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DESIGN & FABRICATION OF UAV FOR DATA TRANSMISSION

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Abstract- *Aircraft which fly without any human being is called Unmanned Aerial Vehicle (UAV). It is the sign of success of modern aircraft and advancement of in automated technology. Capability of UAV should be compact, lightweight, and have the ability to carry a multitude of interchangeable instruments to suit its application. An UAV is designed and fabricated which can be used in our country for weather and for measuring temperature of radioactive areas according to height from ground. Temperature sensor (LM-35) GPS sensor and Bluetooth device are used for this purpose. We found the temperature range of LM-35 is 28℃ to 30℃. The altitude at the starting point of UAV was 0 meter. During this experiment the UAV has reached 6.7 meter high which was maximum in this experiment, data collected from GPS sensor and temperature*
Sensor represented a graph which reflects the variation of temperature according to altitude.

Keywords: aircraft, GPS sensor, Temperature sensor, radioactive area, Bluetooth device

1. INTRODUCTION

Bangladesh is in the age of development of science & technology. Science & technology are developed day by day. The growth rate of technology is good while comparing others and we are trying to develop it. As much as we can develop science & technology in our country, we can live a better life. A UAV can play a great role in this sector of Bangladesh.

Many research have been made on quad rotor by worldwide researchers. Pounds et al. presented fundamental dynamics analysis and control approaches through the design of a large-size quad rotor with total weight of 4kg and capable of lifting a 1kg payload which was deemed necessary for the computers and sensors of the time [1] Due to the various applications, costing, and the most prominent thing human safety led to the researches in Unmanned Aerial Vehicle. As well as its various advantages over helicopter and the challenges in it led to enhancement in quad copters. Quad copter requires dynamics in order to account for gravity effect and aerodynamic effects [2] Javier, Masoud and Bruce presented the usability of quad copter as safety inspection tool in industries. They focused on the construction industry. Their study proposed the use of a quad copter to fly over the construction jobsite and provide the safety manager with real time information about what is happening on the jobsite. Also through the communication tools embedded in the quad copter, safety manager can interact directly with workers [3]. In our country increasing day by day. Guard UAV can be applicable to ensure the safety of people. It can help in border security for 24/7 surveillance that is more efficient human to keep border free from unwanted entrance. It can be used in the industries to do different risky & difficult jobs. It can also be used in security force to detect bomb & explosives. In the time of natural disaster sometimes it's too hard to deploy rescue team with rescue arrangements. An UAV employment would be faster rescue mode that would be able to minimize the loss. In the time of different accidents like industrial or any kind we can employ an UAV that can move through the ways through which entrance of man is quite impossible or time consuming. This can save a lot of life & minimize the losses for developing countries like ours.

Attempts to build a quad rotor go back to the early 1900's, it was more of an experimental rotary-wing plane but similar to the concept of a quad-rotor. Such aircraft

was built by the Breguet brothers and the assistance of a professor called Charles Riche. It flew for the first time in 1907.

Starting in the 1970's drones starting becoming lighter and began resembling to lightweight and glider like glider like drones used today. Where priority in 50s and 60s seemed to be speed, in the same speed, in the 70s and 80s it seemed to shift to weight and maneuverability [4]. We had studied data analysis of quad-copter like temperature measurement as respect of altitude. By this UAV technology we can find out many problems such as remote sensing, agriculture, mines, construction sites, forecasting, wild life research, emergency response, environmental monitoring, search and rescue, commercial aerial surveillance. In case of CUET UAV research can make some works easy like Area monitoring, security purpose and it can be developed in its functions. We have analyzed data transmission system. Data of temperature and GPS is collected from sensor.

2. EXPERIMENTAL EQUIPMENTS

2.1 Electrical components

During study we have used many electrical equipment. List of main components are mentioned below.

2.1.1 Brushless DC motor (980kv):

Using brushless dc motor has some advantages like high torque per weight, higher efficiency, increased reliability, reduced noise. We have used 2212-980kv DC motor. The number 2212 has two meanings. First half (22) means the diameter of motor or rotor and the second half (12) means the height of motor. 980kv means the number of rotation per kv. MT is model number of motor. We have used four dc motors in this study.

