Weather Station Quadcopter Using Arduino with NRF24L01 and GPS Module

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Abstract – *Winds and weather always play an import role in the life of every things on this Earth in many ways. Knowing weather parameters accurately may help in the future weather prediction which help us and the farmers, scientists, researchers and trackers to plan their work accordingly and helps in making important decisions. But creating weather station is costly and requires much larger space. This project is aimed to reduce the cost and increase the speed of data collection of weather parameters as well as it will help in collecting data in rough or unreachable terrains and areas. It can be used for studying and monitoring of weather. It has GPS implementation which help the drone to collect the data with its location and with accuracy. The drone is built using wooden frame with BLDC motors 0f 1400 KV rating and 1045 propellers. The flight controller of drone is made up of Arduino Uno and ESC (30 A) and it is controlled by using remote with transceiver module NRF24L01.*

***Key Words*: Drone, BLDC motor, GPS, Arduino Uno, NRF24L01, Flight Controller, ESC, Cost, Weather.**

1.INTRODUCTION

In our day to day life weather affects a wide range of our works and activities such as transportation, agriculture, research work, etc. The drone (Quadcopter) weather station is designed to take the necessary measurements to predict or track the weather or its movement in a cost-effective way with accuracy. The main aim of this project is to record the weather parameter such as temperature, humidity, pressure with its tagged GPS location. Using the collected, weather can be predicted or it can be used for further studying purpose. This project will also help in selecting a specific site for a specific work which requires special detail to the temperature, humidity and pressure of the environment. The mobility of quadcopter weather station will help in reaching the rough terrain areas and make the measurements.

The Quadcopter has MicroSD card slot and WIFI connectivity which can be used to see the data collected. MicroSD will store data in KML format which can be read using GOOGLE EARTH application. This paper describes the working and assembly of quadcopter and data collection method using sensors and GPS module
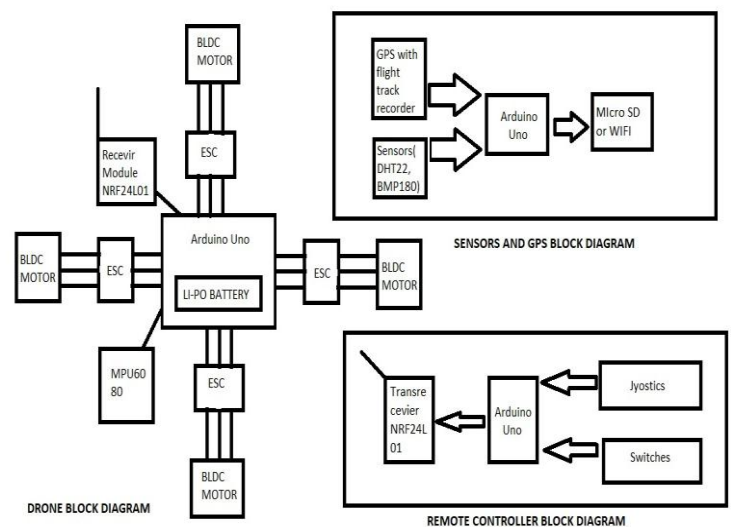
1.1 BLOCK DIAGRAM

Fig 1: Block Diagram of Quadcopter and Sensors

Block diagram consists of Arduino, BLDC Motor, ESCs, Li-Po Battery, Transceiver Module. Arduino contains the ATMEGA328P microcontroller which is the main brain of flight controller of the drone. Esc convert the dc signal to three phase ac signal which is used to run the BLDC Motors. BLDC motors are used here because of their high revolution speed which helps to generate the thrust required to lift the quadcopter. Li-Po battery has high current output which is required for the BLDC motor to run. We have used 2200mAH battery which can give the flight time of around 20-25 minutes with BLDC motor having 1400 KVA ratings. NRfl24L01 transceiver module is to communicate with the remote. But in testing stage we used Bluetooth module HC-06 for simulation purpose and used the Mobile app to give the commands to the Quadcopter.

The sensors block diagram consists of different types of sensors, Arduino Uno, ATMEGA328P, NRF24L01. The sensors may be temperature, Humidity, Pressure, etc. The sensors give analog output to the ADC (Analog to digital converter), which converts the analog input to its digital equivalent and gives it to the microcontroller. The Arduino-Uno is used to take the digital input from the sensors. This input is given to a RF transmitter module that transmits the signal. The signal transmission can be done over Wi-Fi.

1.2 WORKING

It has Arduino with ATMEGA328P. The flight controller of the quadcopter is the main controlling component for the quadcopter to fly properly. It has 4 ESCs connected to the digital pins of Arduino. Here, Arduino is powered using 9v Battery. BLDC motors are powered using the Li-Po battery of 2200 mAh. Mpu6050 is connected to the Arduino board using the serial communication pin. NRF24L01 Module is also connected to the Arduino board using RX-TX pin. To power the Mpu6050 and NRF24l01 Module the 3.3v pin and 5 v pin output on the Arduino board is used. The motor has 3 wires which are connected to the esc three output pins. The connections of motors to the ESC is based on in which direction we need to rotate that motor i.e. Counter or clockwise rotation. The rotation speed of motor is controlled using the esc, while programming the input to esc pins are given in the form of degree (min 30) which controls the speed of rotation. The range can vary from 0 to 180 degree only.

MPU6050 helps the quadcopter in balancing. Sensor network on the quadcopter measures the parameter in the analog form and gives the input the Arduino Uno. The microcontroller reads the measurement of sensors with the GPS tagged location and store it in the MicroSD or sends the data over WIFI to the receiver device.

2. RESULT

We were able to make a drone with wooden frame in X - frame form. The flight controller of drone using Arduino Uno was made and programming was done using Arduino IDE. The program was the main firmware for the flight control which helps the flight controller to work according the user's requirement. As per now, we have used Bluetooth Module HC-05 for reception purpose and used Android mobile app to communicate with the flight controller using Bluetooth. The android app is used to control and give command to the flight controller.

3. CONCLUSIONS

Wireless weather monitoring system serves as a reliable and efficient system for monitoring of the environmental parameters. Wireless monitoring of field not solely permits user to cut back the human power, but it also allows user to see accurate changes in it. It is much cheaper in cost, consumes less power.

This paper helps in development of Arduino Uno based Quadcopter for weather at a less expense. We are using this quadcopter for wireless weather station purpose which will have different types of sensors to sense the weather parameters such as temperature, humidity, pressure, altitude, etc. Using this quadcopter user can also get to read the weather parameters on the google earth with their tagged locations.

4. FUTURE SCOPE

In further improvements on small scale it is desired to be cased within an Arduino case either own made or bought as desired. Adding one more sensor LDR (Light dependent sensor) one of the other available cheap sensors can be used to light cloudy weather or not. One of the future scopes of it as desired is compatible with smartphone apps to give any critical feedback of data. Updating twitter status and performing actions on the basis of that which is one of the most efficient use of IOT. The special feature to be included as an idea in this device is that it can be used for any critical environments or local area rather than expensive weather stations capable of performing over a large scale. These work on small scale too on public wireless LANs.

This project can be further developed for the study of tornados or areas where weathers are unstable and violent and it can be further developed for the study of another planet's atmosphere.

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