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A Project Synopsis on

Land Survey and Mapping for Agricultural Purpose using UAV

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Introduction

Unmanned aircraft systems or unmanned aerial vehicles (UAVs) are more common names for drones. A drone is essentially a flying robot that uses software-controlled flight plans in its embedded systems to fly independently or remotely using onboard sensors and a global positioning system (GPS).

Land survey and mapping using unmanned aerial vehicles (UAVs), also known as drones, has become increasingly popular in recent years due to its efficiency and accuracy in capturing high-resolution data and imagery of the earth's surface. This technology has revolutionized the way land surveying and mapping is conducted, enabling surveyors and engineers to collect detailed data about topography, terrain, vegetation, buildings, and other features on a site. The process of land surveying and mapping using UAVs involves several steps. First, the area of interest is identified, and the surveying and mapping objectives are defined. The UAV is then deployed to fly over the area and capture images and data using its onboard cameras and sensors.

Segmentation is the process of dividing an image's pixels into two categories: crops and weeds in the foreground, and soil in the background. The color index-based thresholding method for background and foreground segmentation of plant images is presented in this paper. Color index based thresholding is a method used for agriculture survey that involves analyzing the color information in images captured by UAVs or other sensors. The basic principle of this method is to use color index values to distinguish between different types of objects or features in an image.

OBJECTIVES

- The objectives of the proposed work are:
- To build a fully autonomous UAV for agricultural land surveying purpose.
- To segment the crops and land covered using color index based threshold image processing technique.

Methodology

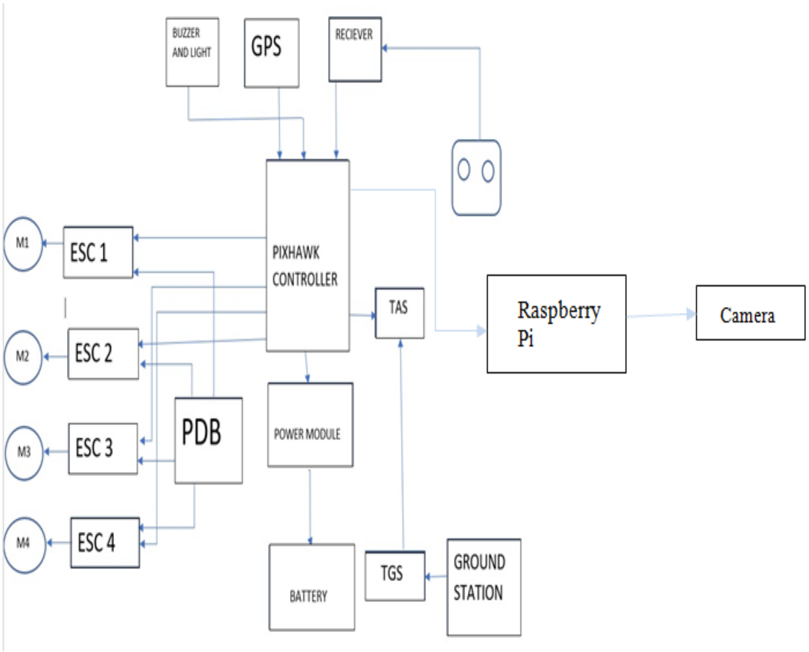

Figure: Block diagram of UAV

The power module, which is connected to the PDB (Power Division Board), is connected to the LiPo battery. The devices get the power they need from PDB. The UAV's speed, direction, and altitude are all controlled by the Flight Controller, which is a Pixhawk. ESC (Electronic Speed Regulator) controls the speed of the motor instruction given by flight regulator. GPS is used for mapping and making a path. During the UAV's flight, telemetry provides the precise location of the ground station. Battery, solar, hydro fuel cell, combustion engine, cable tube power supply, and laser beam power are just a few of the many power sources available to a drone. The most common source of power is a lithium polymer battery.

UAV incorporates computerized electronic speed regulators associated with motors, propellers, servo engines and others. The use of drones necessitates the use of autopilot software. Most robots utilize radio recurrence to impart between the remote and robot, which can work independently or semi independently. One of the following sources can send signals to the operator's side of the remote control: Ground control, which is a human working radio transmitter, PDA, PC or comparable control framework. The output to servos and motors can be enabled or disabled with a safety switch. Through the 6-position cable, the Pixhawk power module provides clean power from a LiPo battery and measures current consumption and battery voltage for the Pixhawk flight controller. Pixhawk and autopilot use a buzzer to announce milestones. The signal remembers two position DF14 connector for the one side that plugs straightforwardly into the Pixhawk.