2.1.2 Electronic speed controller (ESC):

Electronic speed controller is an electronic device whose main purpose is to control the motor speed. ESCs are often used on electrically powered radio controlled models, with the variety most often used for brushless motors essentially providing an electronically generated three phase electric power low voltage source of energy for the motor. We have used 4 in 1 30A ESC.

2.1.3 Flight control board (CC3D Revolution):

CC3D is a flight controller that is developed by Open Pilot project. CC3D stands for Copter Control 3D. A programming is installed in the controller.

2.1.4 9 Channel Radio:

We used 2.4 GHz 9-channel radio control the flight & movement of our vehicle. The main benefit of using 9 channel radio is fast response & high resolution. This 2.4 GHz radio control system gives the vehicle about 500m lift with a radius of 1km control. The fast response of the signal transmission system enables emergency flight & landing.

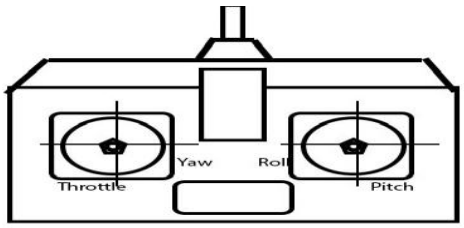

Fig.1: Throttle, Yaw, Roll and Pitch

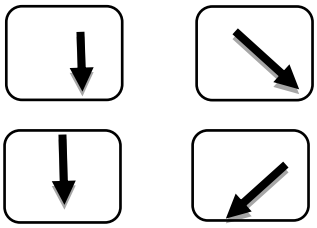

Fig.2: Motor lock and unlock

Figure 1 is the schematic drawing of 9 channel radio. Throttle, Yaw, Roll and pitch is marked on the drawing. Figure 2 is the drawing of motor lock and unlock functions.

Yaw Motion (ψ):

Rotation around the vertical axis is called Yaw. The Rudder controls Yaw (Left and Right). **Pitch Motion (ɵ):** Rotation around the side-to-side axis is called Pitch i.e. Moving Upside and Downside about horizontal axis. The Elevator controls the Pitch

2.1.5 Transmitter and Receiver:

Transmitter is an electronic device that generates and amplifies a carrier wave modulates it with a meaningful signals derived from speech or other sources, and radiates the resulting signal from an antenna.

A radio receiver is an electronic device that receives radio waves and converts the information carried by them to a usable form.

2.1.6 LI-PO Battery:

LI-PO stands for lithium polymer which is the most efficient battery used for quad copter. It makes oxidation & reduction more efficient resulting in the higher rate of electron passing from anode to cathode. It has uniform voltage discharge. In our copter we used 1800mAh LI-PO battery than enables the copter flying up to 8 minutes. The battery discharge is connected with 4-mm bullet connector

2.1.7 Bluetooth Module (HC-05):

Bluetooth module is the fast growing fields in communication technology. It transmits and receives data wirelessly from device.

2.1.8 Arduino Board (Mega):

We have used ATmega328p Arduino board for this study. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller. It is simply connected to a computer with a USB cable or power it with an AC to DC adapter or battery to get started.

2.1.9 Temperature Sensor (LM-35):

Temperature sensor LM-35 is used for temperature measurement by quad copter. The prefix LM stands for linear monolithic. It is a precision integrated circuit temperature device. . The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin.
The general equation used to convert output voltage to temperature is:

$$T = [V_{out} \times \frac{100}{V}] \ ℃ \qquad (1)$$

Eq.(1) represents the formulae of calculating temperature
So if V_{out} is 1V , then, Temperature = 100 ºC
The output voltage varies linearly with temperature.

2.1.10 GPS Sensor (GT-7223F):

GPS stands for Global Positioning System by which anyone can always obtain the position information anywhere in the world. It is one of the most fantastic utilities ever devised by man .We can find the latitude, longitude, AMG, Altitude etc. It is a satellite-based navigation system consisting of a network of 24

2.2 Software components:

1. We have used c programming for language.
2. We have used Arduino IDE to write, modify and compile the program.
3. Proteous-8 is used for designing circuit diagram
4. We have used mobile app Blue Act for showing Data which is collected from sensor

3. EXPERIMENTAL SET UP

3.1 Electrical connection

The connection of quad-copter setup is described below. At first arms are joined with base. Then CC3D is connected with the ESC For signal receiving, receiver is added with the CC3D. Motors are mounted on the arms.

