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Automatic Destination Reaching Drone Using Autopilot Software

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Abstract- This paper represents Quadcopter (QC) as a low- weight and low-cost autonomous flight capable Unmanned Aerial Vehicle (UAV) for delivering ordered by online by using an autopilot software as its core on-board processing unit. This Quadcopter by following Google map can locate and navigate destination. This paper demonstrates the Quadcopters capability of delivering order by online and coming back to the starting place. The promising result of this method enables future research on using Quadcopter for delivering parcel.

Keywords- Quadcopter, Autonomous Flight, Home Delivery, Autopilot software.

I. INTRODUCTION

An Unmanned Aerial Vehicle (UAV) is an air-craft without a human pilot aboard. Unmanned Aerial Vehicle(UAV) can be controlled in two ways by onboard computers or by the remote control of a pilot on the ground . The Quad Copter is an Unmanned Aerial Vehicle which is lifted and propelled by four rotors.

The Unmanned Aerial Vehicle has got good maneuverability with many applications. Departing from a century old design, modern Quad Copters are designed with small size and less weight. Quadcopters has proved it can be used as real time applications like aerial imaging tools, new research is allowing Quad Copters to communicate perceptively with other Unmanned Aerial Vehicles (UAV), to explore unknown environments and to maneuver in dense surroundings with speed and precision. Individually, these advances will allow QC to complete missions such as long- term surveillance and search and rescue.

Individually, these advances allow QC to complete missions such as long-term surveillance and search and rescue. However, when all of these evolving technologies are combined, quadcopters enable highly autonomous missions that are not currently possible with other vehicles. This paper provides details and usage of QC as a weight lifter that can find routes using the Global Positioning System "GPS". For delivery of packages ordered online [1].

II. LITERATURE REVIEW

Quad Copters make very easy to transport the products to customers on time. By using Quadcopters we are able to reducethe fuel consumption by vehicles and human labor of home delivery. Besides, it will improve transportation management and also we can control air pollution.

In general delivering the products requires vehicle and manpower. The vehicles will consumes more fuel and time of service delivery boy. In urban areas the vehicle will get stuck in traffic jam then it will take more time for product delivery. So, by using an autonomous Quad Copters we can overcome this problem for quick home delivery.

By using Quad Copters the Company's will get more productivity with huge this leads to improve supply chain management. By taking the help of autounous vehicles which can increase customer's satisfaction. The Revenue will get directly impacted by better supply chain management. By this capital utilization also impacted by better supply chain management.

Needless to say, better supply chain management will ultimately help companies create a competitive advantage in the market. The effect of reducing fuel and labor costs is to lower production costs, increase consumer surplus and increase manufacturer profits.

The basic QC design consists of four complete rotor assemblies and a central hub that are equidistant from each other. As shown in the figure, all rotors are in the same plane and the thrust generated by each rotor is oriented perpendicular to the vehicle. If the rotors are made up of parts with the same specifications and expected performance, each will generate the same thrust for a particular power input.

The angular momentum of one of the four rotors produces torque around the center of inertia of the vehicle. This torque can be effectively offset by the torque produced by the rotor on the opposite side [1].

In this configuration, the opposing rotors must rotate in the same direction and the adjacent rotors must rotate in the opposite direction. The direct advantage of the quadcopter design is that it does not require the implementation of additional equipment such as a control torque gyro, solely for the purpose of counteracting the external torque of the vehicle [2].

Fig 1. A prototype QC.

There are two types of QC working principle [3]. They are: In "+" configuration: In this configuration two motors of Quadcopters rotate clockwise and other two rotate in anticlockwise. Opposite motors rotatein same direction. Quadcopter motherboard's front will be pointing rotor1 shown in Fig.2.

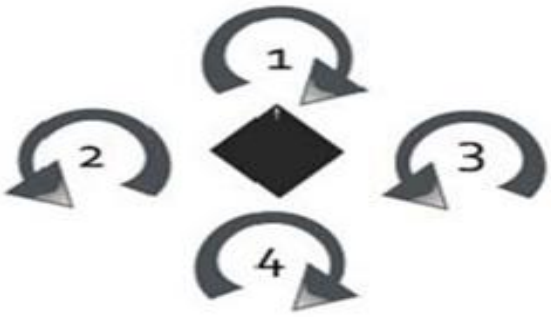

Fig 2. "+" configuration.

x" Configuration: It same as "+" configuration. Difference is Quadcopter operating motherboard's front end will be pointing to the direction between rotor-1 and rotor-2, shown in Fig.3.

