Savitribai Phule Pune University

A

PROJECT REPORT

ON

"CANOPY DETECTION AND PESTICIDES SPRAYING USING AGRICULTURAL DRONES"

Submitted in partial fulfillment of the requirement for the award of the degree of

BACHELOR OF ENGINEERING

IN

ELECTRONICS & TELECOMMUNICATION ENGINEERING

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DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION ENGINEERING

SANDIP FOUNDATION'S

SANDIP INSTITUTE OF TECHNOLOGY& RESEARCH CENTRE

Mahiravani, Trimbak Road, Nashik-422213

2020- 2021

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Certificate

This is to certify that, this Project report entitled- "**CANOPY DETECTION AND PESTICIDES SPRAYING USING AGRICULTURAL DRONES.**"
Submitted by Mr. Sudhir Pawar, Mr. Yash Shinde and Mr. Hrishikesh More for partial fulfillment of the requirement for the award of the **Bachelor of Engineering** in **ELECTRONICS & TELECOMMUNICATION ENGINEERING** as laid down by the **SAVITRIBAI PHULE PUNE UNIVERSITY**, Pune. This is a record of their own work carried out by them under my supervision and guidance during the year 2020-2021.

Place: -SITRC, NASHIK
Date: -
Exam No.:

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ABSTRACT

There are too many technologies involved in today's Agriculture, out of which spraying pesticides using drones is one of the emerging technologies. Manual pesticide spraying causes many harmful side effects to the personnel involved in the spraying process. The Exposure effects can range from mild skin irritation to birth defects, tumors, genetic changes, blood and nerve disorders, endocrine disruption, coma or death. The WHO (World Health Organization) estimated as one million cases of ill affected, when spraying the pesticides in the crop field manually. This paved the way to design a drone mounted with spraying mechanism having 12 V pump, 5 Litre storage capacity tank,4 nozzles to atomize in fine spray , an hexacopter configuration frame ,suitable landing frame, 6 Brushless Direct Current (BLDC) motors with suitable propellers to produce required thrust about 38.2 KG(at 100% RPM) and suitable Lithium Polymer (LI-PO) battery of current capacity 22000 mAh and 22.2 V to meet necessary current and voltage requirements. A First-Person View (FPV) camera and transmitter can also be fixed in the drone for monitoring the spraying process and also for checking pest attacks on plants. This pesticide spraying drone reduces the time, number of labor and cost of pesticide application. This type of drone can also be used to spray disinfectant liquids over buildings, water bodies and in highly populated areas by changing the flow discharge of the pump.

Table Content

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Chapter 1

Introduction

The Indian Agricultural sector is the most important sector as it amounts to a staggering 18% of India's Gross Domestic Product (GDP) and also provides employment to 50% of the national human workforce. Our country is dependent on agriculture so much, has yet to tap into the real potential of agriculture, because of improper methods of monitoring crops and the irrigation patterns and the pesticides required to be applied. In India, there are over 35 drone start-ups that are working to raise the technological standards and reduce the prices of agricultural drones. This project aims to develop Unmanned Aerial Vehicle (UAV) for overcoming this problem and also spay large amounts of pesticides within smaller interval of time using Hexaocopter. To achieve this, an Unmanned Aerial vehicle (Drone) is designed by using spare parts like BLDC (Brush Less DC) motors, ESC's (Electronic Speed Controllers), Flight Controller, Propellers, drone base, power distribution board, RF Transmitter, receiver etc. for controlling purpose are integrated to it. In addition to that several applications like spraying, crop and weather monitoring are also added. For these, the required components are water level sensor, DH11, LDR, water sprinkler, connecting wires, motor driver and finally, an advanced Raspberry Pi for controlling all the components. It has inbuilt Wi-Fi, Bluetooth, serial and parallel bus connectors, audio, video jack, hdmi cable, usb ports, ether net jack and 40 GPIO (General Purpose Input Output) pins. Due to all these special features in-built in Raspberry pi, it is chosen over the other controllers in this project. Python language is used for programming the Raspberry pi. Raspberry pi is treated as the minicomputer i.e. a system on hand. Rasbian is the OS available in the internet for free of cost. One can download that and install it into the memory card and use it as a computer. For particular components to interface, special drivers have to be installed.