The pixhawk flight controller is connected to a microcontroller, such as a Raspberry Pi, which is powered by the lipo battery, which provides power to the entire UAV. During surveillance, the images are captured by connecting the USB camera to the Raspberry Pi. On the based of the caught information and the program unloaded on Raspberry pi,the segmentation is performed.

Components

Frame: The frame provides the structure and stability to the drone. It can be made of materials such as carbon fiber, aluminum, or plastic.

Motors: Drones typically have four motors (quadcopters) or more for higher-end models. Brushless DC motors are commonly used due to their efficiency and power-to-weight ratio.

Propellers: Each motor requires a propeller to generate lift and propulsion. The size and pitch of the propellers depend on the specific requirements of the drone.

Electronic Speed Controllers (ESCs): ESCs control the speed of the motors based on the commands received from the flight controller.

Flight Controller: The flight controller is like the brain of the drone. It processes sensor data and controls the motors through ESCs to stabilize and maneuver the drone. Popular flight controllers include those based on Arduino or Pixhawk platforms.

Battery: Drones are powered by rechargeable batteries, usually Lithium Polymer (LiPo) batteries. The battery capacity and voltage rating should be chosen based on the drone's weight and flight time requirements.

Radio Transmitter and Receiver: These components enable remote control of the drone. The transmitter is held by the operator, while the receiver is installed on the drone.

GPS Module : A GPS module allows the drone to determine its position accurately and enables features such as autonomous flight, waypoint navigation, and return-to-home functionality. Camera or Gimbal (optional): Drones used for aerial photography or videography may include a camera or a gimbal to stabilize the camera and capture high-quality footage.

Power Distribution Board (PDB): The PDB distributes power from the battery to all the components of the drone, ensuring they receive the required voltage and current.

Raspberry Pi : raspberry pi is a series of small single-board computers developed by the Raspberry Pi Foundation. It is designed to provide an affordable and accessible platform for learning, experimentation, and building various projects.

Compass calibration

- Compass calibration in Mission Planner refers to the process of configuring and calibrating the compass sensor on a UAV
- . The compass is a crucial component that helps the UAV determine its heading or direction in relation to the Earth's magnetic field.

Radio control calibration

- Radio control calibration refers to the process of configuring and calibrating the radio control system used to pilot and control an unmanned aerial vehicle (UAV).
- This calibration ensures accurate and reliable communication between the transmitter (remote controller) and the UAV's receiver.

Accelerometer calibration

- Accelerometer calibration in Mission Planner is the process of ensuring that the accelerometer sensor on your unmanned aerial vehicle (UAV) is accurately calibrated and providing accurate data.
- The accelerometer is a crucial component that measures the acceleration forces acting on the UAV, allowing it to maintain stability and perform various flight maneuvers.

ESC calibration

- ESC calibration in Mission Planner refers to the process of calibrating the Electronic Speed Controllers (ESCs) of your unmanned aerial vehicle (UAV).
- ESCs are electronic devices responsible for controlling the speed and direction of the motors on the UAV.

Navigation and Mapping

- For a navigation and mapping the waypoints are set, which defines a predefines path for quadcopter to travel.
- Additional parameters such as altitude, speed, and actions can be assigned to each waypoint.
- The waypoints are then arranged in a sequence to create a flight path for the UAV.
- Once the waypoints are set, the mission can be saved and uploaded to the UAV for autonomous execution, allowing the UAV to navigate through the designated waypoints and perform predefined actions at each point.

Threshold Segmentation

Thresholding in color detection refers to the process of classifying pixels in an image based on their color values using a predefined threshold.

It is commonly used in computer vision and image processing applications to extract specific objects or regions based on their color characteristics.

The general overview of how thresholding works in color detection are:

Image Acquisition: Obtain an image or frame from a camera, file, or any other image source.

Color Space Conversion: This conversion is often performed to separate color information from brightness or luminance.

Thresholding: Select a threshold value or range for each color channel in the chosen color space.

Pixel Classification: Compare the color values of each pixel in the image to the threshold values.

Object Extraction: Based on the classification results, you can extract or mark the regions of interest in the image that correspond to the target color.

Post-processing: Depending on your application, you might apply additional image processing techniques such as morphological operations (e.g., erosion or dilation) or noise reduction to refine the extracted regions or enhance the results.

Results

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Conclusion

- In this project, we assembled a drone and then uploaded the firmware to a flight controller. The hardware components are then calibrated in accordance with the ardupilot software. Acceleration, Radio, Compass, Flight Mode, and ESC calibration are all parts of the calibration process. The Navigation and Mapping process, in which a predefined path is provided to a UAV's flight controller follows.
- Using a threshold-based image segmentation method, the cultivated land and uncultivated land area can be determined using this proposed method. We carried out this on the Robots (UAV's) we can accomplish the more effectiveness and precisely.