Volume 5, Issue 2, February 2015 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Design and Implementation of Flying Robot

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Abstract— This paper describes the model of the flying robot with gripper mechanism for surveillance purpose. The goal of flying robot is to create a small robust and highly manoeuvrable robot that can fly indoor and outdoor for surveillance. The aim of this project is to develop a real-time system for detecting and tracking the specific capabilities of the flying robot. This project involves the design of a light-weight electronic gripper system to be used on the flying robot. The flying robot can be controlled by R.C Controller using the radio frequency. The wireless camera assemble with the flying robot to perform aerial surveillance and inspection purpose. For smooth flying, flying robot is equipped with K.K multicopter controller board. The controller board has inbuilt gyro and accelerometer sensor. All signals from sensors are processed by open source K.K multicopter board. Output from controller board used to control flying robot propellers

Keywords— Flying robot, K.K multicopter board, Electronic Gripper Mechanism, Wireless Camera

I. INTRODUCTION

In last few years, there are an increasing amount of researchers taking efforts which are directed towards flying of inventive systems. Those systems are generally called as flying robots or unmanned air vehicle (UAV). Flying robot are de-fined as Ariel vehicle without the on board presence of pilots . Today, lots of different UAVs model are available, and these structures are named with respect to rotor number. Those systems are widely used for military applications, search and rescue operations, agricultural distillation, shoot the sports events or movies from almost any angle and transporting or controlling equipment. Today unmanned aerial vehicles (UAVs) are an important part of scientific study of both in military and space research. As a replacement for human piloted vehicles they are advantageous to protect human life in multiple dangerous environments. Their re liabilities in tough circumstances are much higher than their counter parts.
Flying robot also named as quadcopter, is a vehicle that moves with electric motor Basically there are four upward rotors which help quadcopter for any kind of man oeuvres within its flying region .In the last decade, due to the military and security reasons many attempts had been conducted related to this issue. These days, the Quadcopter used as a safety and security robot in wide rage area

II. BASIC PRINCIPLE

In the flying robot each rotor produces both a thrust and torque about its centre of rotation axis also put the force opposite to the vehicle's direction of flight[1]. If all rotors are spinning at the same angular velocity, with motors one and three rotating clockwise and rotors two and four anticlockwise. The net aerodynamic torque, and hence the angular acceleration about the yaw axis is exactly zero. The schematic movement of flying robot as shown in fig.1. Take-off is movement of flying robot that lifts up from ground to hover position and landing position is vertical of take-off position. Take-off (landing) motion is control by increasing (decreasing) speed of four rotors simultaneously which means changing the vertical motion.

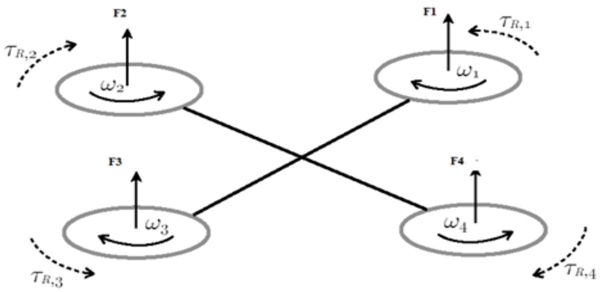

Fig. 1: Direction Of rotation motor

III. HARDWARE DESCRIPTION

3.1 BASIC UNIT

We are going to design our flying robot with four dc out runner motor of 1800kva.For controlling that motors we use open source kapatin kuk's multicopter board(2.0) ,formally known as K.K multicopter board. The multicopter board is the brain of our system .the board consist gyro sensor with accelerometer which maintain the stability of the flying robot.

The control board accept the signal from R.C controller via ESC(electronic speed controller) and proceed to motor according calculation of all parameter regarding the sensor signal.