Chapter 2

Literature Survey

- **Huang et al. (2015)** made a low volume sprayer which is integrated into unmanned helicopters. The helicopter has a main rotor diameter of 3 m and a maximum payload of 22.7 kg. It used to require at least one gallon of gas for every 45 minutes. This study paved the way in developing UAV aerial application systems for crop production with higher target rate and larger VMD droplet size.
- Chennai based **ZUPPA** provides farm, irrigation, and crop monitoring through use of drones and aerial mapping.

- **Kurkute et al. (2018)** worked on quadcopter UAV and its spraying mechanism using simple cost-effective equipment. The universal sprayer system is used to spray for both liquid and solid content. In their research, they have also compared different controllers needed for agricultural purposes and concluded that quadcopter system with Atmega644PA is the most suitable due to its efficient implementation.
- **Rahul Desale et al. (2019)** described an architecture based on UAV that could be employed for agricultural applications. Their UAV was designed not only for spraying but also for monitoring agricultural fields with the use of cameras and GPS. Their design was optimized for cost and weight. They used a microcontroller kk 2.1.5 which has inbuilt firmware. Prof. B. Balaji et al. (2018) [6] developed an hexacopter UAV with the purpose of spraying pesticides as well as crop and environment monitoring using Raspberry Pi that run on python language. Their UAV also contains multiple sensors like DH11, LDR, Water Level Monitoring sensors. From this experiment, they finally concluded that with proper implementation of UAVs in the agricultural field almost 20%- 90% savings in terms of water, chemical maltreatments and labor can be expected

Chapter 3

Problem Statement and Objective

3.1 Statement of the problem

To design and develop cost effective agriculture drone for sapling detection and pesticides spraying purpose with the help of High Speed STM32 processor along with BLDC motors, Li-Po batteries, ESCs pesticides tank, pump and propellers and in the end to train the farmers to operate the drones.

3.2 Objective

1. Drone capable of carrying payload of 5 kg.
2. Drone with ability to detect a sapling autonomously.
3. Reducing the cost required for the drone compared to present solutions.