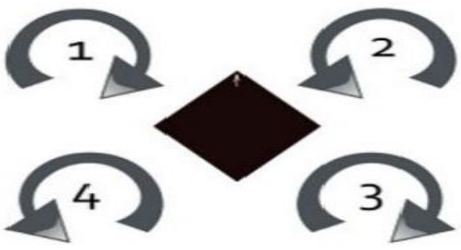

Fig 3. "x" configuration.

III. OVERVIEW OF OPERATION

Quadcopter will start automatically with the order of customers. Before flying the Quadcopter will take GPS Coordinates as input given by computer. Quadcopter will fly according to coordinates its given by user.Once it have reached its destination it will confirm its customer and drop the parcel and get back to the home point through the same route directed initially.

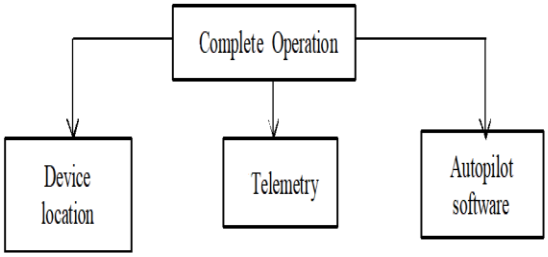

Fig 4. Overview of Operation.

1. Setting device location through Google maps:
In the Pc that we have installed with autopilot software, which can display us the google maps.As an instructor we can give commands to drone to go to the destination. We can give more than one destination points.

2. Telemetry:
The telemetry ha stwo components: one acts as transmitter and receiver. The instructions that we have given is transmitted to receive can decode it.

3. The Auto Pilot Software:
According to the received signals by telemetry the software which we uploaded initially in the APM flight controller gets worked accordingly in to signals.

IV. STRUCTURAL AND POWER COMPONENTS

Quadcopter is designed to have four arms which provide the body a stable balance. Each arm is associated with one motor of 3350 rpm/volt, comprising of total four motors. Each motor is associated with one propeller of APC electronic E series of 14 inch diameter and 10 pinch. Each motor is connected with one Electronic Speed controller (ESC).

V. CONTROL SYSTEM

Quad Copter will start automatically with the order given by customers. Before flying the Quadcopter will take GPS co-ordinates as input given by computer. QuadCopter will fly according to coordinates it's given by Local Office.

Once it have reached its destination location it will confirm its customer and drop the parcel and get back to the home point through the same route directed intially .

Complete operation of delivery service via Quad Copter can be completed in following phases shown in Fig. 4.

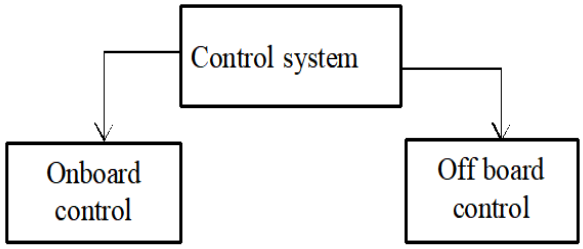

Fig 5. Control system.

1. Onboard Control System:

1. Following Google Map viaGPS:

1.1.1GPS: The advance drones are embedded with GPS receivers such that we are able to fly the drone in the required directions. This is a new technology which allows the drone to move for the given way points. The software which is running in the APM 2.8 Flight Controller Board can instruct the drone to fly with high speed or low speed. The GPS module can be programmed in such a way to make the drone to hover for a thperiod of time at each way point. The GPS module should be mounted in such a way to get strong signals from satellite. GPS has three segments:

1.1.2Space Segment: In space segment there are 24 satellites revolving around the earth with an altitude of 12,400 miles away from earth. By maintaining high altitude we can cover entire geographical area of earth. The GPS receiver always receives the signals from at least four satellites at any point of time. Each satellite will transmit the signals with different code with different frequencies. This makes the GPS receiver to identify different signals. The GPS receiver can easily calculate what is the time taken by the signal to reach the Earth. The travel time is multiplied by speed of light can give us distance between GPS receiver and satellite.The signals will have low signal strength as they are travelling for long distances. So we have to make sure to place receiver to view the sky properly.

