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Landslide Monitoring System through Drones

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ABSTRACT; A drone is described as an aerial automobile that uses aerodynamic forces to provide car carry, maybe recoverable or expandable, can be piloted remotely or fly autonomously, does not carry a human operator, and may convey a non-lethal or lethal payload. Beforehand, drones have been used most effectively for navy packages like spying on each international and home threats because they do not position the lifestyles of a pilot at risk in combat zones. In addition, they do not need rest, which permits them to fly so long as there is fuel or battery inside the craft. Currently, the advanced drones can be utilized in a huge quantity of applications, along with deliveries, policing, tracking flooded regions, and lots of others that were discussed in this record. The mechanism defined in this file targets more than one discipline that falls below the Mechatronics umbrella, which contains mechanical, electrical, and digital components. This mission focuses on designing and growing a trendy-motive drone that may be used in one-of-a-kind packages, especially in landslide monitoring & deliveries. The developed drone layout has been simulated with the use of different software, consisting of MATLAB, Jupyter notebook for phototype the use of Python. The intention of this challenge is to build quadcopters and to display landslides in susceptible regions & to obtain aerial photos, accumulate and keep GPS statistics, and perform landslide tracking challenges using Image Processing.

KEYWORDS: Brushless DC motor, electronic speed controller, GPS, flight controller, WIFI camera, propellers, frame, landing gears, etc.

I. INTRODUCTION

A Drone or Quadcopter is an automobile that has a massive ability for appearing duties that are risky or very pricey for human beings. For example, inspection of excessive systems, humanitarian functions, or seek-and-rescue missions. One specific kind of drone is turning into more and more popular currently: the quadcopter. When travelling to big occasions or parties, professional quadcopters can be seen which are used to capture video for promotional or surveillance functions.

A drone is a flying car that makes use of swiftly spinning rotors to push air downwards, therefore creating a thrust force retaining the drone aloft. Conventional helicopters have rotors. These may be organized as coplanar rotors both offering upwards thrust, but spinning in opposite instructions (with the intention to stabilize the torques exerted upon the frame of the helicopter). A quadcopter is an easy flying mechanism additionally called a quadrotor that has four arms, with each considered one of them having a motor that is connected to a propeller. Nowadays, drones are capable of useful sensors including laser, infra-purple, and optical sensors to maintain the song of their surroundings from more than one angle to imitate the human eye. By taking advantage of this generation, a drone is able to navigate on its person to perform any assignment that it turned into the set to perform. With the advancements in generation, more precisely intelligent structures, it's now possible to personalize and increase the autonomy of drones.

Drone application to a few not unusual regions:

- Aerial Surveillance
- Agriculture
- Search & Rescue
- Military Operation
- Shipping Delivery
- Research & Science
- Aerial imaging & images

II. WORKING THEORY OF A DRONE

Quadcopter uses four propellers, each controlled by its own motor and electronic speed controllers (ESC's). The transmitter transmits the data to the receiver which is placed munted on the flight controller of the quadcopter. The receiver then sends the data to the flight control board. The flight controller is an inbuilt microprocessor that manipulates the signals received by it and

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commands the brushless dc motor (BLDC) motors through the ESCs.After the command is received the motors act according to the signal transmitted by the remote. The throttle is created by rotating all 4 rotors at the same speed.

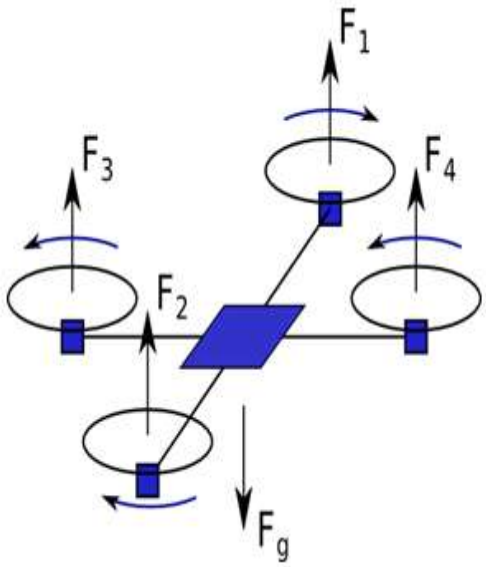

Figure 1.1 Forces acting on a drone

For Hovering:

- SUM(F_i) > m*g --- Climb
- SUM(F_i) = m*g --- Hover
- SUM(Fi) < m*g --- Decline

Where, $F_i = F_1+F_2+F_3+F_4$&
F_g=m*g

An elevation is created by rotating the 2 rear rotors at greater speed compared to the front rotors whereas for backward motion the front rotors have higher speed than rear rotors.
Aileron is created by rotating the left 2 rotors to rotate at a higher speed than the right rotors for the right turn and vice versa for the left turn.
Rudder action is created by rotating the diagonally situated rotors moving with the same spin to rotate at a greater speed than the other two.

