TRAFFIC MONITORING AND SURVEILLANCE DRONE WITH CLOUD BACKUP

[1]Kunal Kaul, [2]Himanshu Saini, [3]Dhruv Seth and [4]Sabar Gupta,

[1]Department of Mechanical engineering, Vishwakarma Institute of Technology Pune, Maharashtra, India
[2]Department of Mechanical engineering, Delhi Technological University Delhi, New Delhi, India
[3]School of Mechanical engineering, Vellore Institute of Technology Vellore, Chennai, India
[4]Department of Mechanical and Automation engineering, Maharaja Agrasen Institute of Technology Delhi, New Delhi, India.

Abstract: Traffic rules are being broken regularly and there have been many new and innovative ways to tackle this problem. This research paper displays one such way. A traffic monitoring drone with cloud panaroma camera is used. This research paper shows a way to construct a simple traffic monitoring drone, explains its working principle, the hardware components used and circuit connects. Such drones are an effective solution for the traffic monitoring problem as they can record videos around the traffic areas, backup them to cloud so that these videos can be viewed again if needed and one can record the whole area using only one such drone.

Index Terms **- Drone, Cloud, Panaroma, Backup and Monitoring.**

I. INTRODUCTION

Quadcopter is a device with an intense mixture of Electronics, Mechanical and mainly on the principle of Aviation. The Quadcopter has 4 motors whose speed of rotation and the direction of rotation changes according to the users desire to move the device in a particular direction (i.e. Take off motion, Landing motion, Forward motion, Backward motion, Left motion, Right Motion.)The rotation of Motors changes as per the transmitted signal send from the 6-Channel transmitter. The programming is done in the APM by using mission planner software and calibration of esc is also done by this software. The esc controls the motor rpm and thus our lift generation. The transmitter channels provide us with pitch, roll and yaw motion. A synchronisation of these motions results in proper lift of the drone. All the power is drawn from the lipo battery which is then equally transmitted by the power distribution board and the power module unit. Gps, telemetry and camera are secondary accessories used for different functions which are governed by the APM.

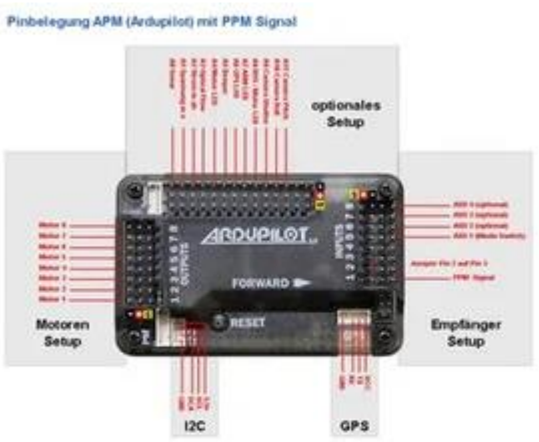
II. HARDWARE COMPONENTS

- PLASTIC CHASSIS WITH STAND
- FOUR ELECTRONIC SPEED CONTROLLERS BRUSHLESS (30A)
- POWER DISTRIBUTION BOARD
- ARDUPILOT/AUTOPILOT
- POWER MODULE UNIT
- TELEMETRY
- GPS MODULE
- PANAROMA CLOUD CAMERA
- TRIPLE CELL LI-PO BATTERY (11.2V)
- FOUR BRUSHLESS DC MOTOR (1400KV) WITH FOUR STANDARD PROPELLERS
- TRANSMITTER AND RECIEVER 6 CHANNELS 1.2 GHz
- SOFTWARE REQUIRED: MISSION PLANNER, V380 APP (FOR CAMERA)

III. CIRCUIT CONNECTIONS AND DIAGRAM

- The positive and negative wires of the four esc(s) are connected to the four positive terminal and negative denoted points on the power distribution board.

- The 3 phase wires of esc(s) are connected to the 3 phase wires of the bldc(s) respectively.
- The 3 pin connectors of the esc(s) are connected to the pins of ardupilot or apm.
- Transmitter and receiver are binded and the receiver is connected to the apm. A
- GPS module and one half of the telemetry is connected to the apm. The other half of the telemetry is connected to the laptop having software.
- The motors are connected in clock and counter clockwise sense in such a way that they form an alpha with the opening of alpha towards the forward direction of movement of the drone. The motors on the same line of the alpha must have same direction of rotation.
- The battery is connected to the power distribution board and its connector is connected to the apm via power module.
- Camera is linked to its app by simply using a qr code at the bottom of it. After being linked, this camera attached to the bottom of the chassis from where it records the data.



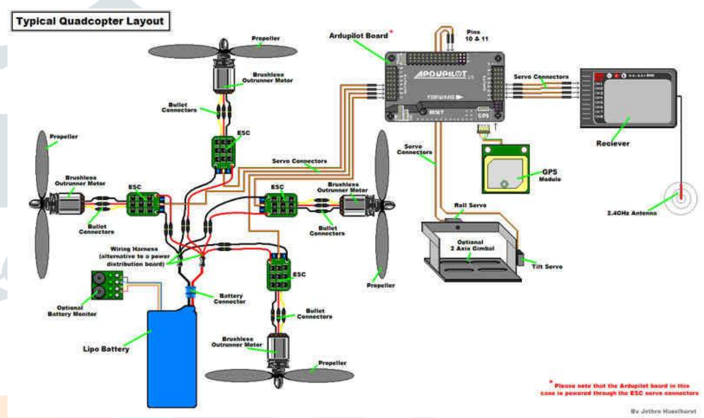


Figure 1 and 2 shows the circuit connections of ardupilot board with other electronics in the drone

IV. WORKING DISCUSSION AND EXPLANATION

The flight of the drone depends upon the effect of these two laws:

1. Newton's Three Laws

The most powerful tools for understanding flight are Newton's three laws of motion. They are simple to understand and universal in application. They apply to the flight of the lowly mosquito and the motion of the galaxies. Let us look at these laws, not quite in order.

