

UAV System for Wireless Network Monitoring

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Abstract- This work focuses on designing an autonomous Unmanned Aerial Vehicle capable of self-sustained flight via wireless communications while utilizing a microcontroller. In this age of internet, the security of the network is so important not only it would cause loss in internet speed but also it will allow the intruder to get access of all our files and all the system data. So the main feature of this project is taking steps towards the security of network. These days the wireless network used widely and has increased the security concern with it. So the UAV is useful for finding the Wi-Fi spectrum information and so we can take further steps to control it. The application of the project is to monitor wireless networks using the UAV System. The smartphone having wireless network monitoring software is mounted on UAV system. And make UAV fly in the area to be analyzed for wireless networks. The readings and graphs of channels, bandwidths, users, network strength, are observed and Examined on the Laptop screen which is connected to the smartphone using cast screen feature.

Keywords: UAV, Autonomous, Microcontroller, Accelerometer, Gyroscope.

I. INTRODUCTION

The UAV is an Unmanned Aerial Vehicle that uses four motors for lifting, steering, and stabilization. These UAV's are having more stability in vertical flight. The UAV has no torque issues that a helicopter experiences due to the main and only rotor. Due to the cyclic design of UAV's, it's easy for construction and maintenance. The motivation of this project was to make flyer which is useful for wireless network monitoring. The UAV's are now commercially produced which can be controlled by using radio transmitter i.e. manual control, we had idea of flying the UAV without radio transmitter i.e. autonomously by using some sensors. With the flying the other application wireless network monitoring can be achieved.

II. LITERATURE REVIEW

Øyvind Magnussen et. al. [1], have given the UAV investigation. In this, the main design was founded and the major components were selected. The report did also contain a literature chapter where it was focusing on the main difficulties with the UAV. The main problems while constructing a UAV were often described as a lack of good sensors and their reliability.

Jürgen Schröder et. al. [2], has studied the conventional and also advanced system for the object delivery. For the parcel delivery AGV with locker system is more suitable, but point view of cost drones had more suitable. UAV has more speed than AGV so faster delivery achieved.

Mr. Kalpesh N. Shah et. al. [3], have investigated the complete designing process of UAV-Quadrotor from the engineering perspective and to fabricate a working model of UAV-Quadrotor with improvement in its weight carrying capacity. The main goal is to fabricate a UAV-Quadrotor which can be used for multipurpose application in market, military, commercial and industrial applications like Traffic monitoring and management, Search and rescue operation, Temperature and altitude estimation, etc. They chose the UAV-Quadrotor for project because of its flexibility, high learning opportunity and potential of future research. The UAV can go further in variety of research work to integrate various technologies to get various useful outputs, and will be definitely useful to implement new function of high weight lifting in the account of UAVs.

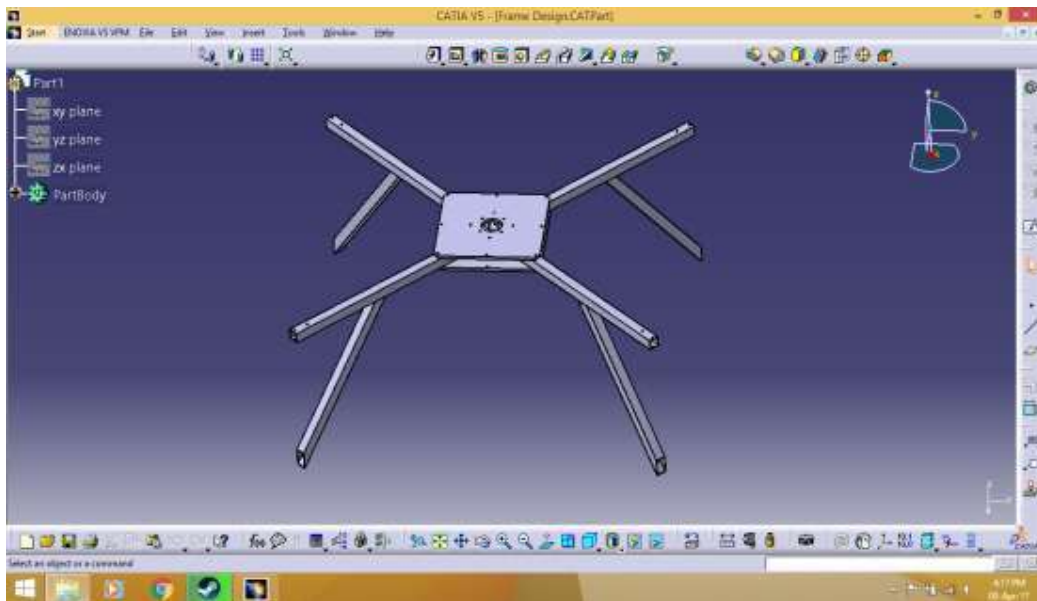
III. CONSTRUCTION

The basic component of the UAV is frame, on which all the other components are mounted, the frame is made from the aluminum as per availability and cost estimation. The centerplates of the frame are made from acrylic which holds all the arms together. 880kV Brushless motors are mounted on each arm in such way that two will run in clockwise motion and other two will run counter-clockwise motion. 30Amp ESC are connected between motors and the PCB which is fixed between two centerplates. The flight controller is mounted on top centerplate with the receiver and GPS module. The Velcro strip is used below lower centerplate to hold the battery tight. The smartphone is fixed with tape in between the two of the centerplates, the screen of the smartphone is connected to laptop with screen mirroring feature.

