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RS3 : Agricopter for Crop Detection and Optimization

Shashank M Gowda[1], Raviraja Nayak[2], Shruthi Poojarthy[3], Spoorthi[4], Sushanth Nayak[5]

Assistant Professor, Department of ECE, YIT, Moodbidri, Karnataka, India[1]

Student, 8th Semester, Department of ECE, YIT, Moodbidri, Karnataka, India[2 3 4 5]

ABSTRACT: India's main source of income is agriculture. Agriculture production rates are based on various parameters like temperature, humidity, rain, etc. Farmers or humans cannot control natural factors. But these factors can easily be measured and used as a result. Wheeled bots struggle to navigate uncertain terrain. But we can use an aerial vehicle to determine these factors. With these aerial vehicles, you can easily analyze the factors in any situation effectively. In any condition, these aerial vehicles remain stable and can measure the required parameters. There are so many aerial vehicles. However, drones are very commonly used aerial vehicles because they can maintain stability, fly through any conditions, and monitor and analyze factors continuously without moving their positions.

KEYWORDS: Quadcopter, video surveillance, agriculture, crop optimization, image processing, stability, fly time.

1. INTRODUCTION

Over the last few years, we have seen massive growth in the manufacture and sales of remote control airborne vehicles known as drones. There are so many types of drones based on their arms, preferences, etc. Quadcopters are aircraft with four propellers. The four motors which drive the propellers are fixed to the respective sides of the drone frame. Camera modules are implemented to monitor and supervise. India's main income source is agriculture. Agriculture production rates are based on various parameters like temperature, humidity, rain, etc. These are natural factors and are not controlled by farmers or humans. Agriculture also depends on factors like pests, diseases, fertilizers, etc which can be controlled by treating crops properly. In India, agriculture is a major sector of our economy, but it still falls behind western countries when adopting the latest technologies for better farm output. Farmers in the developed world have started using agricultural drones equipped with cameras to improve crop treatment.

This project is mainly about agriculture-related problems and solving those problems, so we named it "AGRICOPTER". Drones are classified into many types based on their architecture, arms, etc. The most commonly used drone is a quadcopter. A quadcopter is a four-armed drone with four motor in its arms. The quadcopter's motors will help lift the drone. The motors rotate clockwise and anticlockwise to cancel torque motion. The drone will be lifted upwards with no torque. The flight controller gives instructions to the Electronic Speed Controller (ESC) which converts the instructions into signals that the motor can easily understand. The flight controller receives instructions from the receiver which is wirelessly connected to the drone using a transmitter. The transmitter and receiver are connected using radio waves. The waves may be 2.4GHz in frequency. Drone lifting power depends on motor capacity.Higher the drone capacity , the drone can lift more weight, and lower motor capacity the drone can lift less weight.

FPV drones are the most commonly used camera drones for capturing and monitoring the surrounding areas. The camera process the video or image frame by frame and send it to the user. The video or image transmission is also done over the transmitter and receiver with a 2.4 GHz of frequency. By adding additional things to the drone we can improve the fly time, camera requirements, etc. By adding Gimble we can avoid the vibration caused by the drone's motor. During the rotation of the motors, the motor starts to vibrate. The motor then starts to vibrate the drone body which will affect the camera to capture the stabilized video or photo frames. So by adding these additional things we can improve the drone capabilities.

Moreover, we are using image processing in the camera module in order to detect the crops count them, optimize them and capture the parameters that are required for the improved mentation of crops. By using python and OpenCV techniques image processing is done. The camera module needs to be a high-quality pixel-rated camera and a high clock speed NodeMCU for processing the image. The camera module captures the image and sends it to the

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microcontroller. The microcontroller processes the image and detects the objects, optimizes it, and sends it to the user. The image processing it has done over the program that is fed into the microcontroller. The project is mainly about agriculture-related applications.