Fig. 2: Real Time Designed module of flying robot

3.2 Block Diagram

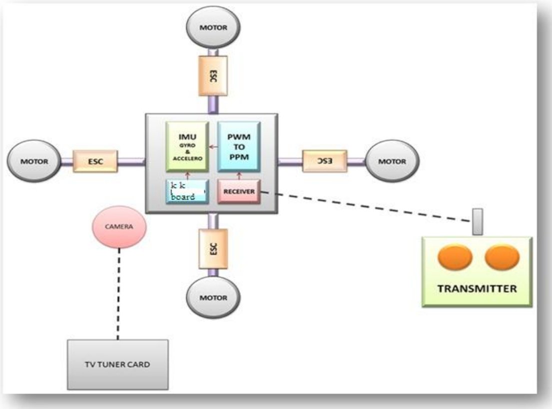

Figure shows the block diagram of flying robot module .An open source KK multicontroller board is placed in the flying robot which receive the signal from the rc controller .The control board connected with four ESC .The ESC will process the PPM signal from the receiver and covert that signal into the PWM signal .According To variation in the width of signal as shown in fig 3. the ESC will circulate the current to brushless motor.

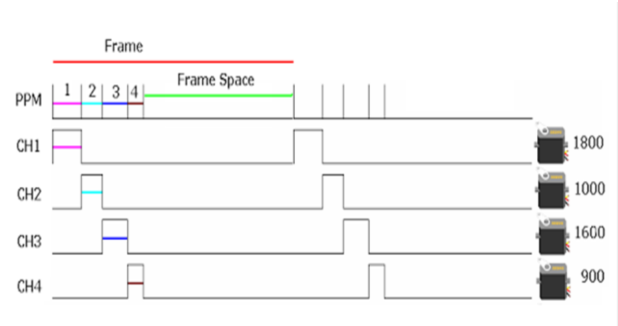

Fig. 3: PPM signal send by R.C transmitter to base station

Also the controller has on board accelerometer and gyro sensor. As per the movement of module it will calculate yaw ,pitch and roll calculation and send to the microcontroller.According receive signal it produce control signal make variation in power distribution The module also assemble with wireless camera for video recording purpose. The camera module also transmit video signal to computer. The video signal from the camera will be feed to the computer by tv tunner kit. The electronic gripper system will also control with help of the servo motor .The electronic gripper will use to lift the pay load.

3. 3 Selection of Hardware

According requirement of our project objective there certain parameter which are more important during the design of flying robot. .The important parameters such as flying time, stabilization lift pay load .flying time is vary as per battery capacity. Also there will be proper selection of the all important component such as ESC, propellers brushless motors .Even if we selected all the component ,but for stable flight the manipulation of all signal will done proper manner. This will we have done with firmware software called drive calculator shown in fig4 and props calculator shown in fig5.after inserting the various parameter such battery capacity in mah. ESC type Then ,it will provide the estimated flying time .hence it is very useful software tool for calculation of estimated flight parameter.