They are already arranged with propeller. The motors are connected with the ESC. ESC gets power from the battery. Transmitter is powered to transmit signal.

At first we have connected the battery with CC-3D Flight controller and given power the on. Then throttle have been increased slowly. By Lifting the throttle switch, device has started lifting at a certain speed. Navigate direction by direction switch. Accelerometer has been balanced itself. A constant
has given constant flight. Reducing speed has made the vehicle safely landed. We have removed power connection to shut off.

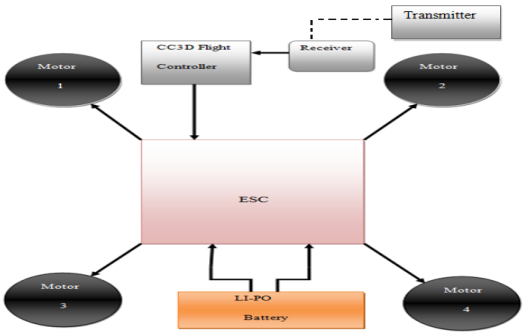

Fig.3: Block Diagram of Final Set up

Fig. 4: Circuit design in Proteous-8

3.2 Circuit Connection:

In this figure 5 there is a PCB board and Arduino MEGA. Temperature sensor is mounted on the PCB board. Temperature data which is formed in voltage is transferred to the ATMEGA328P microcontroller.
From ATMEGA328P microcontroller data is converted to the degree Celsius. Then data is carried to the Arduino with GPS received data. Both temperature and GPS data are calculated and passed to the Bluetooth module as output. Bluetooth module shows us the data on smart phone.

We have designed circuit diagram in proteous-8 software. In this software, electronic device image is ready to be figured. Arduino MEGA is connected with temperature sensor and GPS sensor. From this sensors Arduino gets data as a form of voltage. Data changes with respect to voltage change which is shown to smart phone or computer.

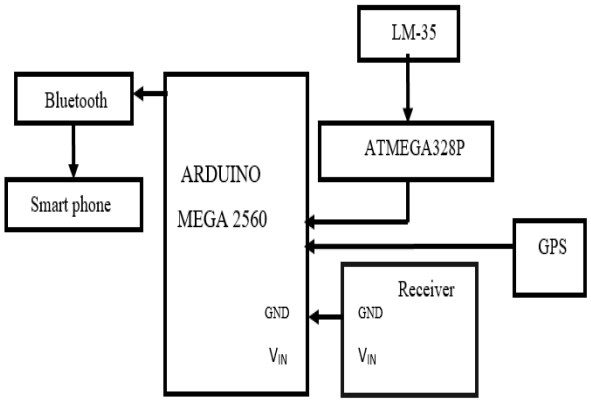

Fig.5: Block diagram of circuit diagram

4. QUADCOPTER MODEL

4.1 Top View

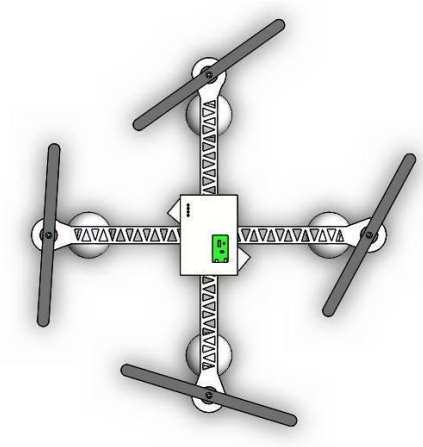

Fig. 6: Top view of Quad copter

This set up includes electric circuit board on the quad-copter.