Chapter 4

Proposed System Development

4.1 Proposed Block Diagram

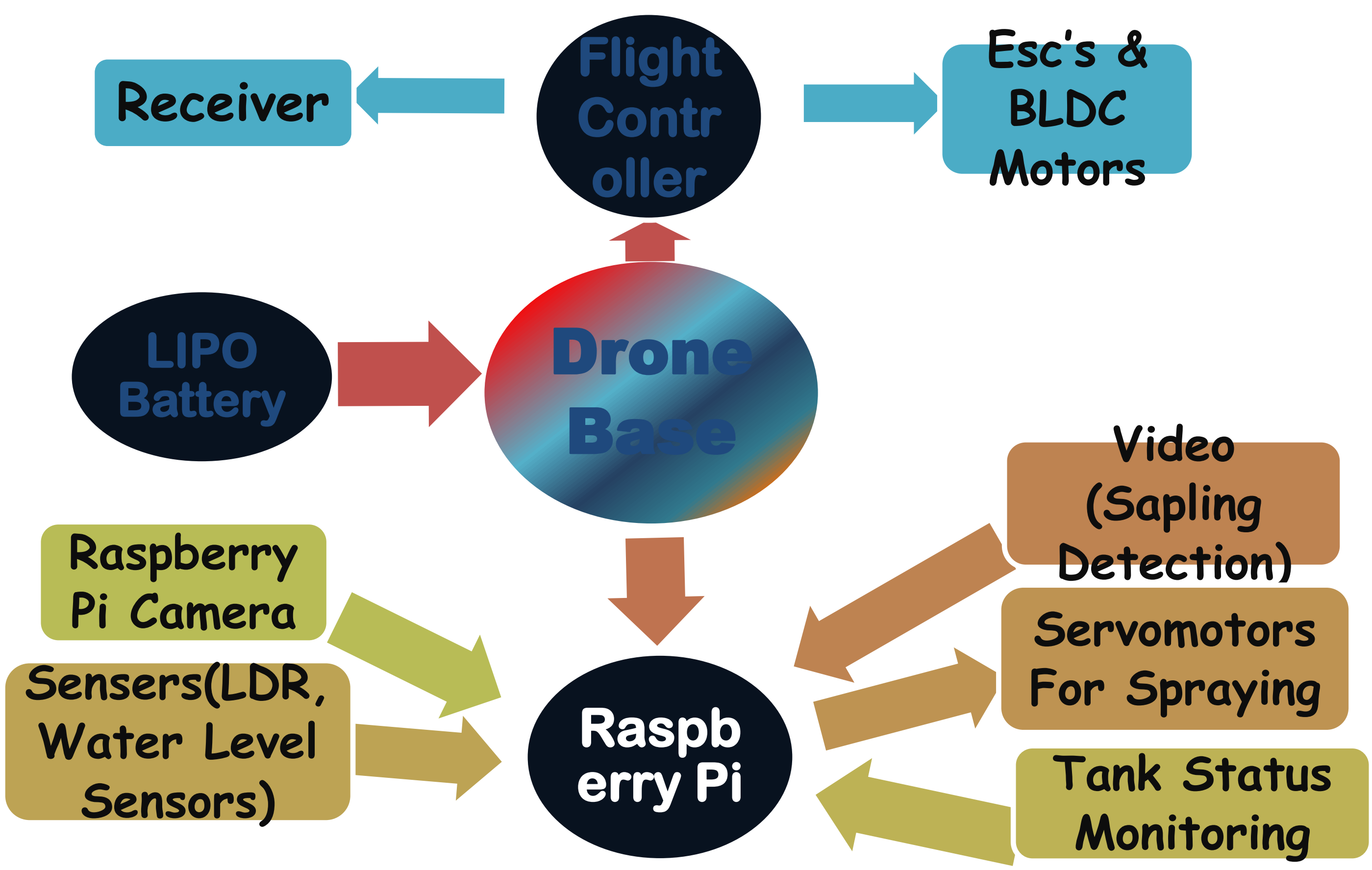


Figure 4.1: Proposed block diagram

4.2 Software Requirement

- Raspberry Pi OS
- Mission Planner Software
- Python OpenCV

4.3 Hardware Requirement

- Drone
- Raspberry Pi
- Pump
- Water Sprinkler
- Motor Driver IC
- Water Float Sensor

Chapter 5

Software Based Proposed System

RASPBERRY PI :-

It look like a credit card but it perform as a mini computer .it used for many things that desktop PC does like video word processing,
spread sheets, home automation server,
parent detectors to weather stations,
tweeting houses of birds with IR cameras etc.
After installing the Raspbian OS we can get the Raspberry pi desktop as shown in the fig which is similar to our normal computer desktop.