Building of Frame:

The frame is the basic component of the UAV the projected weight of the whole assembly is up to 1.5kg approx. the ideal material for frame is carbon fiber but as per this weight requirement and availability the aluminum material is ideal. Four hollow bars of aluminum of square shape having 10cm length taken as four arms, for centerplate material aluminum cannot be used because aluminum resist the radio waves, as the receiver generally set at the top of centerplate, using different material such as acrylic considering its properties of low weight and rigid thermoplastic material that has the breakage resistance in most cases (full filing

concern about crash survival). The acrylic ideal would be for this purpose is plexiglass of 0.3mm width. This are assembled together to form 'X' Frame. The drawing is carried out in CATIA V5.



[Figure 1. Catia V5 3D Drawing of Frame]

Frame specification:

1. Material used aluminum with rectangular cross section.
2. Internal cross section 10mm*10mm.
3. Material used or center plates (for support for the electronics) is Acrylic.
4. Weight of frame with electronics=587 gms.
5. Dimensions of frame with maximum configuration for UAV = 450 × 450mm.

IV. PROPOSED WORK

In this age of internet, security of the network is most important part. In the metropolitan cities the offices of the firms are on the top floors of multistory buildings the wireless network of the company is accessible outside the reach where a person cannot be. That can be useful for hackers to enter into the system and handle confidential files, as all the machines are connected to the same network. So we can fly the drone in that particular area and measure our network strength, bandwidth and all other useful information and we get the idea of how much of our network is out of reach and we can lock the particular network up to certain area. And we secure our network from intruders.

V. COMPONENTS

- a. **Frame:** The Basic component on which every other component is mounted should be able to carry the weight of the all the components.
- b. **ESC:** 30Amp, at particular time how fast motor must spin is decided by Electronic Speed Controller.
- c. **Motors:** 880kv The Brushless dc motors are ideal for this application. The motors spin the propellers to provide the UAV with lifting thrust.
- d. **Propellers:** 10×4.5mm, Propellers are connected to the motors these are nothing but blades which provide lifting thrust by cutting air.
- e. **Smartphone:** Smartphone with the software for the wireless network analyzing which is easily available on the play store.
- f. **Flight Control:** It is regarded as the brain of the UAV, It controls the every function of UAV. Consist of various sensors.
- g. **Receiver-Transmitter:** These are used to control the UAV's by giving a command signal. The receiver placed on UAV receives the signal and transmitter transmits the signal.
- h. **Battery:** 3000mah-25c, lithium polymer batteries are used because they give high discharge as per the requirement of power.
- i. **Laptop:** To get the graphs of network, the laptop is connected to the smartphone with cast screen feature.

VI. WORKING

Manual control:

All the motors are connected to Electronic speed controllers (ESC) which controls the speed of the rotors and supply motor the required power. In the manual control, the signals to the ESC's are directly sent by the transmitter remote control through receiver. Transmitter is used by the user to control the quad manually. If the user changes the input, transmitter sends radio signals to receiver and receiver changes these signals to PWM signals. These PWM signals are sent to ESC's causing the change in the speed of the motors.

Autonomous control:

UAV's are very much difficult to control by only manual control without using any sensors. So, if we use some specific motion sensors e.g. GPS, Accelerometer, Barometer, Gyroscope etc. and apply some algorithms to the values read from these sensors, the UAV can itself balance its motion. If we use the above technique to control the UAV, it can then be called as "Autonomous".

UAV uses four propellers and four motors which creates thrust and helps to elevate high, out of four motors with propellers attached, two motors rotates in clockwise(CW) and other two rotates in counter-clockwise(CCW).

