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AUTOMATED BIRD REPELLENT SYSTEM

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ABSTRACT :

Agriculture is a backbone of India. According to the Ministry of Finance, 42.3 percent of the population shares 18.2 percent of the country's GDP (2023-24). Farmers face lots of issues due to birds; they eat the harvested crops and pick the seeds from the land. Due to this, we create an effective bird repellent system. The hardware and software components are integrated to perform tasks without human involvement and perform real-time activities. The hardware components are a Raspberry Pi to act as a controller, a camera for image capture, a battery to store the energy from the solar panel, a solar panel for a power source to ensure sustainability, and an ultrasonic sensor to repel the birds. The software components are OpenCV for image recognition, and Python as a programming language helps to operate OpenCV technology.

Keywords: Bird repellent, Raspberry pi, openCV, Buzzer, Solar panel.

INTRODUCTION

"Agriculture is a backbone of India," and Tamil Nadu contributes around 13% to the state's economy. However, farmers face significant issues due to birds. In many agricultural fields, crops and plants are damaged by birds such as peacocks, parrots, and other small bird species, leading to substantial losses.In our place, Trichy, and in our region, farmers highly consumed paddy, small grains, millets, vegetables, etc. So now they use "traditional bird repellent methods," such as pesticides or chemical mixtures, which can harm the environment. And our region's farmers use bird-scaring devices like buzzers. They give off the sound continuously, so they create environmental impact and noise pollution. Due to this, use of these devices does not give the solution badly; it gives the environmental impact. So, according to this, we introduce the cost-effective bird repellent system."Our system utilizes sound waves. These sound waves are used to repel birds without harming the birds or the environment. This system utilizes solar power, so it does not need any other external power sources.

The solar energy is saved in the battery, and depending on the climate change, we use one battery for power supply. We've been using Python programming and integrated a camera with OpenCV to detect birds and also any other species entering into agricultural land. Then we use the Raspberry Pi to connect the camera and control the whole process. We integrated the camera with OpenCV, which is used to detect the birds through image processing. Once the bird is detected, then sound wave is generated, and then we scare the bird through this device. which is used to protect the crops and other small grains in agricultural land. So it's a fully automated system, it's Doesn't need human interventionSo this innovative solution used to lessen the losses due to birds, and it used to scare the birds effectively.

PROBLEM STATEMENT

In recent years, agricultural lands have suffered from the significant impact of birds activities. In many agricultural lands, birds are affected because they damage the crops, seeds, and also fruits and vegetables. Due to this damage, not only is the overall yield reduced, but also the quality of the crops and small grains is affected, resulting in substantial economic losses for farmers.During planting and harvesting seasons, the birds tend to gather in large numbers, targeting the most vulnerable stages of seeds and crops growth. As a result, farmers face a significant challenge in protecting their crops and agricultural investments from bird-related damage. So the farmers need more efficient, sustainable, and innovative solutions to minimize the crop losses.

OBJECTIVE

The main objective of our project is to develop an automatic bird repellent system using OpenCV to detect and deter the birds from the agricultural land. It will combine with a camera and Raspberry Pi to effectively scare the birds without harming them. This system utilizes the solar system, so it doesn't need any other external power sources. This system provides automatically monitor the agricultural land using cameras to identify the birds or other species entering into the land. This is real-time monitoring through image processing without causing harm to the birds and environment. By

using solar energy, the system gives sustainable and cost-effective operation. The primary goal is to minimize the crop and small grain losses and improve agricultural productivity, protect their farmland, and give them an eco-friendly system to control the birds.

LITERATURE REVIEW

This literature review aimed to explore various aspects of techniques and focus on the use of classifiers, Kalman filters, and solar panels. We learn about classifiers for the accurate bird detection process. These classifiers can detect the Birds images and videos. Then get knowledge about solar panels they provide a renewable energy source for powering our bird repellent systems. It provides energy-efficient and sustainable solutions to the farmers. Finally, we learn about the Kalman filter flowchart. It can track bird motion and predict future positions. These reviews are used to identify effective strategies for implementing cost-effective bird repellent systems that can help to reduce crop damage and eco-friendly solutions to scare the birds in agricultural land.

PROPOSED SYSTEM

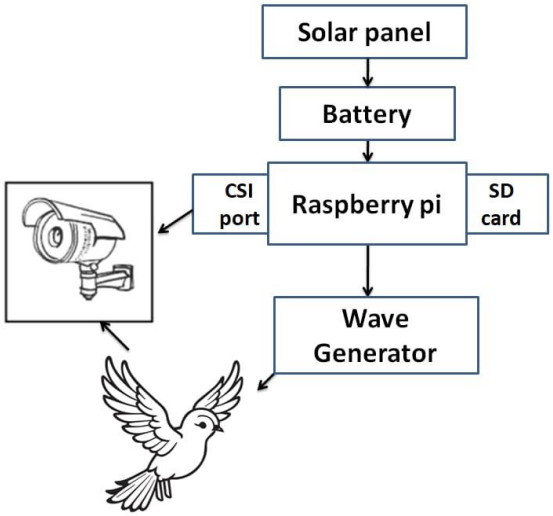

Fig. 1 – flow chat.

