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ARTIFICIAL INTELLIGENCE BASED FARM INTRUDER ALERTING SYSTEM

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ABSTRACT: *Agriculture is a critical sector in India, and securing farms against theft and damage is crucial to safeguarding the harvest. With the introduction of modern technologies, it is now possible to develop security systems for farmlands. IoT technology, in particular, offers numerous possibilities for smart agriculture. This report proposes a unique solution for agricultural farmland surveillance that leverages a Raspberry Pi board to detect suspicious activity or movement in the farmland and activate the PiCam to capture images of the situation. The image processing on the Raspberry Pi board uses Deep Learning and SSD to identify the object in the image. The farmer is notified of any suspicious activity via email and telegram. The system's precision and consistency were evaluated through studies conducted on farmland, and the results showed that the system is 100% reliable and 92% accurate in detecting fraudulent activities.*

1. INTRODUCTION

That's correct. The Internet of Things (IoT) has the potential to revolutionize agriculture by enabling real-time data collection and analysis to optimize crop productivity, reduce waste, and improve resource management. With IoT sensors and devices integrated into farming equipment and machinery, farmers can monitor and control every aspect of their operations, from soil moisture and nutrient levels to temperature and weather patterns. This data can then be used to make informed decisions about irrigation, fertilization, pest control, and other important factors that impact crop growth and yield. Additionally, by incorporating image processing techniques into IoT, as in the case of Vision Based IoT, farmers can enhance their security systems and monitor their farms remotely to ensure that everything is running smoothly. Overall, IoT has enormous potential to transform agriculture and make it more efficient, productive, and sustainable. IoT technology has a lot of potential in the agriculture sector. By utilizing real-time data collection and analysis, farmers can make better decisions about their operations and improve productivity. Precision farming, which involves using data to tailor farming practices to specific areas of a field, can improve crop yields and reduce waste. Variable rate technologies can also help farmers optimize their use of resources like fertilizer and water, reducing costs and environmental impact. Smart irrigation systems can monitor soil moisture levels and weather conditions to ensure that crops are watered efficiently, and smart security systems can help prevent theft and damage to crops. With vision-based IoT, farmers can even monitor their fields using cameras and image processing techniques, allowing them to identify problems like pest infestations or crop diseases early and take action before they spread. Overall, IoT has the potential to revolutionize the agriculture sector and help farmers operate more efficiently and sustainably.

The integration of vision technology in IoT devices has enabled the creation of more advanced and intelligent devices that are more valuable to users. Vision technology is a highly advanced sensor modality that provides countless opportunities for monitoring and regulating agricultural environments when combined with IoT. Vision IoT technology is particularly useful for security and surveillance in agriculture, as theft, animal infiltration, criminal disturbance, and damage to bioengineered plants pose significant challenges for farmers. There is a need for a cost-effective approach to detect harmful behavior on farms, identify the culprit, and alert farmers, despite the relatively low risk of violence on farms.

The goal of this study is to create an IoT security system that uses vision technology to detect motion on a farm and identify the object causing the motion using deep learning techniques like MobileNets and Single Shot Detectors. The system combines these techniques with OpenCV's Deep Neural Network module to identify objects in real-time with limited resources like smartphones and Raspberry Pi. The system sends notifications via email and SMS to the farmer when it detects motion and identifies the object causing it. The system has an accuracy rate of 92% and a consistency rate of 100%. This document outlines the proposed system and is divided into five sections. Section 2 reviews literature related to IoT security systems in agriculture, and Section 3 discusses the computer vision-based security systems used to detect motion and malicious activities on a farm and identify the object causing motion. The section also covers the hardware and software components used in the system and the image processing mechanism.