III. DESCRIPTION

BLOCK DIAGRAM

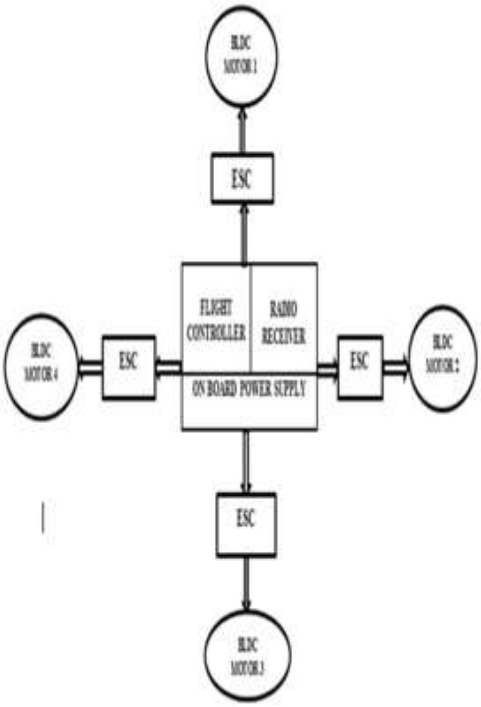

Figure 1.2 Block Diagram of a Quadcopter

3.1 DESIGN OVERVIEW

3.1.1 BRUSHLESS DC MOTOR (BLDC)

Brushless motors are brushless outrunner motors or DC electric motors, which are also known as ECMs (Electronically Commutated Motors). Those motors are synchronous, powered by an electric DC source through an integrated inverter switching power supply that produces an electric alternating current (AC) signal in order to drive the motors.

3.1.2 ELECTRIC SPEED CONTROLLER (ESC's)

ESC or an electronic velocity controller is a tool set up in a far flung-controlled model to manipulate the rate and direction of a brushless motor. Each one of them has an output for a motor and an outlet for a battery. Four of them are required to manipulate each motor. I actually have used a 30A ESC to control each of the brushless motors which constantly offer the required contemporary to drive the motors. Four of them are required to manipulate every motor.

3.1.3 BATTERY

In this experiment, a high amount of current is needed for the brushless motors I have used. Therefore, I chose to use a 3 cell 3300 mAh 11.1 V Li-Po battery that can supply roughly 3A current constantly.

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3.1.4 RC CONTROLLER

An RC controller is the use of a radio that transmits control signals to control a device remotely. A rapidly growing application is control of drones for both civilian and military uses, although these have more sophisticated control systems than traditional applications.

3.1.5 FLIGHT CONTROLLER

The flight controller manages the flight of the drone. Its reason is to stabilize the aircraft in the course of the flight and to try this it takes alerts from onboard gyroscopes (roll, pitch, and yaw) and passes these signals to the Atmega324PA processor, and passes the control sign to the setup Electric Speed Controller (ESC's) and the mixture of these indicators instructs the ESCs to make high-quality adjustments to the cars rotational speeds which in-flip stabilizes the drone. Once processed, this information is dispatched to the ESCs which in turn modify the rotational pace of each motor to control flight orientation i.e., up, down, backward, forwards, left, proper, and so forth.

3.1.6 GPS MODULE

GPS in full Global Positioning System, space-based radio-navigation system that broadcasts highly accurate navigation pulses to users on or near on the Earth.In the United States' NAVSTAR GPS, 24 main satellites in 6 orbits circle the Earth every 12 hours. In addition, Russian maintains a constellation called GLONASS (Global Navigation Satellite System). GPS receiver uses a constellation of satellite and ground stations to calculate accurate location wherever it is located. The GPS satellites transmit information signals over a radio frequency (1.1 to 1.5 GHz) to the receiver. With the help of the received information, a ground station or GPS module can compute its position and time.GPS receives information signals from GPS satellites and calculates its distance from satellites. This is done by measuring the time required by the signal to travel from satellite to the receiver.