The ultimate goal of this system is to develop an automated bird repellent system using cost-effective hardware and software components. It was mainly used to detect the birds using a camera module to distract them through sound waves. This system utilizes solar power for sustainability.

3.1. KEY FEATURES

- Solar-powered operation: The solar panel is powered by the sunlight, and the energy is saved to the battery, enabling sustainable
- Raspberry Pi: It is the brain of this system, and it can be used to control the processes. It allows efficient data processing for real-time monitoring.
- Real-time bird detection: The camera is integrated with OpenCV for image processing through traction technology, and it can detect and deter the birds from entering the agricultural land.
- Automated operation: This system provides a fully automated system, so it doesn't need any manual interaction.
- Eco-friendly solution: This system repels the birds without harming the birds or the environment.

4. METHODOLOGY

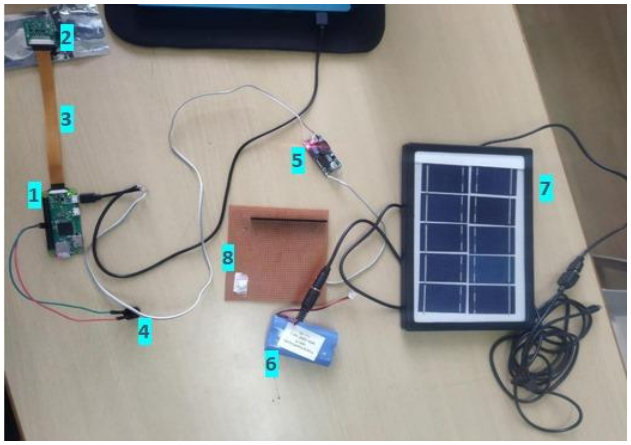

Fig. 2 – Connection setup.

Fig. 3 – Experimental model setup.

The proposed system is made up of two parts, the Hardware and software components.

4.1. HARDWARE COMPONENTS

1. Raspberry Pi

It is the brain of this system. It can be used to process the images captured by the camera through OpenCV object detection techniques. And also it is used to control the system. It constantly analyzes the images from the camera to detect the birds in agricultural land. Once the bird is detected, it will send the signal to the wave generator , which will scare the bird without harming it.

2. Solar panel

This system provides the supply to the whole system without using the grid electricity. It provides 6V output and up to 3 watts of power under ideal sunlight. So it doesn't need any other external power sources. The solar panel absorbs sunlight and converts it into electrical energy. This energy is stored in the battery, and it can be used during cloudy weather.

3. Battery

This is a lithium-ion battery rated at 7.4 V and 2000 mAh capacity used to store the energy generated by the solar panel. Whenever the sunlight is unavailable, then we can use this power for our system .

4. Camera

This is the Raspberry Pi 5MP resolution camera module. Capture the images in real-time monitoring in field of view 54 degree horizontally. It will continuously monitor the agricultural land. If any birds enter the land, it will capture the image and send it to the Raspberry Pi, where the images are analyzed, and then it will scare the bird through a wave generator.

5. Sound generator

The sound generator plays volume or specific frequencies; these sounds do not harm the birds. The Raspberry Pi triggers this device when the Bird is detected. Also, we can change the sound depending on our requirements.

4.2. SOFTWARE COMPONENTS

1. Python programming

It is a high-level programming. It is used to connect the Raspberry Pi camera and sound generator using Python libraries. This gives great support for hardware control. image processing and automation.

2. OpenCV

This tool is used for real-time image processing. It can be used to detect the birds effectively. Once it detects the birds , then the Python program can trigger the sound generator to scare the bird. This tool gives perfect accuracy and used to scare the Bird very efficiently.

4.2.1.OVERVIEW OF CODE

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

[1]

```
# Setup Raspberry Pi GPIO forbuzzer

BUZZER_PIN = 18
GPIO.setmode(GPIO.BCM)
GPIO.setup(BUZZER_PIN,
GPIO.OUT)
```

[2]

```
def activate_buzzer():
   GPIO.output(BUZZER_PIN, GPIO.HIGH)
   time.sleep(1)  # Buzzer on for 1 second
   GPIO.output(BUZZER_PIN, GPIO.LOW)
```