The drone capture the crop images process them out and send them to the authorized user. So because this is an agriculture-related project the authorized user may be a farmer, farming officer, etc. In order to get information about the crops, the information may be temperature, humidity, soil parameters, etc. Baes on the information given by the drone and the image processing the farmer can perform activities for the crop in order to improve them. This paper mainly deals with agriculture-level problems and their solutions. If any farmer has a large crop area and he needs to see the crop health he cannot measure the individual crop health. It takes more time. To reduce the human effort and get more accurate and quick results the agricopter is used. Here the agricopter flies over the field, captures the video frame by frame and the frames are processed by using the microcontroller and sent to the user where the user will perform certain activities that require crop yield optimization. By using agricopter we can reduce more and more agriculture-related problems.

The agricopter can fly over any surface and capture information. It may use for other applications like military applications, border security, photography, enemy detection, etc. To improve the more fly time we need to use light-weighted parts so that the motor can easily lift the drone and stabilize it with balance. The main impact is that the drone need to stabilize so that the camera module needs to capture the images or videos.

II. LITERATURE REVIEW

[1]. Akturk E, Altunel AO (2019) Accuracy assessment of a low-cost UAV derived digital elevation model (DEM) in a highly broken and vegetated terrain.

Description: To build a drone that is feasible for anyconditions and fly on any air terrain in any conditions.Which will allow the drone to fly in any situation-basedconditions. It mainly deals with the terrain that helps thedrone move in any condition based on architecture.According to the project work it consists of advanced technology that helps the drone perform in challenging conditions. The drone deals with the image processing part that detects 3D objects that will later be coded as a digital signal.

[2]. Alzahrani B, Oubbati OS, Barnawi A, Atiquzzaman M, Alghazzawi D (2020) UAV assistance paradigm J Netw Comput Apple.

Description: Assist the drone with covering, providing assistance, monitoring, and relaying information. The purpose of this paper is to assist the drone in controlling its coverage so that it can easily change its position. It will help drones in heavy terrains face challenges that require an application. The drone UAV is controlled using satellite communication which controls the drone in all 3 transform positions.

[3]. Anwar N, Najam FA, Izhar MA (2018) "Construction monitoring and reporting using drones and unmanned aerial vehicles (UAVs)" 21st Century Colombo, Sri Lanka.

Description: To control the drone using wireless devices and monitor and send reports using UAV technology related to wireless communication. In the image processing part, the drone will monitor and detect the surroundings and create a 3D model to form a suitable planning structure. It will help with building, construction, etc.

[4]. Arfaoui A (2017) Unmanned aerial vehicle: Review of onboard sensors, application fields, open problems and research issues. Int J Image Processing.

Description: A wireless communication system for transmitting and receiving radio waves using an antenna. The control will pass through the antenna which helps the drone move and perform certain operations. In this part, the drone will conduct photo mapping and remote sensing activities. It will perform monitoring operations and send data to the user using remote signals.

[5]. Prof. Mone, Chavhan Priyanka Shivaji, Jagtap Komal Tanaji, Nimbalkar Aishwarya "Agriculture Drone for Spraying fertilizer and Pesticides".

Description: The precautions farmers should take to avoid the harmful effects of pesticides and fertilizers, as well as cost-effective technology using components such as PIC microcontrollers for the control of agriculture robots.

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III. PROBLEM DEFINITION

There seems to be a lack of knowledge about such an unknown and sometimes controversial product. Agriculture in India constitutes more than 60% of its occupation. It is very essential to improve agriculture productivity and efficiency by providing safe cultivation for farmers. Farmers did not know their fields. Consequently, crops are optimized with high potential because they don't know the conditions.

IV. OBJECTIVES

To select the required material for increasing the drone's flying time by structural, model, dynamic, and crash and other analysis of its materials by element method. To fly the drone using stability and control it using a remote. In addition, monitor the physical environment by using an image processing camera for surveillance purposes. This is done by performing yield optimization and monitoring crop growth and crop production. To obtain the physical environmental conditions and structural behavior of crops and analyze that information to determine crop optimization.