A statement of Newton's first law is:
A body at rest will remain at rest, and a body in motion will continue in straight-line motion unless subjected to an external applied force. In the context of flight this means that if an object (such as a mass of air), initially motionless, starts to move, there has been force acting on it. Likewise, if a flow of air bends (such as over a wing), there also must be a force acting on it.

Newton's third law can be stated:
For every action there is an equal and opposite reaction. This is fairly straightforward. When you sit in a chair, you put a force on the chair and the chair puts an equal and opposite force on you. Another example is seen in the case of a bending flow of air over a wing. The bending of the air requires a force from Newton's first law. By Newton's third law, the air must be putting an equal and opposite force on whatever is bending it, in this case the wing.

2. The Coanda Effect

The Coanda effect has to do with the bending of fluids around an object. For the forces and pressures associated with low-speed flight air is considered not only a fluid but an incompressible fluid. This means that the volume of a mass of air remains constant and that flows of air do not separate from each other to form voids (gaps). For the moment let us consider the Coanda effect with water. This effect can be demonstrated in a simple way. Run a small stream of water from a faucet and bring a horizontal water glass over to it until it just touches the water, the water will wrap partway around the glass. From Newton's first law we know that for the flow of water to bend there must be a force on it. The force is in the direction of the bend. From Newton's third law we know that there must be an equal and opposite force acting on the glass. The same phenomenon causes forces between the airflow around a wing and the wing. So why do fluids tend to bend around a solid object? The answer is *viscosity,* that characteristic that makes a fluid thick and makes it stick to a surface. When a moving fluid comes into contact with a solid object, some of it sticks to the surface. A small distance from the surface the fluid has a small velocity with respect to the object. The differences in speed in adjacent layers cause *shear forces,* which cause the flow of the fluid to want to bend in the direction of the slower layer. This causes the fluid to try to wrap around the object. The characteristic of fluids to have zero velocity at the surface of an object explains why one is not able to hose dust off of a car. At the surface of the car the water has no velocity and thus puts little or no force on the dust particles.

The above two laws explain how the lift is generated. To summarize it, the propellers from the drone push the air downwards, by Newton's first law we can say there is force acting on the air by the propeller and by Newton's third law, we can say that the air give a reaction force to the above force to the propellers in the upward direction. Also, the propellers create a low-pressure region above them which in turn speeds up the air (by Bernoulli's principle) whereas exactly opposite phenomena happen below them. This pressure difference gives a force on the drone towards the low-pressure region. This upward force from pressure difference and the force due to Newton's laws contribute in the generation of lift.

When all the connections are done in the drone and it is armed then all the mechanisms of the drone are controlled by the transmitter which sends the signal to the receiver. This receiver then sends the data to the ardupilot which responds to the data according to the programming done by the mission planner software. Response of ardupilot is conveyed to the speed controllers through a power distribution board which in turn control the motors according to the programming. The power source is connected to the power distribution board as every component has a direct or indirect connection to the board and in this way, power is distributed equally. Power module is used to control the power going to Gps module and ardupilot so that no frying of circuit can take place. The camera is powered through ardupilot and it gives its feed directly to its app where it backs up data as well. The 6-channel transmitter controls the drone as follows:

1) The 1st channel controls thrust, pitch and lift generation.
2) The 2nd channel controls roll and yaw.
3) The 3rd and 4th channel control trimming of signal from transmitter.
4) The 5th is the kill switch and the 6th is idle.

V. ADVANTAGES

- Drone can monitor traffic areas.
- Video from drone gets saved on the cloud and can used as proof if any rule is broken in that area.
- Only one of such drones is required per traffic signal as we can rotate the drone or change the view of the panorama camera.
- Battery powered so no pollution happens.
- It can be used to track any criminal around a particular area.

VI. Limitations

- It requires Wi-Fi signal for data backup to cloud.
- Its propellers are harmful and can cause physical damage if they strike any human.
- Its range is limited and video recording depends upon quality of camera.

VII. Conclusion

The drone records the data around the traffic area and can easily be used to check and fine anyone breaking the law via the video recording. Its simplicity helps user, from any background with enough practice, in flying the drone. Such drones will help in monitoring and recording any crime around traffic area and can be used to track anyone from air (limited area).

References

[1] Understanding flight, David F. Anderson and Scott Eberhardt

[2] A. Burkle, F. Segor, M. Kollman, "Towards autonomous micro uav swarms", Journal of Intelligent & Robotic Systems, Vol. 61, January 2011, pp 339–353.

[3] David Droeschel, Michael Schreiber, Sven Behnke, "Omnidirectional Perception for Lightweight UAVS Using a Continuously Rotating 3D Laser Scanner", Remote Sensing and Spatial Information Sciences, Germany, September 2013, pp 107-11.

[4] Dario Floreano, Robert J. Wood, "Science, technology and the future of small autonomous drones", Nature 521, 460–466, 28 May 2015.

[5] Minoru Funaki, Naohiko Hirasawa, "Outline of a small unmanned aerial vehicle (Ant-Plane) designed for Antarctic research", Polar Science, vol 2, June 2008, pp 129-142.