

Design and Optimization of Image Processing Drone

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Abstract - Drone technology is being used for military, agriculture, aerial photography, surveillance, remote sensing and many more purposes. In this paper, drone plane is proposed for monitoring and targeting the street crime criminals based on real time image processing techniques. Operations of proposed plane controlled with two processing units, 1st processing unit is for implementation of real time image processing techniques and 2nd processing unit will handle the rest of controlling, monitoring and targeting operations. Drone plane will monitor circular area of 5 kilometer's and it will automatically perform all operations and can be controlled by operator. Shape detection algorithms have been tested to find accuracy in target detection and analysis the processing time before implementing in such environment and results provide optimal accuracy in matching weapons type with name and shape in predefined database.

Keywords :- Unnamed Aerial Vehicle(UAV), Quadcopter, Remote Controller, Image Processing & Computer Vision, surveillance

Date of Submission: 16-07-2021

Date of acceptance: 01-08-2021

I. Introduction

This chapter constitutes a general introduction of the thesis report by presenting an overview of the problem statement, the contributions and the thesis outline. A drone, in technological terms, is an unmanned aircraft. Drones are more formally known as unmanned aerial vehicles (UAVs) or unmanned aircraft systems (UASes). Essentially, a drone is a flying robot that can be remotely controlled or fly autonomously through software-controlled flight plans in their embedded systems, working in conjunction with onboard sensors and GPS. As of today drones are being used in domains such as agriculture, construction, public safety and security to name a few while also rapidly being adopted by others. With deep-learning based computer vision now powering these drones, industry experts are predicting unprecedented use in previously unimaginable applications. We explore some of these applications along with challenges in automation of drone-based monitoring through deep learning. Finally, a case-study is presented for automating remote inspection of construction projects in Africa using Nanonets machine learning framework. Sr. No. Title of the Paper Authors Name of Journal /ISSN No./Volume Number/Year Proposed Concept.

II. History

This paper proposes the drone plane to monitor streets and congested corridors of big cities without help of operator and without making disturbance in human life as shown in Fig. 1. The proposed drone plane is based on self-monitoring and self-targeting on the basis of real time object detection and classification techniques. UAVs have been used for surveying, disaster management, search operations and communications but in near future it will not stop only for given tasks, now it's time to use them for targeting/shooting inside narrow streets, detect electromagnetic emission to find the harmful things at invisible ranges and many more, is worthwhile to stop crimes and terrorist attacks. The proposed model will basically focus on gun/weapon detection during the crime scene. In drone technology after detection of weapon, decision can be taken to stop the crime. The remaining sections of this paper are as follows; section II contains related work of drone technology and features extraction methods, details of proposed design and architecture are given in section III. Results and discussion is described in section IV and finally we conclude work and provide future.

- Improve Power Outage restoration times, find broken components. quickly with better success.
- Equip drones with HD Camera, IR Camera, Corona Camera, RFI Antenna to perform diagnostic survey of High Voltage Transmission.

To define and evaluate the technical specifications of the Unmanned Aerial Vehicle and the multispectral camera needed for capturing high-quality imagery of each proposed crop-weed systems

III. Problem Identification and Problem Formulation

3.1 Problem Objectives :

- Develop, improve, and or explore transmission and substation maintenance and operations by developing or improving one or more areas of interest with an using Unmanned Aerial Vehicle (UAV)Drone:
- Investigate the use of UAVs (Drones) for Transmission Line. Inspection & Maintenance.
- Improve repair times / eliminate the need for helicopter survey.
- Improve Power Outage restoration times, find broken components. quickly with better success.
- Equip drones with HD Camera, IR Camera, Corona Camera, RFI Antenna to perform diagnostic survey of High Voltage Transmission.
- To define and evaluate the technical specifications of the Unmanned Aerial Vehicle and the multispectral camera needed for capturing high-quality imagery of each proposed crop-weed systems.

3.2 Project problem statement

- The development of autonomous navigation has been focused on the control of numerous autonomous machines.
- The meaningful questions that could be asked are how to ensure the safety and security of drones and how they respect the geometry that they should form depending on which strategy of commands.
- In fact, cooperating UAVs must be supported with a high coordination with each other since they move in hostile areas collecting data in order to achieve complex tasks in a dynamic environment.
- The communication between the aerial vehicles is ensured by the wireless medium in a manner that they should send their data in a synchronized and decentralized way.
- Distal ash clouds created by volcanic eruptions can pose great risk to jet aircraft engines.
- The clients, DTA and the New Zealand Air Force require a low cost system that must intercept, detect and sample the distal ash at up to 12 km altitude.
- The solution provides vital information about the ash location at different altitudes, defining the safe flying regions.