IV. FLOW CHART

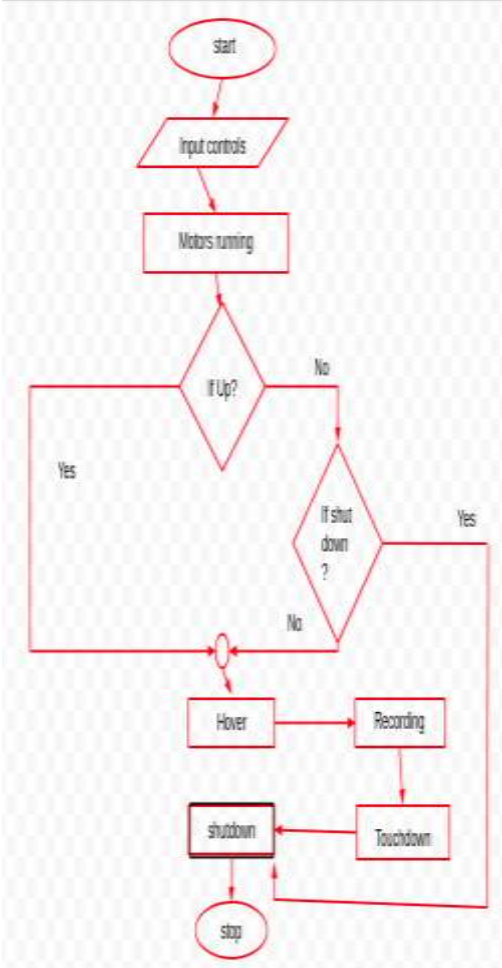

Figure 1.3 Flowchart

V. IMAGE PROCESSING

5.1 IMAGE CLASSIFICATION

The classification method to categorize all the pixels of a virtual photograph into one of the described lessons based totally on precise regulations. Image class plays an important role in far-off sensing images and is used for various applications inclusive of environmental change, agriculture, land use/land planning, urban making plans, surveillance, geographic mapping, catastrophe management, and item detection. The faraway sensing picture facts may be received from numerous sources like satellites, airplanes, and aerial automobiles(UAV's). Image class is an application of both the supervised category and the unsupervised category.

5.2 Workflow In Image Classification

1. Examine and understand data
2. Build an input pipeline
3. Build the model
4. Train the model

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5. Test the model
6. Improve the model and repeat the process

5.3 DATASET USED

CIFAR-10(Canadian Institute for Advanced Research)

The CIFAR-10 is a collection of images that are commonly used to train machine learning and computer vision algorithms. It is one of the most widely used datasets for machine learning research. The CIFAR-10 dataset contains 60,000 32x32 color images in 10 different classes. There are 6,000 images of each class.

The 10 different classes represent:

1. Airplanes
2. Cars
3. Birds
4. Cats
5. Deer
6. Dogs
7. Frogs
8. Horses
9. Ships
10. Trucks

5.4 WORKING PROCEDURE

This project clearly uses a camera and GPS module installed on a Quadcopter. The user commands the drone to switch the camera on through the RC transmitter & receiver. Aerial image or live video feed is transmitted from the area the device is hovering with its accurate position coordinates. At the same time the algorithm detects the lifeforms through its classification process and displays the information about the class of object present on the camera view.

VI. APPLICATIONS

- Thermal sensor drones for search and rescue operations.
- Precision crop monitoring.
- Law enforcement and border control surveillance.
- Gathering information or supplying essentials for disaster management.
- Geographic mapping of inaccessible terrain and locations.

VII. CONCLUSION

My effort behind this project is to design and fabricate a gadget which is capable in itself that provides the advantage of compactness and is easy to use as an emergency responsive way to monitor areas affected by landslides.

In addition, this can be used in favor of many institutes to record attendance by detecting faces without wasting time or effort as a surveillance system,as a tool for precise crop monitoring system by addition of some sensors like RGB or Multispectral sensors. This is only one of many other applications that this general-purpose drone could be used to accomplish, which could have a huge impact on societies.

VIII. FUTURE SCOPE

1. This can be used in favor of many institutes to record attendance by detecting faces without wasting time or effort.
2. It can be used as a surveillance system for military purposes.
3. It can be used as a tool for precise crop monitoring system by addition of some sensors like RGB or Multispectral sensors.

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