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Multi Purpose Drone with Search and Destroy Rover

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ABSTRACT

This paper presents the unique ideology of a multipurpose copter which is capable to carry a payload which is used for surveillance and tranquilizing target with either stunt gun or teaser. Copter itself acts as a birds eye which is used for keeping a eye on moving targets . Main objective of copter is to transport a remotely operated rover from base to operation sight. It is known as multipurpose drone because it can be used for transportation of emergency needs like first aidbox , keep an eye on moving targets, find landmines when equipped with suitable vision camera ,etc. With its built onboard computer, GPS and compass it is capable of flying on its own to a specified point on map. Its on board power supply gives it a flight of 45 minutes which provides a coverage of 67Km with speed of 90Kmph on air.

1. INTRODUCTION

The surveillance and inspection task requires extensive utilization of autonomous mobile robots.

The military use of unmanned aerial vehicles (UAVs) has grown because of their ability to operate in dangerous locations while keeping their human operators at a safe distance. The UAVs also provide cost effective platform for reconnaissance as well as modern weapons. They have grown to become an indispensable tool for the military. UAVs can serve more tactical operations such as keeping an eye on hostiles or a building for enemy positions. Current day bots are efficient even to eliminate target without any further inputs. Smaller UAVs, on the order of a couple feet to a meter in size, should be able to handle military tactical operations as well as the emerging commercial and industrial applications and our project is attempting to validate this assumption.

MultiCopters are aerodynamically unstable and absolutely require an on-board computer (aka flight controller) for stable flight. As a result, they are “Fly by Wire” systems and if the computer isn’t working, you aren’t flying. The flight controller combines data from small on-board MEMs gyroscopes, accelerometers (the same as those found in smart phones) to maintain an accurate estimate of it’s orientation and position.

The quad copter shown above is the simplest type of multicopter, with each motor/propeller spinning in the opposite direction from the two motors on either side of it (i.e. motors on opposite corners of the frame spin in the same direction).

A quad copter can control it’s roll and pitch rotation by speeding up two motors on one side and slowing down the other two. So for example if the quad copter wanted to roll left it would speed up motors on the right side of the frame and slow down the two on the left. Similarly if it wants to rotate forward it speeds up the back two motors and slows down the front two.The copter turns (aka “yaw”) left or right by speeding up two motors that are diagonally across from each other, and slowing down the other two.

Horizontal motion is accomplished by temporarily speeding up/slowing down some motors so that the vehicle is leaning in the direction of desired travel and increasing the overall thrust of all motors so the

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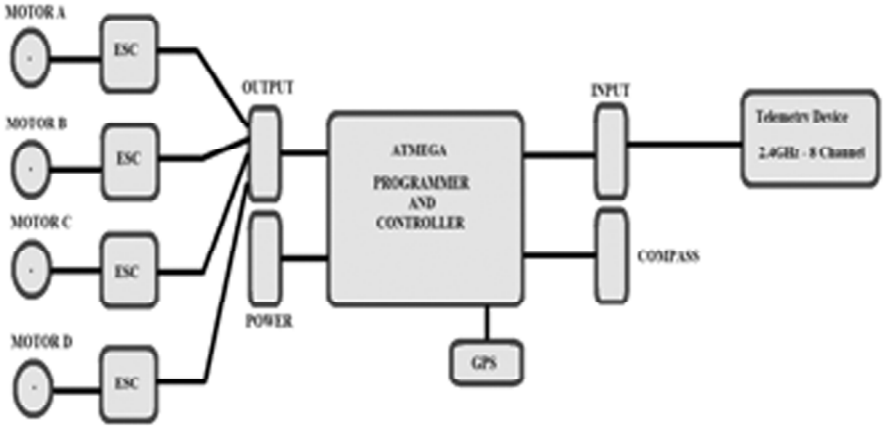
vehicle shoots forward. Generally the more the vehicle leans, the faster it travels.Altitude is controlled by speeding up or slowing down all motors at the same time. In this paper a new approach is taken, which is morecomputationally efficient to compared other methods.