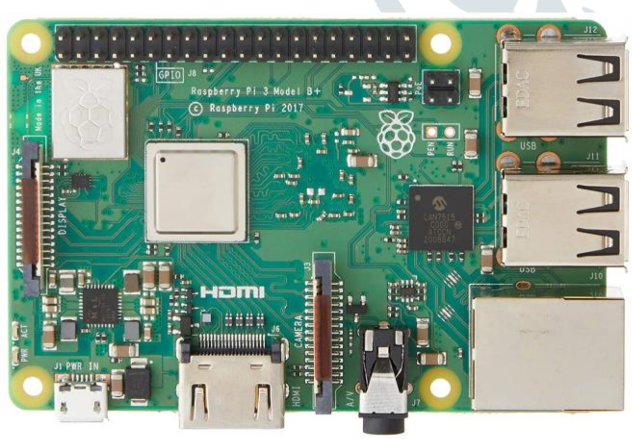
2. EXISTING TECHNIQUE

In the past, various solutions have been proposed to address the problem of elephant invasions. One such proposal involves a surveillance system that tracks elephant movements through the use of seismic sensors. The fastICA algorithm is employed to compare patterns. An embedded system based on the Internet of Things (IoT) was developed for this purpose. The system uses geophones to detect elephant vibrations, which are then converted into electrical signals using a microprocessor. The Arduino receives the data detected by the system, and forest officials are notified through a warning message.

3. SYSTEM HARDWARE

3.1. RASPBERRY PI 3

The Raspberry Pi is highly valuable due to its cost-effectiveness and user-friendly interface, making it an excellent tool for experimentation and education. Additionally, its versatility allows for a wide range of projects, including robotics, computing, and home automation. For individuals interested in programming and electronics, the Raspberry Pi serves as an ideal entry point.



The Raspberry Pi 3 is a versatile device that can be utilized for multiple purposes, ranging from creating a personal cloud storage system to a home media center. Additionally, it can be a great tool for educational activities, such as learning programming and robotics. The device can also be utilized for creating a smart mirror, a retro game console, or a smart home device. Furthermore, it can serve as a low-cost computer for developing a web platform or a home server.

3.2. CAMERA MODULE

The Raspberry Pi Camera Board is an add-on module designed specifically for Raspberry Pi hardware, which utilizes a distinct CSI interface to connect to the Raspberry Pi hardware. In still capture mode, the camera sensor has a native resolution of 5 megapixels, while it can capture up to 1080p at 30 frames per second in video mode. This camera module is ideal for mobile projects due to its small and lightweight design.

3.3. BUZZER

A piezo buzzer, also known as a piezoelectric buzzer, is a type of audio transducer that can be directly connected to a Raspberry Pi. It works by converting an electrical signal into a mechanical vibration, which produces sound waves. By varying the frequency of the electrical signal, you can control the pitch of the sound produced by the buzzer. The piezo buzzer is a simple and compact device that is often used for generating basic audio alerts or tones in DIY electronics projects.

3.4.POWER SUPPLY

Different Raspberry Pi models require different power supplies. However, all models require a 5.1V power supply, although the amount of current supplied may vary depending on the model. For models up to Raspberry Pi 3, a micro USB power connection is required.

3.5 GSM MODULE

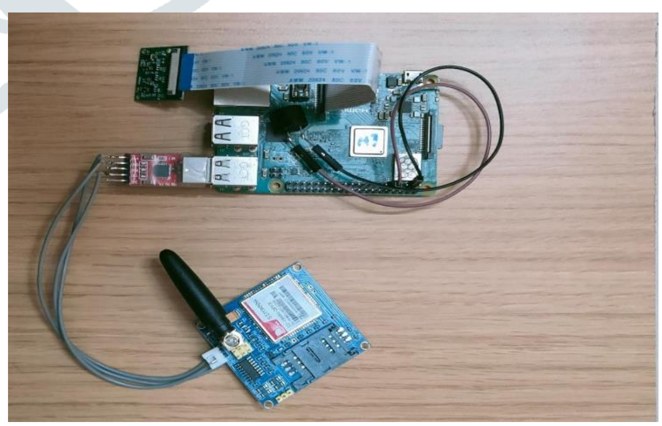
GSM technology was created with the objective of providing digital communication using the time division multiple access (TDMA) technique. The data is digitized, compressed and transmitted through a channel containing two distinct streams of client data, each allocated its own specific time slot. This digital system is capable of handling data rates ranging from 64 kbps to 120 Mbps.