Yaw (ψ):

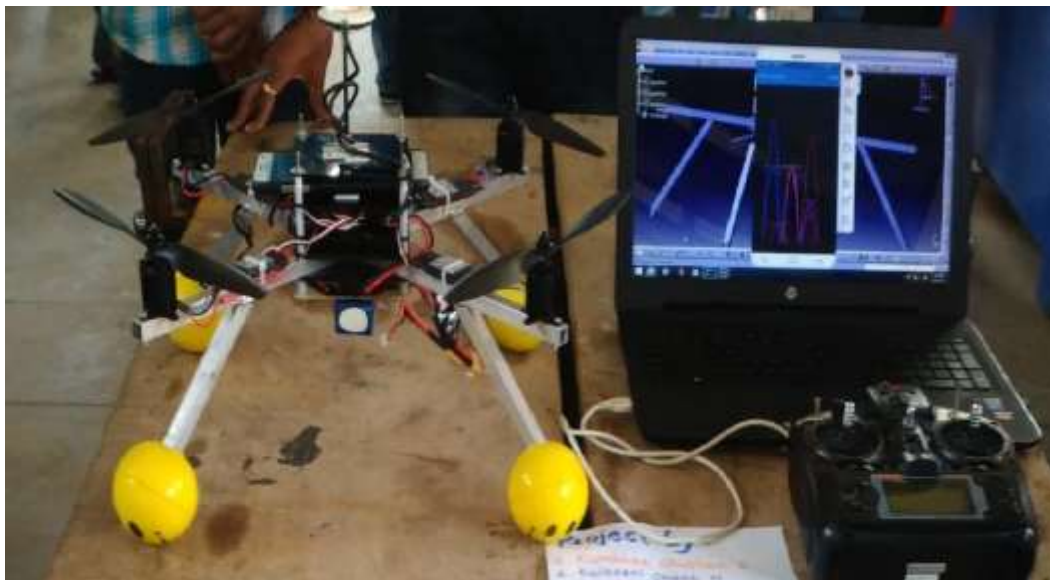
Yaw is the deviation/Rotating the head of the UAV either to right or left, yaw can be controlled through the throttle stick, also called rudder, making it to rotate either to the left or Right.

Pitch (θ):

Pitch is the movement of UAV either forward or backward. Forward Pitch is achieved by pushing the aileron stick forward, which makes the UAV tilt and move forward, away from you. Backward pitch is achieved by moving the aileron stick backwards (towards you), making the UAV, come closer to you.

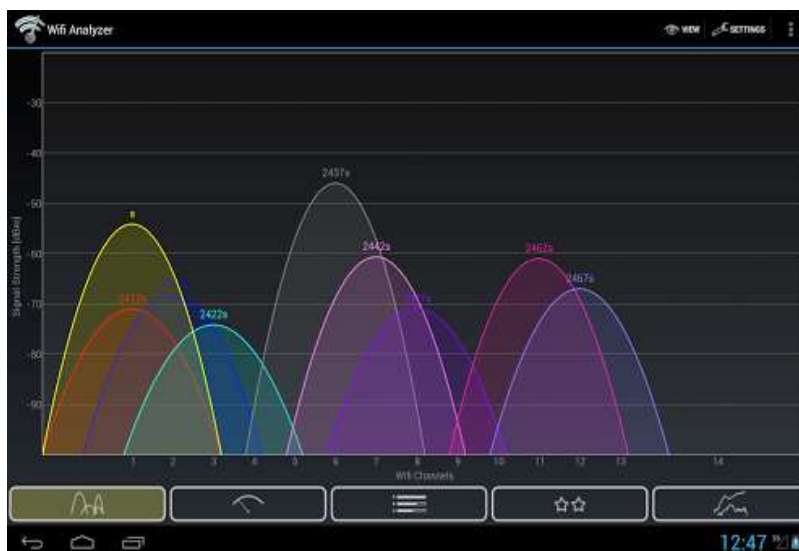
Roll (Φ):

Most people get confused with Roll and Yaw, Roll is making the UAV fly sideward, either to left or right. Roll is controlled with the aileron stick, making it move left or right, if you move the aileron stick to the left, the UAV will fly left, if you move the aileron stick to right, the UAV will fly right.



[Figure 2. Full Setup]

When the UAV is made fly in the target area i.e. the area which is to be monitored for the network, the smartphone which is mounted on the UAV with the Wi-Fi analyzing software installed in the application shows how long our network is spread and what are the areas where we do not have access or the Wi-Fi, the graphs of strength, bandwidth, and channels etc. on the smartphone screen and gives the precise details about network, we can see it live on laptop screen connected to the smartphone by cast screen feature, while the UAV is flying in targeted area. That's how we get the idea about how far our wireless network has spread. And we can do further actions to prevent it from intruders. Such as locking the range of the Wi-Fi signal in that Particular area. This application will be mostly useful for the network providing companies, would serve security purpose of multinational companies.



[Figure 3. Wi-Fi Analyzer]

VII. CONCLUSION

The Main objective of the project is to design the UAV which will be able to carry some weight which can be used for wireless network monitoring by using the smartphone and Wi-Fi analyzing software. We chose the UAV for project because of its flexibility, high learning opportunity and potential of future research. This project can go further in variety of research work to integrate various technologies with UAV's to get various useful outputs.

Future Scope:

1. Use for Telecom Networks
2. Surveillance
3. Aerial view of Land
4. Increase the efficiency

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