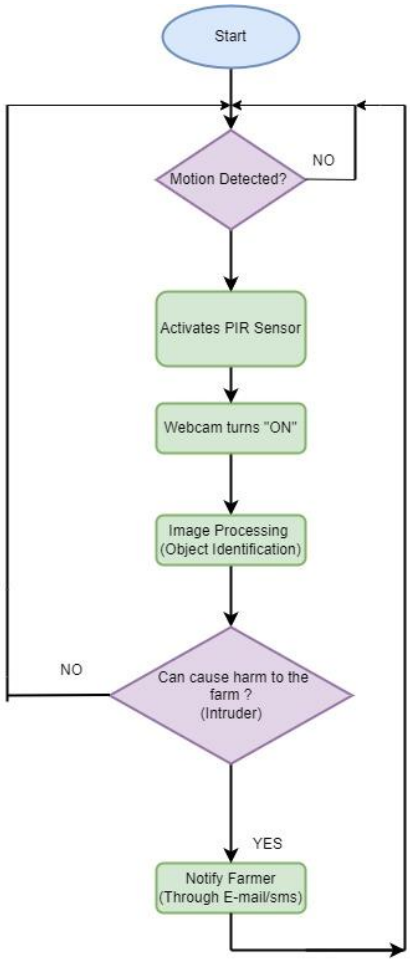

Fig. 3.2: Flowchart of the proposed system

3.4 Algorithm of the Proposed System

The Algorithm of proposed system is as discussed:

Step1: Start and wait until PIR sensor detects the motion.

Step2: If motion is detected then go to Step 3 else go to Step 1.

Step3: Activates webcam and captures the scene images.

Step4: Perform image processing to identify the intruders and owners in the imaStep5: If intruder is found then notify the owner through email and SMS, else no action taken.

Step6: Move to Step 1 and repeat.

3.5 Advantages

In addition to detecting and identifying potential threats, the proposed security system can also provide valuable insights into the behavior of animals in the farm environment. The system can capture images of animals and use image processing algorithms to track their movements and behaviors. This data can be used by farmers to better understand animal behavior and make informed decisions about animal management practices.

The system can also be configured to provide real-time monitoring of the farm environment. Farmers can access the system remotely and view live images from the webcam to monitor activity in the area. This allows them to respond quickly to any potential threats and take necessary actions to protect their crops, livestock, and property.

Another advantage of the proposed security system is its scalability. The system can be easily expanded to cover larger farm areas or multiple locations. Additional PIR sensors and webcams can be added as needed, and the image processing algorithms can be adapted to handle the increased data load.

To ensure the reliability and accuracy of the system, it is important to select high-quality components and use robust image processing algorithms. The PIR sensor should have a wide detection range and high sensitivity to detect even small movements in the farm environment. The webcam should have a high resolution and good low-light performance to capture clear images even in low light conditions. The image processing algorithms should be carefully designed and tested to ensure accurate detection and identification of potential threats.

In summary, the proposed security system that uses a PIR sensor, webcam, and image processing algorithms can provide a reliable and effective way to protect farm properties from various threats. The system can detect the presence of living beings, identify them as either harmless animals or potentially harmful humans, and activate additional security measures if necessary. With its scalability and real-time monitoring capabilities, the system can provide valuable insights into animal behavior and allow farmers to respond quickly to potential threats.

CHAPTER 4

IMPLEMENTATION OF THE SYSTEM

In this chapter, we are discussing the implementation part of our project which is basically done in three parts. First, we will detect the motion which turned on the webcam. After this image processing is done and intruder and owner has been detected. In case of intruder, e-mail is sent to the owner.

4.1 Integrating PIR sensor and webcam with Raspberry pi 4:

The first step in the process is to detect motion in the farm environment. This is done using PIR sensor. The PIR sensor detects changes in the infrared radiation emitted by objects in its field of view. When a moving object, such as an animal or a human, passes through the PIR sensor's field of view, it triggers a signal that indicates motion has been detected. Once motion is detected, the control unit receives a signal from the PIR sensor and activatesthe webcam to capture an image of the scenario. The webcam captures a still image of the area where motion was detected.