4.2 Isometric View

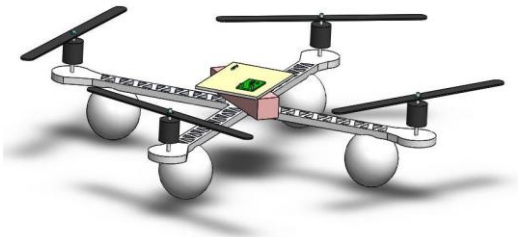

Fig.7: Isometric View of Quad copter

Two views of Quad copter model given. One is Top view and another one is Isometric view. It is an assembly of quad-copter and circuit board mounted over the UAV. The circuit board is used for temperature data and GPS data transmission.

4.3 DATA FROM SOURCES

Numerical data is from temperature and GPS sensor is collected from mobile software BLUE ACT. This software shows the value of Latitude, Longitude, Altitude Temperature etc. according to programming. From these data we have collected temperature variation according to altitude. In this experiment we have 18 data from various location. From these data we have made a graph which indicates the changing proportion of temperature with respect to altitude.

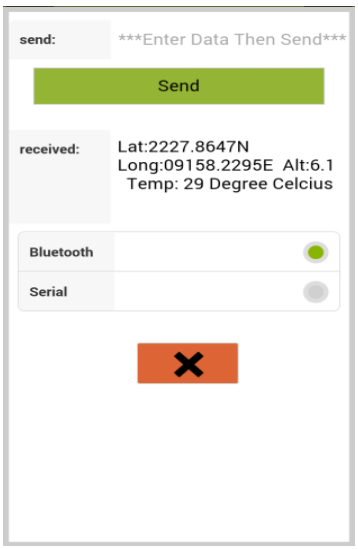

Fig.8: Data from Temperature and GPS sensor.

By using GPGGA-NMEA sentence, graph is prepared on the basis of information of altitude and temperature which is given below.

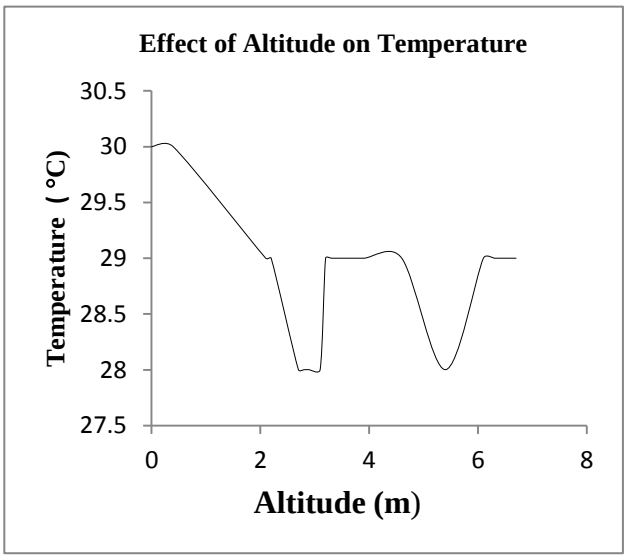

Fig.9: Temperature vs. Altitude

Figure 9 represents the graph between temperature and Altitude how temperature varies with the variation of altitude.

5. CONCLUSION

Small Unmanned Aerial Vehicles should continue to improve in both performance and overall functionality. There are many field to improve. As a developing country to keep pace with the modern world we must pay attention to research based works even though we have limitations. By developing technologically it's possible to develop totally. So government & private sector funding necessary for research based works.

In CUET quad copter research brings about good opportunity for students to develop and use in various purpose. It opens some ways to compete with other country students. it enhance their skill and thinking capacity.

In this experiment various data of temperature is calculated on the basis of altitude. The maximum altitude is 6.7 meter. Temperature varies from 28 to 30 °C during lifting the quad-copter. Sometimes variation of temperature data is large because of loose of control.
In this project, a 4x flyer UAV has been fabricated that can be controlled from a safe distance

Creating this kind of opportunity plays a vital role in any student life. Quad copter is a advanced topic nowadays. In developed country research in quad copter is increasing day by day and as a result they upgraded their UAV technology.

6. REFERENCES

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7. ACKOWLEDGEMENT

During this study we have faced many financial and decision making problem. This problem cannot be solved if the authority didn't provide help economically or physically. We would like to thank to our authority to stand our aside and give their helping hand.

8. NOMENCLATURE

Symbol	Meaning	Unit
T	Temperature	(K)
V	Pressure	(m^3)