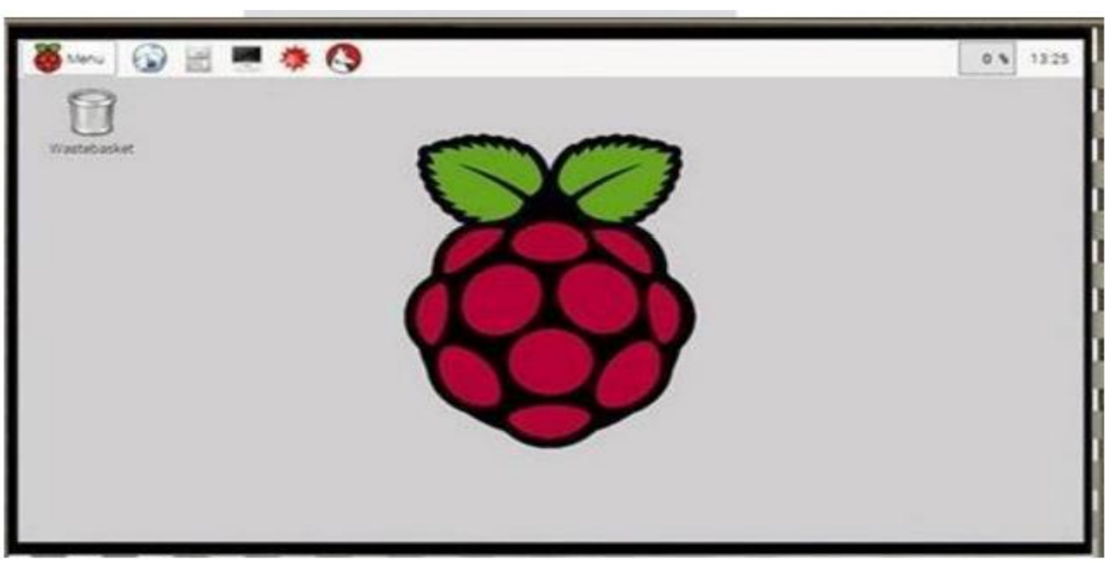


Figure 5.1: Raspberry Pi

Spraying Mechanism: -

There are a lot of plant protection products exist today. Main pesticides that used in precision agriculture are:

1) Insecticides
2) Fungicides
3) Herbicides

Crops spraying Drones suited ideally for such task, because most fields need ultra-low application volumes of pesticides per hectare, only on some specific zones of a field and only at some specific time.

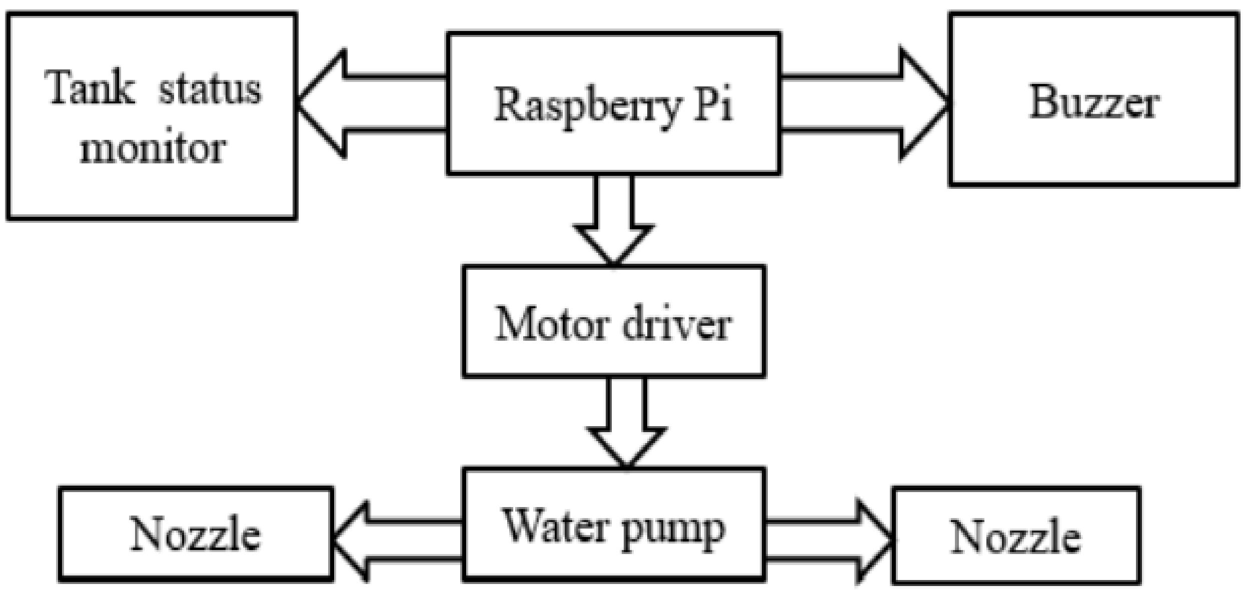
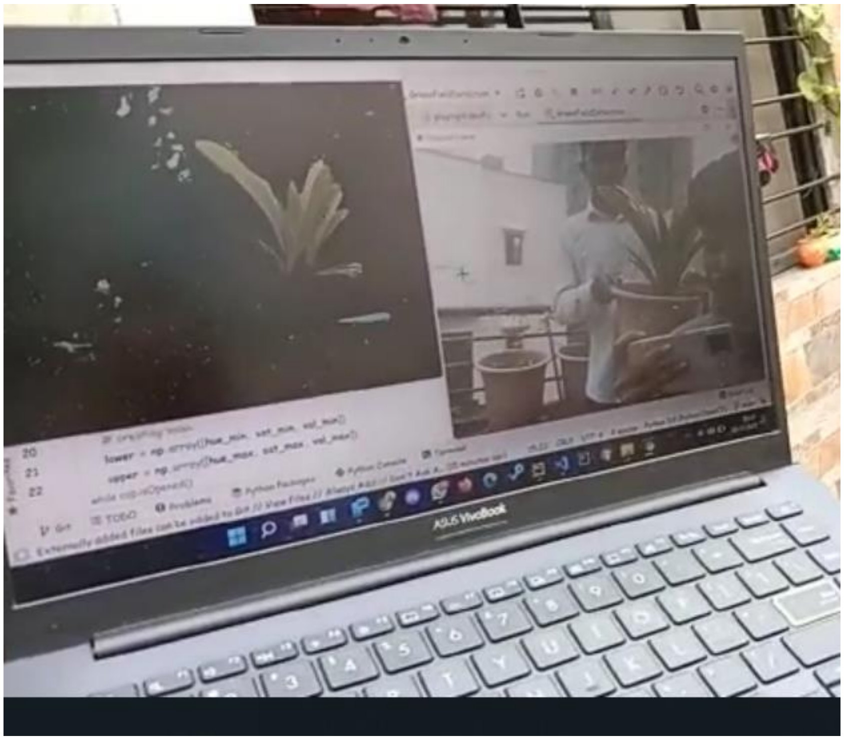