1.1.3Control Segment: The control stations are used to track the location of satellites and the time which is synchronized with earth. The control segment consists of four unmanned control stations and one master control station. The unmanned control stations will always receives the information about the satellite location and timing. Then they send the signals to Master control station. The Master control station will correct the information and send them back to GPS satellites.

1.1.4User Segment: The user segment consists of the user and their GPS receivers.

1.2 How GPS Works:

- When the GPS receiver turns on it starts downloading all the orbit information of four satellites. This process can take about 12.5 minutes for the first time of downloading. Even though the GPS receiver knows the exact location of satellite, still it needs to know the distance between the satellite and receiver. The distance is calculated by the receiver by multiplying the velocity of the transmitted signal with the time it takes the signal to reach receiver. The velocity of transmitted signal is same as velocity of light.
- To determine the time taken by the signal to reach receiver. The receiver matches the satellites transmitted code with its own code. By comparing them we will get to know the how much the code must be delayed to match with satellites code. The delayed time is multiplied with speed of light to get distance.
- Triangulation: Once the satellite time and position are know to GPS receiver of atleast four satellites. The receiver can get the position of drone.

Fig 6. Triangulation Method.

1.3 APM 2.8 Flight Controller: The APM 2.8 Flight Controller board can be used for design of multicopters and rovers. The Flight controller board which can turn the multirotor vehicle in to fully autounomus vehicle, so that it is able to perform GPS missions with waypoints. APM has some on-board sensors.

They are-

- Gyro: It has 3-axis Gyrometer to know the movement of the drone when it is hovering.
- Accelerometer: APM Flight Controller Board has 3-axis accelerometer which can calculate the speed of the drone. Sensing capabilities: Onboard 4 MegaByte Data flash chip for automatic data logging Optional off-board GPS, uBlox LEA-6H module with Compass.
- Barometric pressure sensor upgraded to MS5611-01BA03, from Measurement Specialties.4D ultrasound / IR

The following figure describes the total on-board control system:

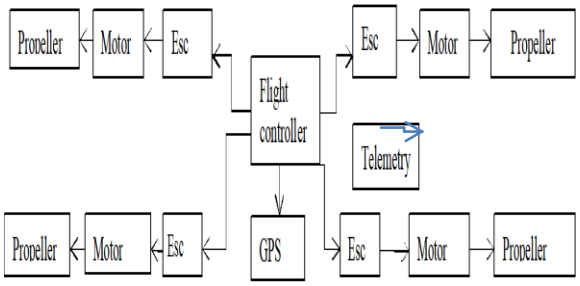

Fig 7. On board Control system.

2. Off Board Control System:

The Off Board Control System consists of PC and Telemetry. The PC should get installed with Autopilot Software. Auto Pilot software act as ground station form Plane, Copter and Rover.

- Load the Auto Pilot Software in to Flight controller board
- Tune the Auto Pilot Software with the Autonomus vehicle by fixing baud rate
- Plan,Save and Load the GPS Coordinates i.e.,waypoints to the drone by click way point entry on google maps .The google maps can be displayed on PC screen.
- With proper Telemetry Settings
- Monitor the vehicle status while it is operating
- We can record Telemetry Logs which contain much information about onboard autopilot logs

Fig 8. Off Board Control System.

VI. CONCLUSION

This paper deals with a systematic process of online delivery with an autonomous Quad Copter using interfaced software installed in PC. Quad Copter will deliver the parcel to the customer by following Google map which will reduce both time and manpower using for delivery. This process will make benefits to optimize the cost of delivering products through QC so that poor people can use these systems more easily.

VII. LIMITATION AND SCOPE FOR FUTURE RESEARCH

The QuadCopter is unable to perform at long distance range due to limited amount of power supply from Lithium polymer battery. Increment of power source will increase the range.

VIII. ACKNOWLEDGMENT

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