[3]

```
bird1_cascade = cv2.CascadeClassifier('bird1-cascade.xml')
```

[4]

```
# Use default camera (0) instead of a video file
cap = cv2.VideoCapture(0)

while True:
   ret, img = cap.read()
   if not ret:
      break

   gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
     birds1 = bird1_cascade.detectMultiScale(gray, 1.3, 5)


   bird_detected = False

   for (x, y, w, h) in birds1:
      cv2.rectangle(img, (x, y), (x + w, y + h), (255, 255, 0), 2)
      font = cv2.FONT_HERSHEY_SIMPLEX
      cv2.putText(img, 'Bird', (x, y - 10), font, 0.5, (0, 255,
255), 2, cv2.LINE_AA)
```

[5]

```
# Activate buzzer if a bird is detected
    if bird_detected:
        activate_buzzer()

    cv2.imshow('Bird Detection', img)

    k = cv2.waitKey(30) & 0xFF
    if k == 27:  # Press 'Esc' to exit
        break

cap.release()
cv2.destroyAllWindows()
GPIO.cleanup()
```

[6]

Stage:

- Required software packages installed for python compiling environment imported.
- Setup raspberry Pi GPIO for buzzer:
  To create a connection between raspberry Pi GPIO to buzzer .
- Activate buzzer:
  The buzzer is activated , when the Bird is detected through camara module and it will send to raspberry Pi then it triggers the buzzer .
- Classifiers:
  The variable bird_cascade is cascade classifier object that contains the Bird features.
- (5)Use default camara :
  This camara is integrated into opencv.This camara is connected to raspberry Pi and the image is captured by this process.once the Bird is detected then it will send the image to raspberry Pi.
- (6)Activate buzzer if a bird is detected:
  The image is processing in raspberry Pi. It analyze whether the captured image is bird or not , once it find out the image is bird then it will trigger the buzzer.

5.DATA FLOW

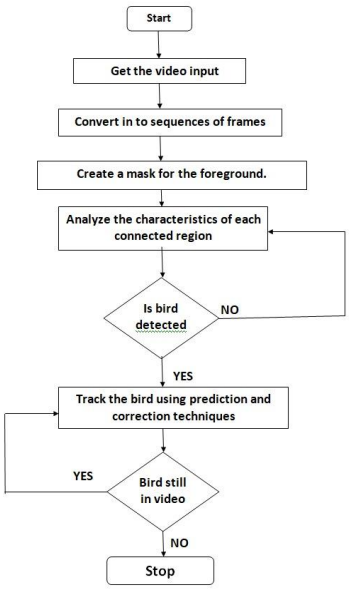

Fig. 4 – Data flow chat.

Flow of working

Step 1: camera module:
The primary goal of this camera is to capture the image of birds or any other species that enter into the agricultural land. Then it sent the image to the Raspberry Pi.
Step 2: Raspberry Pi :
The detected images are sent to the Raspberry Pi, and then it will analyze the image to determine whether the captured image is a bird or another species. Once it confirms the bird image, then it triggers the sound generator.
Step 3: Sound generator:

When birds are detected, the Raspberry Pi triggers the sound generator to emit specific sound frequencies that scare the birds without harming them. The frequency range is designed to be unpleasant for birds, so it can effectively repel the birds in farmland. Ultimately it will reduce the losses of crops.

6.RESULT AND DISCUSSION

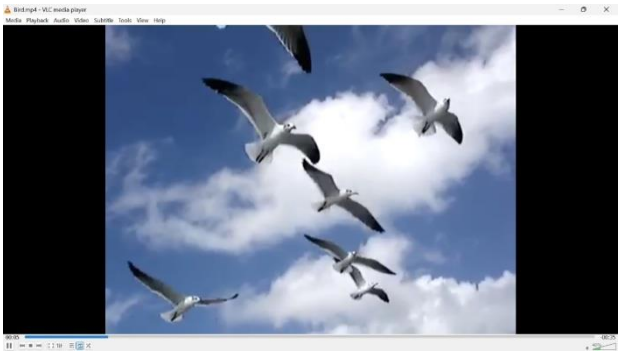

Fig. 5 –Input video .

Fig. 6 – Bird detected video.

The automatic bird repellent system effectively controls the bird-related crop losses that will ensure an increase in yield production. That also verifies the absence of human involvement, which reduces the labor cost. We will reduce around 40 percent of yield losses due to birds. This setup also ensures the sustainability Basically, we use solar as the main power source, which means it will be used in any location that doesn't need a special power supply. The automatic bird repellent system provides real-time monitoring, which processes real-time videos and sends signals to Buzzer. This enriches the traditional methods and increases the yields.

7.CONCLUSION AND FUTURE WORK

- Our entire project is an effective and the best solution for bird repellent to safeguard the farmland from birds. To reduce farmers' stress and losses due to birds.
- Our future work is to implement the integrated surveillance systems or remote monitoring, weather monitoring system, and data collection. This
- integration helps to increase safety and reduce human time. The weather monitor is used mainly in rainy seasons to predict the rain, and it also sends the
- real-time data through our mobile phone. The integration of surveillance systems helps to reduce plant damage. We plan to integrate the surveillance
- system through our mobile phone for remote monitoring.

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