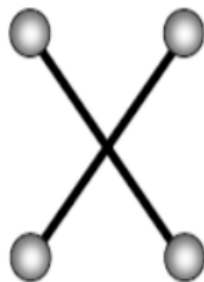
IV. Research Methodology

4.1 Components :

Components used in Image Processing Drone :

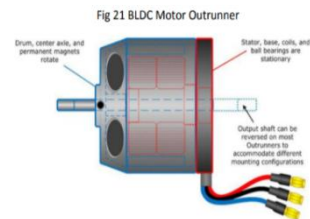
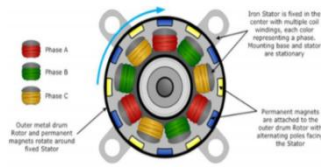
- Frame
- Motors
- Electronic speed controller (ESC)
- Flight Control / board
- Propellers
- Radio Transmitter
- Battery, Electronics, and Power Distribution Cables
- Camera
- Landing Gear

1.Frame



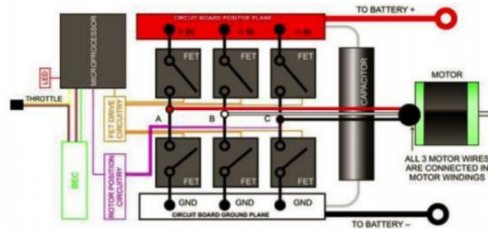
This is a structure (frame) in which all the other parts fit in. It acts as a skeleton in which different components are placed in such a manner that they uniformly distribute the drone's center of gravity. Different drone designs have different quadcopter frames structure with a minimum of 3 propeller fitting gaps. They are available in various shapes and sizes and their price ranges from \$10 to \$500 depending on their quality.

2.Motors



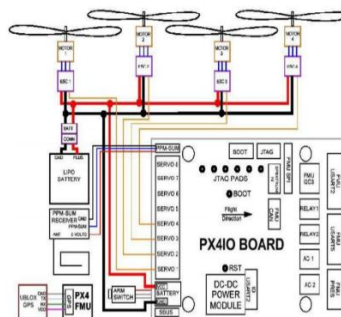
Motors are essential for the propeller's rotation. This enhances a thrust force for propelling the drone. Still, the number of motors should be the same as the number of propellers. The motors are also fitted in a way such that they are easily rotated by the controller. Their rotation enhances the drone control in terms of direction. Choosing the right motor is essential for the efficiency of the drone. You have to check carefully about various parameters such as voltage and current, thrust and thrust to weight ratio, power, efficiency and speed, and so on.

3.Electronic Speed Controller (ESC)



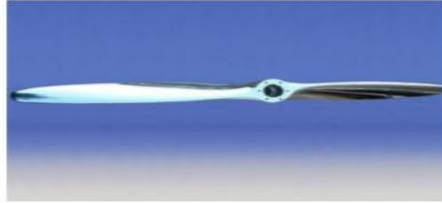
This is an electronic control board that varies the motor's speed. It also acts as a dynamic brake. The component helps the ground pilot to approximate the height at which the drone is running in. This is attained by gauging the amount of power used by all the motors. Altitude is associated with power drain from the power reservoir

4. Flight Control / board



The flight board makes a log of the takeoff place just in case the need arises for the drone to go back to its takeoff location without being guided. This is known as 'return to home' feature. It also determines and calculates the drone's altitude in respect to the amount of power it consumes

5. Propellers



Propellers are clove like blades structured to create a difference in air pressure. When in motion, they cut through the air creating difference in pressure between the top and bottom of the rotors. The top side is characterized by low pressure as compared to the bottom causing the drone to lift into the air. The price starts from as low as \$1 and follows an upward trend depending on their make and model. For example, carbon fiber propellers cost around \$50. They are lightweight and durable, which are qualities not present in propellers costing around.

7. Battery, Electronics, and Power Distribution Cables



The battery acts as the power source to the drone. It supplies energy in all the electronics in the framework through the power distribution cables. Nickel Metal Hybrid or Nickel Cadmium based batteries were first used; however, their use has diminished while the use of lithium batteries has increased. They can store a greater amount of energy than the Nickel Cadmium and Nickel Metal Hybrid. The rating of a typical battery is 3000mAh and 4V. It costs about \$10. The electrical and electronic part is a crucial part pertaining to the control and operation of the drone. However, in respect to the purpose of the drone, other components can be either included or omitted. The drone may be functional without these parts, though for multitasking purposes it's advised to include them.

8. Camera



For video footage, cameras are attached to the drones. Cameras with the capability of shooting and storing or sending videos are available and used in relation to the operator's taste or budget. Some use their own cameras while the quality conscious use GoPro cameras.

9. Landing gear



This is a structure meant for safely landing the drone. However, it can be exempted since an experienced user is capable of balancing the motors speed for safe landing in emergencies. There are two major types of landing gear. One is fixed landing gear and the other is retractable landing gear.

V. Working Principle:

Connectivity-Drones can be controlled remotely, often from a smartphone or tablet. Wireless connectivity lets pilots view the drone and its surroundings from a birds-eye perspective. Rotors-A drone relies on rotors for its vertical motion. Drones use their rotor. To hover, two of a drone's four rotors move clockwise, while the other two move counterclockwise, ensuring that the sideways momentum of the drone remains balanced. Accelerometer and ultimate -An accelerometer feeds the drone information about its speed and direction, while an altimeter tells the machine its altitude. Camera -Some drones have built-in cameras onboard that allow the pilot to see where the drone is flying without having a direct line of sight to the device.