V. METHODOLOGY

After building the drone mainly the flight control contains 3 built-in sensors which help the drone to fly in stability and move from one place to another within a certain distance to avoid a crash with the collision of propellers or body. This sensor acts as an actuator in the drone. An object found in front or on the side will alert the user and prompt them to move away. During take-off conditions, the drone should provide high power to the motor so it can fly. In this process, all motors will have equal power. If any motor gets too low, the drone crashes. When the drone takes off the drone's weight will be lesser than the motor speed. In this condition, only the drone will be taken off. After take-off, when it reaches a certain level the drone's weight equals the motor speed. To maintain the balance all motors are given equal amounts of power. In the case of transformation, the drone's rear-end motor will increase its speed. The front motor will provide high power to move backwards. For different movements, the motor speed will be changed. A flight controller will control all of this using a remote control. According to the user's instructions, the flight transmitter and receiver will send a message to the flight controller. The flight controller performs certain operations. A camera module is implemented for live footage and image processing.

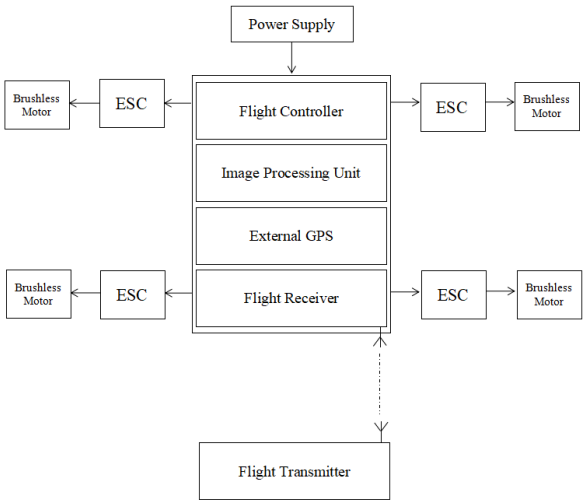

Fig.1 Block Diagram of Agricopter

Based on the application, the camera will detect objects or crop behavior. This will be transmitted to the user for further inspection. According to the crop's behavior, the user can take the required actions to help the crops grow well. There is a focus on agricultural and fundamental needs in this project. It will help the user monitor crops remotely, and based on the monitoring, the user can take action accordingly.

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VI. FUNCTIONAL PARTITIONING

The technique of system or program decomposition in which the primary criteria is to identify the problem statement and work on a solution. This is based on agricultural applications. The function the partitioning unit perform the action the is required for the fly time and capturing of the images.

1. Control Unit

The flight controller uses the sensors' data to calculate the optimal speed for each motor. The flight controller sends this certain speed information to the ESCs, which translate that speed into a signal that the motors can understand and rotates.

There are four main drone controls:

- **Roll:** Turning the right stick to the left or right we can perform roll. Literally rolls the drone, which maneuvers it left or right.
- **Pitch:** By turning the right stick forwards or back we can perform pitch. Tilts the drone, which maneuvers forwards or backward.
- **Yaw:** By turning the left stick to the left or right to perform yaw. Rotates the drone left or right. Points the copter front in different directions and helps change directions while flying.
- **Throttle:** To increase, push the left stick forward. To decrease, pull the left stick backwards. This adjusts the drone's altitude or height.

2. Image Processing Unit

The acquired images endure multiple platforms of processing to end up with the desired results. Combination of images for occlusion detection; filtering for noise reduction; thresholding the images to determine gray value; segmentation or edge detection to find objects; pattern recognition for template matching; blob detection to count the number of blobs segmented; color analysis and deep learning processing are some image processing methods for the machine vision system. The position and orientation measurements are provided to robots through machine vision for axis control and locomotion. In this project, image processing mainly deals with crop health detection by using the micro python language. It detects the crop, identifies it, monitors the structural and environmental behavior, and converts it into a usable format so that the user can easily detect the issue or problems that will harm the agricultural environment and try to solve them. Image processing technique has been proven as an effective machine vision system for the agriculture sector. Imaging techniques with different spectra such as Infrared, hyperspectral imaging, and Remote sensing were useful in determining. For this purpose, the artificial neural network concept is used. Processing the data using software installed on a local desktop computer or network, Uploading the data to a cloud-based system for automated processing, and giving the data to experienced professionals who will handle the processing. It helps to improve images for human interpretation. Images can be stored and retrieved easily. Image processing in drones is done by openCV libraries and machine learning. We used ESP32 with a camera module for capturing videos frame by frame. The program is implemented by using python language.