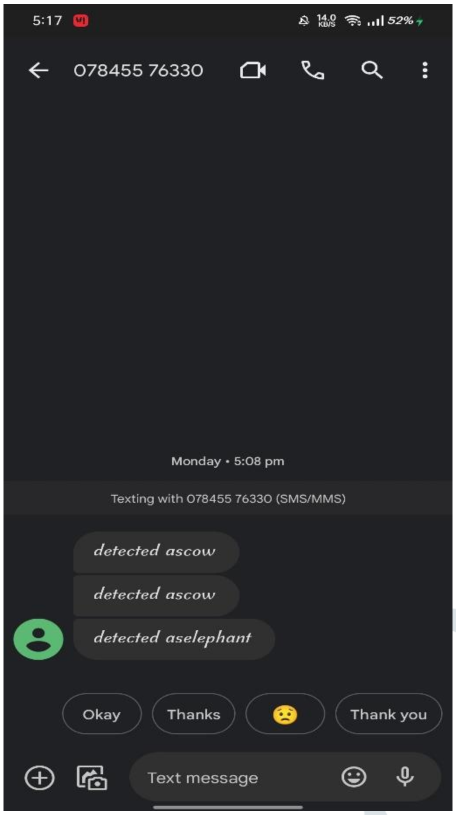
4.WORKING OF PROPOSED METHOD

This section discusses a Smart Security System for Agriculture that is based on Raspberry Pi and incorporates OpenCv. The system is designed to detect any movements within the farm and capture a snapshot of the scene upon detection. The captured image is then processed using OpenCv within the Raspberry Pi to determine the object responsible for the intrusion, such as an animal or person. The farmer is then notified of the intrusion through an email or SMS notification module. The PIR sensor has two slots.To create the holes, a special substance that can detect infrared photons is used. The PIR sensor has two slots that detect an equal number of infrared photons when the sensor is not in use. As a warm body such as an animal or person passes by, one half of the sensor is hit by the infrared rays that are emitted as heat energy. This results in a positive difference between the two halves of the sensor. When the warm body leaves the detection area, the situation flips, and there is a negative differential change. These changes in pulse rate confirm motion detection. The processing module consists of a Raspberry Pi board and an image processing component that uses OpenCV for speedy image processing. When the PIR sensor detects motion, the Raspberry Pi instructs the PiCam to take a snapshot of the surrounding area.The collected scene picture is processed using Single Shot Detectors (SSD) and MobileNets, which are deep learning models that identify objects in the image. The SSD model uses convolution filters and feature maps to detect objects in a single shot, without requiring multiple shots to identify objects. On the other hand, the MobileNets model uses depth-wise independent convolutions to create lightweight deep neural networks. By combining these two approaches, a super-fast, real-time object detection technique is achieved, suitable for devices with limited resources like Raspberry Pi and smartphones.The system uses OpenCV's deep neural network module to load a pre-trained object identification network, which can process input photos and provide bounding box coordinates for each object in the image. Object identification is performed by the OpenCV module installed on the Raspberry Pi, which detects any movement or harmful activity and sends the information to the Email notification module. This module uses the SMTP protocol to send an email containing an alert picture to the user's email address. The SMS notifier module uses the Telegram messenger to send a security alert message to the registered user. The following sections provide a detailed explanation of the system's architecture, hardware, and software.

5. RESULT

This section explains how the Smart Agriculture Security System works in four phases: Motion Detection, Event Capture, Object Identification, and Event Notification. These phases are deployed and tested on a real agricultural field. The system is capable of detecting any movement or suspicious activity in the farm, taking a snapshot of the scene, using Raspberry Pi's image processing module to identify the objects responsible for the motion, and then sending an alert to the user via email and Telegram message.





6. CONCLUSION

It is clear that the vision-based IoT system proposed in this study is an effective and reliable solution for farm security. By utilizing a layered architecture and advanced image processing techniques, the system is able to detect and identify objects that cause motion in the farmland, and notify users in real-time through email and telegram messages. The system has a high level of accuracy, and can be used for various applications, including detecting criminal activity, preventing wild animals from entering the farm, and protecting crops from fire hazards. However, one limitation of the system is the large amount of data required to transfer photos via email and telegram messages. Future work can focus on developing more efficient image compression techniques to improve the speed of notifications for users. Additionally, the use of thermal imaging for night vision can further enhance the system's capabilities in low-light environments.

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