VI. Design Project

6.1 Design and Drawing

In the works of the aerodynamic design of solar UAVs, for example, a conceptual design method for a hybrid solar-powered aircraft was presented in [8], which uses a propulsion system that was a hybrid between an internal combustion engine and an electric motor. In [9], authors carried out solar radiation research where they collected data in 12 cities around the world indicating that the duration of sunlight is as important as radiation for the performance of a UAV powered by solar cells; therefore, the cities closest to the Ecuador line have the advantage of obtaining more radiation and sunlight, the authors presented a method to calculate the number of solar cells required to obtain the power necessary to have a straight-and-level flight as well as the energy efficiency of the solar cells. In [11], the authors presented a flight dynamics simulation using the simplified 2 DoF model and proposed a maximum altitude and minimum altitude to obtain the necessary energy to maintain flying.

6.2 Conceptual and Preliminary Design of The UAV

The design requirements to evaluate and configure structural components of an aircraft include airfoil, wing position, size, and type of wing . The methodology used in this work. starts with the flight mission and evaluation of the atmospheric conditions; for aerodynamic analysis, two phases of the conceptual design were defined as follows: the main wing and the elevator. The study continues with the preliminary design proposing a 3D model, and it finishes with a computational fluid dynamics analysis. If it does not satisfy the required results, the process is modified returning to the preliminary design.

6.3 Design Calculation

General equation:

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$$\text{“WGL} = \text{WE} + \text{WF} + \text{WPL} + \text{WCrew} \text{”}$$

- WGL = Ground launch.
- WE = Empty weight.
- WF = Fuel weight.
- WPL = Payload weight.
- WCrew = Crew weight. By apply this equation we get: In drone the Fuel weight and Crew weight will equal zero. so,

$$\text{“WGL} = \text{WE} + \text{WPL} \text{”}$$

So,

From that we can find the We and it will equal:

From datasheets we will collect the weight for every component

- 1- Wight of battery = 207gm
 - 2- Wight of DC motors =100gm
 - 3- Wight of ESCs =100gm
 - 4- From Fig (3.2.2) weight of frame= 300 gm.
- So, $W_e = 707$ gm

To find WPL:

- 1- Wight of video link = 22g
 - 2- Wight of camera = 8 g
- WPL = 30 gm

So, the WGL will equal:

WGL=737gm

Estimation of brushless DC motor:

WGL = 737gm

The total thrust =1474 gm

Thrust for each motor = Total thrust / Number of motors = 368.5 gm

In our motor the maximum thrust = 450 gm,

So we are in the safe side.

Estimation of the battery:

Battery = current * Flight time

Assume,

Flight time = 8 min

Note that: 1S =1 Cell =3.7 volt

3S = 11.1 volt

Power total = I V

I = 11.5 Ampere

So, Battery that need = 6130 mA

So, actual flight time will equal.

VII. Conclusion

In this Paper , we focused the topic of fleet of drones flying in formation, in a hostile environment. This thesis has implemented several dependability approaches in order to ensure the communication reliability for UAVs fleet formation flight in addition to the communication between the drones and their ground control station. Firstly, a description of UAVs was given showing their strategies and communication architectures for drones' fleet. The dependability concept was also introduced in order to define the importance of the reliability term, in addition to safety analysis approaches. From this description, we studied, based on FTA approach, the different causes that affect this communication such as crash of drone, information flow faults, the drones' software, and the status of the GCS as well as the environmental factors that play an important role in connection loss. This method was evaluated by simulations representing several cases. Furthermore, a second probabilistic approach was proposed based on a stochastic process, Absorbing Markov Chain, to ensure the communication reliability. The objective is to improve the efficiency of the fleet performance in their environment by avoiding the reasons of presence of threats and failures. We show the transition states in addition to the absorbing states that should be prevent. Despite the hardware failures, software failure is considered as a repairable state. Environmental factors could be prevented in non-emergency cases since we can choose the suitable place for the mission, the season and the appropriate time. After exposing the different risks that influence the communication in drones' networks,we aim to guarantee the message transmission by the receiver that could be another drone or the GCS. Numerous parameters play role in wireless medium transmission such as the number of bits error in a single message, the length of the message depending on data's type, the throughput of the signal, the modulation in addition the number of data that should be transmitted. Noise and interference are the majorfactors that affect the wireless medium. For this, the proposed protocol focus on the attempt of retransmissions in order to be ensured with a high probability of reliability, the message receipt. Different scenarios have been considered within we vary the parameters values.

VIII. Future Scope

Over the past few years, drones have become central to the functions of various businesses and governmental organizations and have managed to pierce through areas where certain industries were either stagnant or lagging behind. From quick deliveries at rush hour to scanning an unreachable military base, drones are proving to be extremely beneficial in places where man cannot reach or is unable to perform in a timely and efficient manner.Increasing work efficiency and productivity, decreasing workload and production costs,

improving accuracy, refining service and customer relations, and resolving security issues on a vast scale are a few of the top uses drones offer industries globally. Adoption of drone technology across industries leapt from the fad stage to the mega-trend stage fairly quickly as more and more businesses started to realize its potential, scope, and scale of global reach.

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