2. Sensing Unit:

In this project, the main sensing part is the camera. The camera is attached to the ESP32 module where the camera captures the video frame by frame and the ESP32 module performs image processing. The module senses the frame and performs openCV algorithms and detects the object as per user requirement.

3. Actuating Unit:

After image processing, the data should be sent to the user. So that will be performed by using wifi communication with a 2.4 GHz frequency of radio wave. To access the data by the user, the user should connect to the same wifi that the ESP32 module is connected to. The user will receive the data and he will perform the required action based on that information.

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VII. MOVEMENT OF QUADCOPTER

1. Take-off motion

Take-off is the movement of a Quadcopter that lift up from the ground to the hover position. Take-off motion is controlled by increasing the speed of four rotors simultaneously.

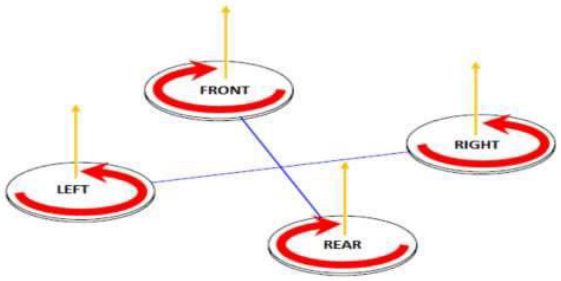

Fig. 2 Take-off motion mechanism

2. Landing Motion

Landing is the movement of a Quadcopter that lift down from air to ground position and landing. Landing motion is controlled by decreasing the speed of four rotors simultaneously.

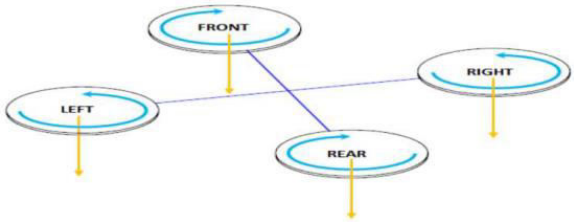

Fig. 3 Landing motion mechanism

3. Forward Motion

Forward motion is controlled by increasing the speed of the rear rotor. decreasing the rear rotor speed simultaneously will affect the pitch angle of the Quadcopter.

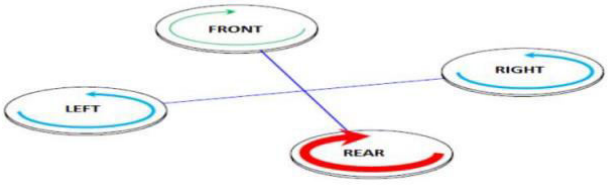

Fig. 4 Forward motion mechanism

4. Backward Motion

Backward motion is controlled by decreasing the speed of the front rotor. Increasing the front rotor speed equally will affect the pitch angle of the Quadcopter backward.

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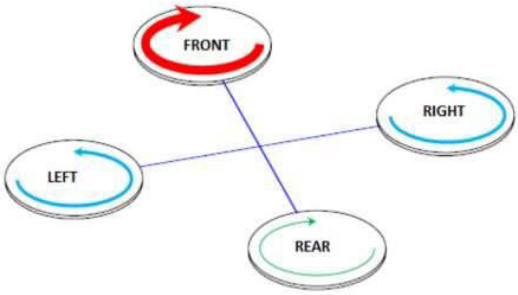

Fig. 5 Backward Motion

4. Right Motion

For right motion, it can control by changing the yaw angle of the Quadcopter. Yaw angle can control by increasing the counter-clockwise rotors' speed while decreasing the clockwise rotor speed.