Connections:

- PIR sensor VCC pin to Raspberry pi pin 2 (5V PWR)
- PIR sensor Output pin to Raspberry pi pin 12 (GPIO 18)
- PIR sensor GND pin to Raspberry pi pin 6 (GND)

Implementation and circuit connection of PIR sensor and webcam with pi is shown in fig 4.1

Fig 4.1: Implementation Circuit of Webcam and PIR

Code: Implementation of Webcam and PIR sensor with Raspberry pi

File Edit View Run Tools Help

test.py *

```
import RPi.GPIO as GPIO
import time
import cv2

# set up GPIO
pirPin = 12


# set up camera
cam = cv2.VideoCapture(0)
cam.set(cv2.CAP_PROP_FRAME_WIDTH, 640)
cam.set(cv2.CAP_PROP_FRAME_HEIGHT, 480)


def setup():
        GPIO.setmode(GPIO.BOARD)

        GPIO.setup(pirPin,GPIO.IN, pull_up_down=GPIO.PUD_DOWN)

def loop():
        while True:
              pirPin_state = GPIO.input(pirPin)
              if pirPin_state == True:
                   print('Motion Detected !')
                   print("Lights  on")        # motion detected
                   ret, frame = cam.read()
                   if ret:
              # save the image
                      filename = time.strftime("%Y-%m-%d_%H-%M-%S.jpg")
                      cv2.imwrite(filename, frame)
                      print("Image saved: {}".format(filename))
                      time.sleep(2) # wait for 2 seconds to avoid multiple captures
#                   time.sleep(0.1) # wait for 0.1 seconds before checking again


                   while GPIO.input(pirPin) == True:
                         time.sleep(0.2)

              else:
                  pass

if _name== "main_":
   setup()

   loop()
```

When motion is detected, “Motion Detected” is printed and image is captured and saved on memory card of Raspberry pi as shown in fig 4.2

Shell

```
>>> %Run CAMI.PY
  Motion Detected !
  Lights  on
  Image saved: 2023-04-14_08-32-17.jpg
```

Fig 4.2: Terminal Screen showing the output when code is executed

4.2 Image Processing and Object Identification:

The captured image is transmitted to the image processing unit for analysis. The image processing algorithms analyze the image and determine whether the source of motion is a harmless animal or a potentially harmful human.

Code: Code for image processing and object identification

File Edit View Run Tools Help

test.py

```
import cv2
import torch
import numpy as np
path='C:/Users/ksans/OneDrive/Desktop/yolov5win11customobj-main/best.pt'
model = torch.hub.load('ultralytics/yolov5','custom', path ,force_reload=True)
cap=cv2.VideoCapture(0)
while True:
    ret, frame = cap.read()
    frame=cv2.resize(frame,(640,480))
    results=model(frame)
    frame=np.squeeze(results.render())
    cv2.imshow("FRAME", frame) # show image in window
    if cv2.waitKey(1)&0xFF==27:
        break
cap.release()
cv2.destroyAllWindows()
```

Fig 4.3: After image processing, owner is being identified

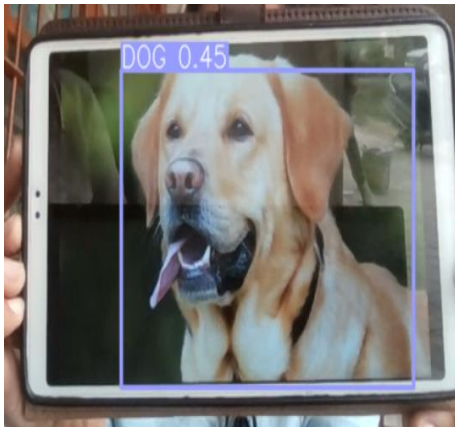

Fig 4.4: After image processing, dog is being identified

4.3: Sending Notification to the Owner:

Once the webcam is turned on and image processing is done, the intruder and owner have been detected. If an intruder is present, an email or SMS is sent to the owner notifying the owner about an intruder in the farm.

Code: Code for sending notification about intruder to the owner

```
emailgy.py
1  import os
2  from email.message import EmailMessage
3  import ssl
4  import smtplib
5
6  email_sender = 'nvarshney174@gmail.com'
7  email_password = 'ykxcjhlaewigcvhp'
8  email_receiver = 'nandanivarshney1701@gmail.com'
9
10 subject = 'SMART SECURITY SYSTEM FOR FARM PROTECTION'
11 body = """ Intruder is detected """
12
13 em = EmailMessage()
14 em['From'] = email_sender
15 em['To'] = email_receiver
16 em['Subject'] = subject
17 em.set_content(body)
18
19 context = ssl.create_default_context()
20
21 with smtplib.SMTP_SSL('smtp.gmail.com', 465, context=context) as smtp:
22     smtp.login(email_sender, email_password)
23     smtp.sendmail(email_sender, email_receiver, em.as_string())

Shell
>>> %Run emailgy.py
>>>
```