Figure 5.2: Spraying Mechanism

Green Field Detected: (Output)



CODE:

```
import cv2
import numpy as np

hue_min = 25
sat_min = 52
val_min = 72

hue_max = 102
sat_max = 255
val_max = 255

cap = cv2.VideoCapture(0) # video capturing

while cap.isOpened():
    ret, frame = cap.read()   # original frame

    vidGray = cv2.cvtColor(frame,cv2.COLOR_BGR2HSV) #hsv frame
```

```
    # creating mask
    lower = np.array([hue_min, sat_min, val_min])
    upper = np.array([hue_max, sat_max, val_max])

    mask = cv2.inRange(vidGray, lower, upper) #applying mask to the hsv frame

    # bitwise anding to each pixel to get the object
    Green = cv2.bitwise_and(frame, frame, mask=mask)

    cv2.imshow("Green Field Detection", Green)
    cv2.imshow("Original Frame", frame) #original video

    if cv2.waitKey(1) == ord('q'):
        break
cap.release()
cv2.destroyAllWindows()
```

Figure 5.3: OUTPUT AND CODE

Chapter 6

.1 Conclusion

- This method of spraying pesticides on Agricultural fields reduces the number of labors, time, cost and the risk involved to the personnel involved in spraying the liquids. This drone can also be used in spraying disinfectant liquids over buildings, water bodies and highly populated areas.
- Drone is responsible for both spraying chemicals and monitoring of agricultural fields, environment.
- It helps in improves coverage, boosts chemical effectiveness and makes spraying job easier and faster.

.1 Future Scope

- The maximum quantity of fertilizer that the drone carries can be increased.
- Battery life can be increased.
- With image processing techniques, the drone can be involved in surveillance to determine the pest attack on the plants, condition of ripening fruit.

.1 Advantages:

- High Productivity
- Low Fuel Consumption
- Low Noise Pollution
- No chemical contamination risks for operator
- Crop dusting costs are much lower
- Ultra-low volumes spraying methods, avoids waste of water and ground waters contamination
- Multifunctional Frame

Chapter 7

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