

Self Navigating Quadcopter

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Abstract—This project defines the new options for parcel delivery through the aerial means of transportation. The UAV which is used in this project is the quadcopter which is quite more stable than the helicopter and is able to track the destination's location automatically and is capable of flying to the location without any assistance of human operator. The system is equipped with telemetry, GPS and is capable of handling payload of around 200-300grms.

Keywords—APM(Ardu Pilot Mega), GPS(Global Positioning System), MP(Mission Planner), ESC(Electronic Speed Controller).

I. INTRODUCTION

The multi rotors or quadcopter is a device which is designed to fly and even carry small objects with it. Being specific the quad-copter is small in size it is not as big as our conventional helicopters; currently it is not designed to carry humans. The important function of quad-copter is that it can fly anywhere and it can be controlled by humans. And we are using this application of it very firmly. Actually the quad-copter is easily available in the market as a toy but it has to be controlled by wireless remote and it has too many restrictions as it cannot fly on its own you will have to continuously keep an eye on it. A little distraction and you could lose it. Hence we have come across with a technology which will drive the quad-copter on its own. The motivation of developing this technique was taken from the autopilot system which are available in aircraft but even there the system cannot drive the aircraft to the destination completely it has to be monitored by the pilot. In our system we have to just provide the location's coordinates to the system and then it will trace the location of the destination and then the system will fly itself to the destination. The quad-copter is being used as a flying object as it has better stability and it can easily carry the package with itself. The need of this project is sincerely observed in the military applications and even for commercial use and medical emergencies. As our key importance is that

our transporter can fly and use the traffic fewer mediums to transport that is air and it proves to be very efficient for the applications which have critical time limits. In medical applications if there is an emergency with a patient important medication can be parceled with the quad-copter to patients location no matter where the location of the patient is the quad copter will deliver its parcel to it and can save life. It can be even used in the events of natural calamities to provide help for the people trapped. And it can also be used to track people trapped by implementing some panel of sensors onto it. Observing all its advantages and features the system can be used in variety of applications in commercial as well as military operations. So if it is applicable in day to day life it will be proved as most convenient means of transporting the parcels and packages. Also its GUI is so flexible and user friendly that any one can use this device to accomplish the task of parcel delivering. Also the software is equipped with full parameters which are continuously transmitted from the quadcopter to computer

The computer will continuously display the data from the copter so that we can control the system more safely and easily and will allow us full control in charge to make a secure flight.

II. HARDWARE USED

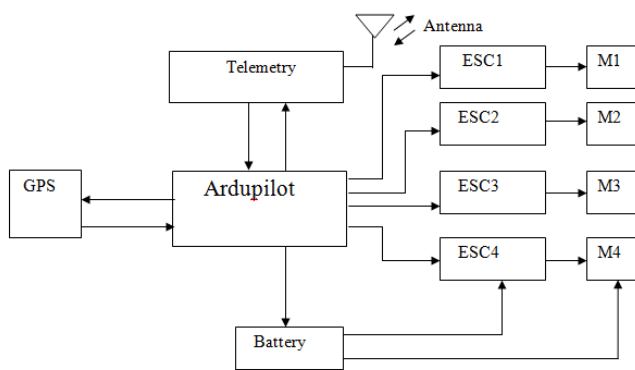


Fig .a. Block diagram of quad-copter

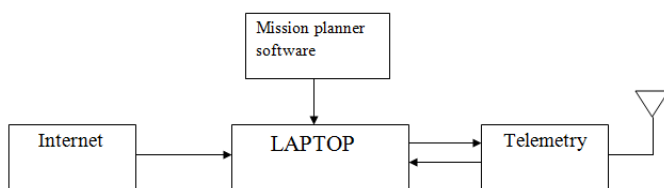


Fig .b. Block diagram of base station

The quad-copter name itself indicates that it consists of four units which work together to make it fly in the sky. The actions which are taken by the motors are totally directed by the controller. Discussing about what are the important peripherals required for the system to operate are APM, high speed less weight motors, suitable propellers, ESC i.e. electronic speed controller which is used for controlling the speed of motor when the execution is in process, frame, GPS, the system is capable of achieving its aim due to all this hardware.

• ARDUPILLOT MEGA:-

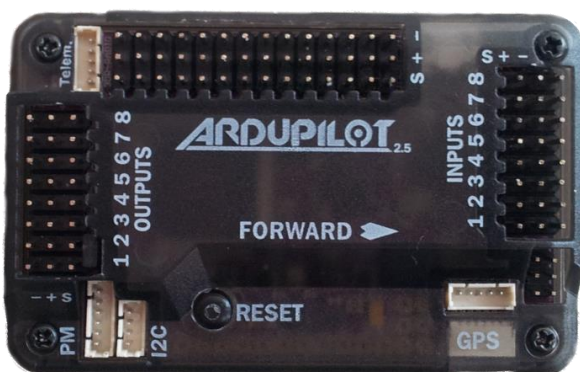


Fig .c. APM 2.5

APM is the ArduPilot Mega. It is the device which is responsible for the flight management of the system. As the system is designed to deliver the parcel to the required or specified location, the APM generates the suitable coding instruction to the motors according to the set location. It will

then make the system fly towards the given location. The locations are supposed to enter through a computer which is virtually connected to the system through a wireless communication link. APM is responsible to take the instruction given through the computer and process it into proper signal which will eventually lead the motors to rotate the propellers towards the set location point. The APM works on the basic principle of following set instructions. For this process the APM is required to install a firmware which will set the APM in respective Quad copter mode. Basically there are so many different modes of flight like quad-copter in Plus mode and same quad-copter in cross mode, in this project we are using the cross mode which will make two motors in one direction and another two motors in opposite direction. This all information to configure the APM in particular mode we need to install respective firmware in it. This firmware is open source software which is available on various internet sites and forum and can be downloaded freely without any charges.