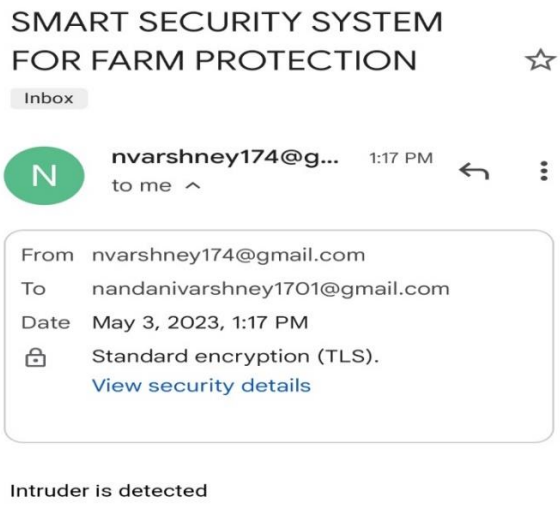

Fig 4.5: E-mail is sent to the owner about intruder is being detected.

After object identification, if intruder is detected, E-mail is sent to the owner as shown in fig 4.5. If owner is detected then no action is taken. In this way our implementation has been done.

This chapter provides a detailed explanation of the implementation of the proposed security system. It includes a discussion of different components of the system and how they were integrated to create a working prototype. It gives description of the testing and validation procedures that were used to evaluate the performance of the system. Overall, this chapter provides a practical view of how the proposed security system was implemented in practice**.**

CHAPTER 5

RESULT AND DISCUSSIONS

The smart security system was tested successfully, and the results were promising. The PIR sensor was able to detect human movement within a range of around 6 meters, and the web camera was able to capture clear images of the intruders. The Raspberry Pi was used to process the data from the PIR sensor and web camera and send notifications to the owner via email or SMS. The system was able to detect intruders within around of their arrival and send notifications to the owner immediately.

This smart security system will help farmers detect potential threats to their farms in real-time, allowing them to take appropriate action to prevent theft or damage. This can result in improved security and reduced losses.Compared to traditional security systems such as security guards, CCTV camera, a smart security system is generally more cost-effective. Once installed, the system can run autonomously, reducing the need for human intervention and resulting in lower costs. This system for farm protection is generally designed to be easy to install and use, requiring minimal technical knowledge or expertise. This makes it accessible to farmers who may not have a strong technical background.

The smart security system using a PIR sensor and web camera connected to a Raspberry Pi offers several advantages over traditional security systems. Firstly, one of the traditional security systems involved use of a CCTV camera which consumes electricity all the time, resulting in power wastage. This security system is cost-effective and easy to install, making it accessible to farmers and landowners with limited resources. Secondly, it is highly customizable, allowing users to adjust the sensitivity of the PIR sensor and the frequency of notifications based on their specific needs.The system's ease of installation and use is another critical advantage. Farmers with minimal technical knowledge can install and operate the system, making it accessible to a wide range of users. The system's customizable settings also allow farmers to adjust the sensitivity according to their specific needs, reducing the number of false alarms and minimizing unnecessary disruptions. Lastly, it provides real-time notifications to the owner, allowing them to take immediate action to protect their property.

With the smart security system, farmers can increase their efficiency by remotely monitoring their farms without having to physically visit the site. This can save time and resources while still ensuring that the farm is protected. This system can improve the safety of the farmers and their families by providing them with real-time alerts of any potential threats on the farm. This allows them to take appropriate action to protect themselves and their property.

By installing a smart security system, farmers can focus more on their core activities, such as crop cultivation or livestock management, without having to worry about potential security issues. This can lead to improved productivity and increased yields.

Implementing a smart security system for farm protection can come with a few challenges that need to be considered before designing and deploying the system. The range of the PIR sensor is limited to 6 meters, so it may not be suitable for larger farms or properties. Additionally, the web camera requires a stable internet connection to provide real-time images, which may be a challenge in some remote locations.

Weather conditions can also significantly affect the accuracy and reliability of the system. Heavy rain, fog, or snow can obstruct the camera's view and affect the quality of the footage. Therefore, it is crucial to choose weather-resistant cameras and sensors that can operate under harsh conditions. Apart from these, the use of webcams for security monitoring raises privacy concerns for farm workers, visitors, and neighboring properties. It is crucial to establish privacy policies and ensure that the system does not infringe on anyone's privacy rights.