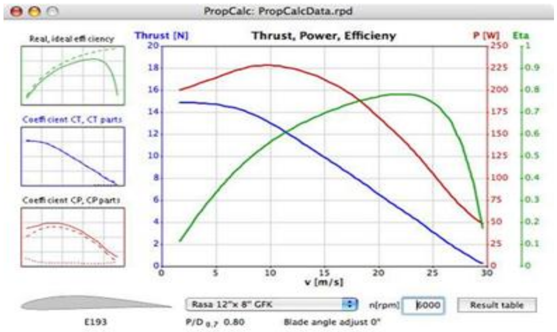

Fig. 4: Simulation window for the calculation module flight duration

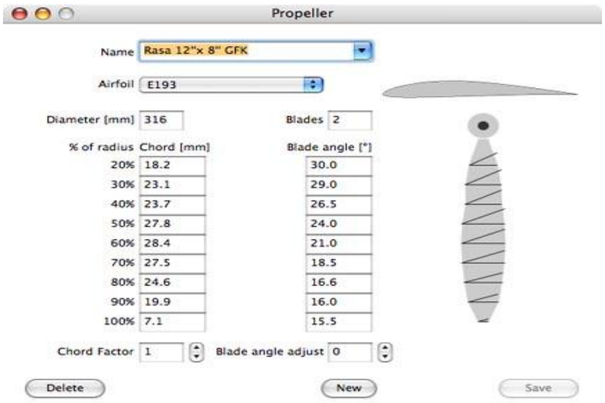

Fig. 3: Simulation window for propeller selection

3.4 Control Board

For successful designing purpose of the flying robot we used the open source controller board called KK multicopter control board. The K.K multicontroller is a flight control board for remote control flying robot with 2,3,4 and 6 rotors. Its purpose is to stabiles the aircraft during flight. To maintain the stability it takes the signal from the three gyros on the board (roll, pitch and yaw) and feeds the information into the Integrated Circuit (Atmega IC). This then processes the information according the KK software and sends out a control signal to the Electronic Speed Controllers (ESCs) which are plugged onto the board and also connected to the motors. According to the signal from the IC the ESCs will either speed up or slow down the motors. The board also takes a control signal from the Remote Control Receiver (RX) and feeds this into the IC through the aileron, elevator, throttle and rudder terminal on the board. After processing this signals, then IC will then transmit the signals to the motors to speed up or slow down to achieve controlled flight the command signals from the RC Pilot sent via his Transmitter (TX).As we are using control board version (2.1.5) uses the Atmega 164 IC.

3.4 Electronic Speed Controller

Electronic speed controller play an important role for control the movement of the dc brushless motor .In our project we are using programmable electronic speed controller .programmable in the sense it will allow to set up various parameter limits for safe operation of motor. ESCs we used in our project needed to be calibrated to read the pulse width modulation (PWM) signal generated by the control board. Calibration of ESCs, defines how to set the max and min speeds of the motor in relation to the max and min width of the PWM signal sent by the control board. A PWM signal is simple a square wave signal consisting of high and low (5v and 0v) signals for certain durations. Some sample PWM waves are shown below

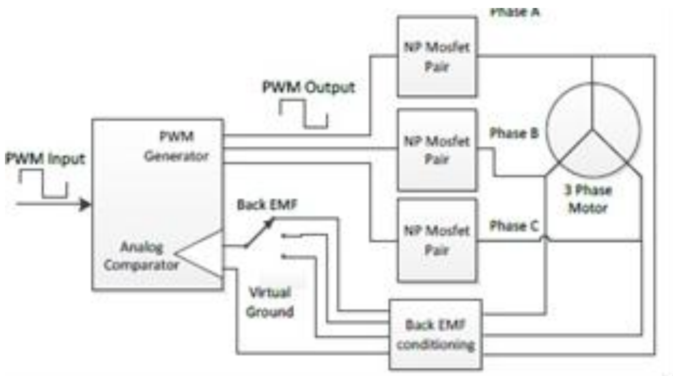

Fig. 6: Internal schematic of ESC [4]

Calibration involves programming the ESC to understand the PWM waves corresponding to the stop and maximum speeds of the motor. For the flying robot, however, we want the range to be as wide as possible to allow for greater incremental control of the motor. we calibrated the ESCs to read a signal width from 700 to 2000 microseconds with 700 being the stop speed and 2000 being the max speed. We found that the ESC unable read a signal lower than 700 microsecond.

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3. 5 Electronic Gripper

As we are designing our module for surveillance purpose will implement our module with servo based electronic gripper The electronic gripper is use to pick various things which has weight up to the 500grams.The control board we are using has six motor output terminal out of six we just using four hence remaining terminal used for connecting the gripper motor.

IV. IMPLEMENTATION

As per goal of our project it must be capable to lift more payload with stable flight. For lift more payload we used the 1800kva out runner motors, also the flight duration less is one of the problem in previously design system.to increase flight time we used lipo battery of capable5200mah with constant discharge 10c rating. We have achieved our goal by drastically increasing the battery capacity while lowering the discharge constant current drawing rate. Its results in a battery which is still capable of providing sufficient current (Amps) while offering much higher capacity when compared to a standard 20C+ Li Poly battery of the same weight .It will help to increase the up to 80percent.To reduce the weight of the flying robot. we used aluminium frame. for aerial photography we assemble with camera but it require extra power supply .It will increase weight so for that will make power supply coincide with board as in inbuilt it will help to reduce the weight .we also implement with electronic gripper. Recognizable real time video information should be transmitted to the ground receiver point suitably located in the observation area[2].

V. CONCLUSION

A flying robot system robot has been successfully design as per decided objective .The flying robot module aerial photography also simultaneously send the video signal to the base station .After adjusting the gain value in controller board .It will maintain stable flight.

ACKNOWLEDGMENT

I thank Prof. R.M Revatkar sir for their valuable contribution in preparing this paper and helping me out many a time when we needed guidance

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