• MOTORS AND ESC:-



Fig .d. BLDC motor

Motors here are the only means of motion to the system; motors used in this application are way faster in speed and lighter in weight as compared to the conventional motors. But motors are not enough for the system's motion. They require propellers to generate the force of air which will lift the system, the propellers are nothing but the fine, tilted blades which are connected to the shaft of motor so as the motor rotates with a speed the propellers also rotate cutting the air pushing it downward and creating a thrust which effectively lifts the quad-copter in opposite direction. But the speed of the motor is also the attentive issue as the speed of the motor is responsible for the height of the flight hence to control that matter ESC is used. ESC is nothing but the electronic speed controlling device specially designed to control the speed of motors which generally used to design any kind aircraft model or drone. The ESC is completely capable of controlling the speed of the motor linearly without generating spikes which is a need in this type of application and ESC can

be directly controlled through the controller i.e. APM. APM gives speed controlling instructions to the ESC which then precisely controls the speed of the motors to control the motion of and altitude of the flight.

- **GPS AND FRAME:-**



Fig .e. GPS module

The GPS is nothing but the global positioning system which is widely used in numerous applications, now a days the GPS modules are easily and simply available in the market that anyone can buy it and can use it. It's an open source module. The GPS is used to find out the locations of the physical areas which are mentioned in the Google satellite. The GPS gets connected with the open source GPS network which is made available and retrieves the location of the user or can trace the set location. Location in the GPS is mentioned in the coordinates. As our globe is divided in horizontal and vertical stripes named as longitude and latitude. And from these stripes the location can be described in the degrees, minutes and seconds. The GPS in this application is required to trace the given location and to route the flight directions accordingly for this purpose it is crucial that GPS should provide the exact location details we else's the drone may land onto wrong location. The frame is nothing but the chassis of the copter the frame helps to hold the motors and propeller in an angle perpendicular to each other which helps the motors to generate the required amount of thrust. The middle part of frame contains the battery and APM which controls all the operations the system is capable of carrying the payload of around 2-3kg in the centre part of the frame. The material used to make frame is the aluminum which is light in weight and is strong enough to hold the load of the components which are placed on the frame.

- **COMPUTER AND TELEMETRY SYSTEM:-**



Fig .f. Telemetry RF modules

The computer is required to set the destination location. As the application of the system demands to deliver the parcel at a particular location there is the need for a proper destination setting unit and that is nothing but computer. The software named mission planner is used which connects to the internet and downloads the data of maps and telemetry system maintains the link between the quad copter and computer. The computer and telemetry works together to obtain a communication link between internet and quad copter to actually find its destination's location. One part of the telemetry is connected to the computer and another part is with the quad-copter. There is a continuous link between quad-copter and computer. If the link is gone the quad-copter will automatically fly towards its starting position.

III. RESULTS

We have taken the number of flight testing around with the system. Initially the system was not able to resurrect as the speed of the motors were not able to generate the required amount of torque or thrust to lift the entire drone. Then the changes were done to increase the speed of the motors effectively to generate required amount of torque to lift the basic weight of the system without including weight of the parcel.

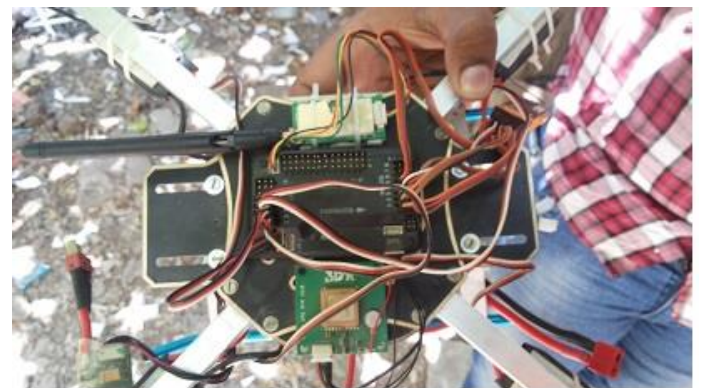


Fig .g. Actual image of Quadcopter

Table I: Result table to describe relation between the payload, speed of the motors and height of flight.

Payload	Speed(rpm)	Height(ft.)
600gm	1200	0.5-1
800gm	2200	5-6 and growing
800gm	2300	Above 20-30

Table II: Result table for determining the effect of payload and the speed of motors on the duration of flight.

Payload	Speed(rpm)	Duration(min)
600gm	1200	25-30
800gm	2200	15-20
800gm	2300	10

The tables above give the comparison between the speed, payload, height and duration of time. It can clearly understand by observing the table that the speed and payload directly affects the height and duration of the flight. As the load is increased the height is reduced and in order to increase the height there is the requirement of increasing the speed of the motors which eventually reduce the duration of flight as increasing the speed of the motors the battery gets drain in faster rate. So all these four parameters are connected to each other.

IV. CONCLUSION

In this way the navigating system for quad-copter is designed. The system is able to handle the payload other than devices weight is around 200-300gm and can fly at the height of 20-30ft and is capable delivering the parcel to the given location. There are also disadvantages of system regarding the range and duration flight which can be overcome by using improved techniques for communication links and power source.

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