In summary, the smart security system for farm protection has the potential to provide farmers with an effective and reliable solution for monitoring and protecting their farms. However, as with any technology, it is essential to consider the potential challenges and limitations before implementing the system.

CHAPTER 6

CONCLUSIONS AND FUTURE SCOPE

In conclusion, the smart security system for farm protection using Raspberry Pi, PIR, and webcam is an innovative solution for farmers to ensure the safety of their property and crops. With the help of these technologies, farmers can monitor their farms remotely and detect any intruders who may be attempting to enter their farm. The PIR sensor detects any movement in its range, triggering the Raspberry Pi to turn on the webcam, which captures the footage of the intruder. This footage can then be viewed remotely using the internet and take further actions.

This system is not only easy to set up but also cost-effective, making it accessible to farmers of all sizes. Additionally, it provides round-the-clock surveillance, which is especially important during periods of high risk, such as harvest time. Furthermore, the system is flexible and can be adapted to suit the specific needs of individual farms.It is also customizable, and farmers can add more sensors and cameras to cover more areas. The system is also scalable, and it can be used in small or large farms.One of the main advantages of the Smart Security System is that it provides real-time alerts, enabling farmers to take immediate action. This is important as it can prevent theft and vandalism, which can result in significant losses. The system is also cost-effective as it eliminates the need for security guards or expensive security systems and electric fencing which is too costly and also harms the animals if they try to enter in the farm.

Overall, the smart security system for farm protection using Raspberry Pi, PIR, and webcam is a game-changer in the agricultural industry. It provides farmers with an effective and affordable way to safeguard their livelihoods and minimize losses due to theft or vandalism. This system is an excellent example of how technology can be harnessed to solve real-world problems and improve the lives of people in rural communities. The system has the potential to enhance farm security, reduce theft, and increase overall productivity.

Future Scope:

The Smart Security System using for Detection of Intruders has great potential for future development. One possible direction is to integrate Artificial Intelligence (AI) and Machine Learning (ML) algorithms to improve the system’s accuracy and reduce false alarms. AI and ML can also enable the system to detect different types of intruders, such as animals or vehicles, and distinguish between them.

Smart Security System can be integrated with other farm management systems, such as irrigation and fertilization systems, to provide a more comprehensive solution for farmers. This can help farmers to improve their productivity and efficiency while reducing costs and risks.

In future we can also mountthe camera on a servo motor to monitor a farm is an effective way to enhance farm security. It can provide a complete view of the farm, detect potential intruders, and help in legal proceedings. However, farm owners should be mindful of privacy concerns and ensure that the cameras are used in an ethical and responsible manner.

By setting a threshold for the PIR sensor, we can adjust its sensitivity to changes in infrared radiation based on the current weather conditions. For example, on a hot and sunny day, the sensor may need to be less sensitive to small changes in temperature to avoid false alarms caused by sunlight and heat. To set up a weather adaptive PIR sensor, we can use a microcontroller or a programmable logic controller (PLC) to monitor weather conditions such as temperature, humidity, and sunlight intensity. Based on the weather data, the system can automatically adjust the threshold of the PIR sensor to optimize its performance.

Installing solar panels on a smart security system for farm protection from intruders can provide significant benefits in terms of power optimization. A solar panel system can help to reduce the energy consumption of the security system, making it more efficient and cost-effective in the long run. By using solar panels, we can reduce our reliance on traditional energy sources such as electricity or batteries. It can significantly reduce the cost of operating the security system over time. While there is an initial investment required for installing the solar panels, the long-term savings on energy costs can make up for this expense. It can be remotely monitored, allowing farmers to keep an eye on their property from anywhere. By using solar panels, farmers can ensure that their security system remains online and functional, even in remote or off-grid locations. In conclusion, installing solar panels on a smart security system for farm protection from intruders can provide numerous benefits, including increased energy efficiency, cost savings, environmental benefits, increased reliability, and remote monitoring capabilities. By reducing energy consumption and improving power optimization, solar panels can help to enhance the security of farm properties while also contributing to a more sustainable future.

Geofencing refers to a technology that uses GPS, RFID, or other location-based technologies to create a virtual boundary around a specific geographical area. This boundary is called a geofence, and when a device or object enters or exits this geofence, it triggers a response or action. It can be used in our proposed system to detect when an intruder crosses the boundary and alert the farmer immediately.

Overall, the smart security system for farm protection using Raspberry Pi, PIR, and web camera is a technology with immense potential. As technology advances, the system can be further improved and expanded to meet the changing needs of farmers and enhance farm security

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