2. DESIGN METHODOLOGY

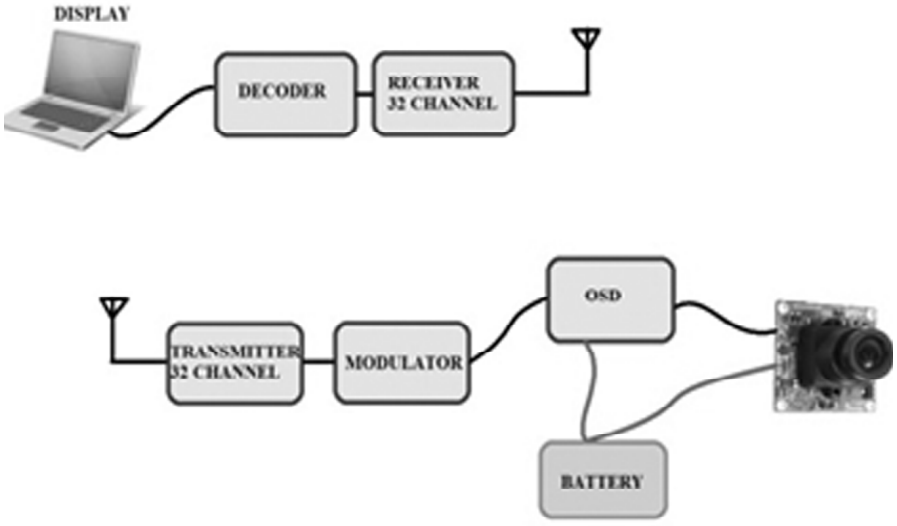
Current day drones used for surveillance and inspection are expensive. Our objective is to reduce the expense and make it economical for self destruction bot. Focusing mainly onto efficiency the bot is able to fly for 45min which is 15 more than existing UAV Surveillance bot DRDO Netra. Getting Netra into visual this project is going to be way more advanced in precision as well as in payload transportation. Payload consists of a rover which is capable of tranquilizer target remotely even in zero luminance. It has the capability of spying on target because of its size.

Motors were set to maximum rpm and propeller's size were determined to 10X4.5 to produce maximum thrust. Frame was designed in raptor form to give low weight to the system but high stability. Processor used for pin point accuracy is Ardupilot (APM 2.8).Transmission system is designed to provide TTnC (telemetry tracking and control) for a range of 200m. The high power telemetry device provides long range control of flight in manual mode. As the main objective of flight is surveillance a live video stream is provided within a range of 5Km in automated mode.Ground station consists of software which are used to see the live status of flight as well as the live streaming of visuals sent from the flight.

Block Diagram for onboard power and signal distribution



Block Diagram for video transmission



3. COMPONENTS USED AND THEIR CALIBRATION

i. APM 2.8

Copter's autopilot board determines its capabilities for autonomous flight.

It is a computer with onboard with high processing speed along with 3DR UBlox GPS, compass and telemetry. It computes data for all sides and sources and sends it to telemetry which transfers to ground station. By this we can know the coordinates of quad copter.

ii. Neo6M GPS Module

It uses the data of three satellites and gives pin point accuracy of the coordinated of copter. At maximum it can be connected to 12 satellites.

iii. Ground Control Station

The Mission Planner is software required if you're going to be loading new versions of Copter onto the flight controller, and for first-flight tuning and calibration. It runs on a PC and can also be used for planning missions.

iv. Telemetry Radio

A telemetry radio allows your Copter to communicate with your ground station from the air using the MAVLink protocol. This allows you to interact with your missions in real time and receive streaming data from your copter's cameras and other components.

v. Calibration of TTnC

Ardupilot is connected with TTnC receiver which operates at 2.4GHz with 8 channels and is calibratedwith TTnC transmitter using turnigy 9XR Pro as remote.All ESCs and motors are calibrated to maximum and minimum levels of remote.

vi. Calibration of camera and Minim OSD

The data from telemetry is bypassed to minim OSD to which video data is streamed from camera, the telemetry overlaid on the video and is sent to transmitter.

The required data on screen is calibrated by connected by minim OSD to computer using a FAT converter. Minim OSD is programmed using Minim OSD software with required parameters. The transmitter and receiver are tuned to same channel to give 5Km range.

4. CONCLUSION

Warfare in contemporary world is neither restricted to contingent troops nor the civil defense. With the revolution of technology and its drastic miniaturing, surveillance bots have been playing crucial role wherein they can access what is inaccessible by humans or can be menacing like treacherous enemy front lines, to prosecute specific operations in extreme weather conditions. With an increased leading edge feature of zero luminescence operation these copters stand in front line of today's surveillance technology.

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