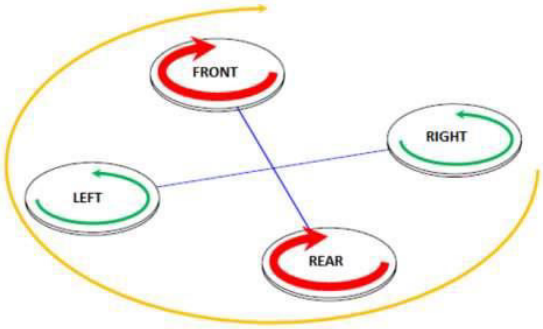

Fig. 6 Right motion mechanism

5. Left motion

For left and right motion, it can control by changing the yaw angle of the Quadcopter. Yaw angle can control by decreasing the counter-clockwise rotor speed while increasing the clockwise rotor speed.

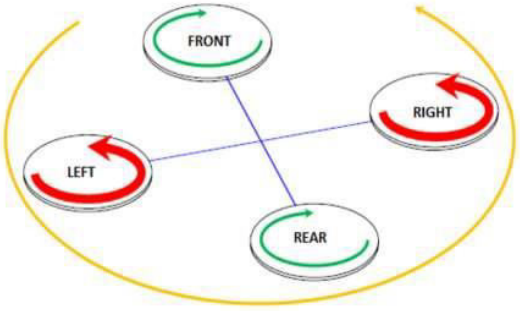

Fig. 7 Left motion mechanism

VIII. ADVANTAGES

- Small-scale UAVs make vehicles safer for close interaction.
- Quadcopters do not require linkages to vary the rotor pitch angle as spin.
- Lightweight, easy takeoff and landing.
- The quadcopter can easily undergo with any conditions.
- Because of its structure it can easily maintained and fly over sky

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IX. APPLICATIONS

- Inspection.
- Broadcasting.
- Border Security.

- Traffic analysis.
- Environmental protection.
- War Reporting.
- Filming Movies.

X. CONCLUSION

The Agricopter drone can be employed to implement a control loop for agricultural applications where the drone processes images of crops. It is concluded that the Agricopter will be successfully implemented and the image processing is done on the crop using OpenCV libraries and successfully get outputs.The image processing unit can easily monitor and process the image for crop optimization. Other applications like industrial inspection, package delivery, and military operations are evolving and expected to improve in the future. During the design of the drone we found a lot of reseach and development ideas and knowledges.
The conditions like:

- The designed quadcopter should weigh at least 1.5Kgs only.
- The quadcopter should take off and land on the surface safely.
- The quadcopter should take all commands given by the flight controller and interpret them effectively
- The quadcopter should hover vertically with ease.

To build a drone a designed should careful about these parameters. Lack of information can damage the project.

REFERENCES

[1]. Scientific American (January 2012), 306, 16 Published online: 28 December 2011
[2]. Tice, Brian P. (Spring 1991). "Unmanned Aerial Vehicles – The Force Multiplier of the 1990s". Airpower Journal.
[3]. Brandt, J.B. and Selig, M.S., "Propeller Performance Data at Low Reynolds Numbers," 49th AIAA Aerospace Sciences Meeting, AIAA Paper 2011-1255, Orlando, FL, January 2011
[4]. Akturk E, Altunel AO (2019) Accuracy assessment of a low-cost UAV derived digital elevation model (DEM) in a highly
[5]. Alzahrani B, Oubbati OS, Barnawi A, Atiquzzaman M, Alghazzawi D (2020) UAV assistance paradigm: State-of-the-art in
[6] A. Matlock, R. Holsapple, C. Schumacher, J. Hansen, and A. Girard, “Cooperative defensive surveillance using unmanned aerial vehicles,” in
Proceedings of American Control Conference, St. Louis, MO, USA, June 2019.
[7] J. S. Gadda and R. D. Patil, “Quadcopter (uavs) for border security with gui system,” International Journal of Research in Engineering and Technology
(IJRET), vol. 2, no. 12, pp. 620 – 624, 2017.

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