Wireless Remote Controlled Video Streaming Quadcopter

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ABSTRACT: Drones are basically remote-controlled robots that can do wide range of fun things, from zooming along the ground, flying high into the sky and hovering in the air with a built-in camera. Our project Drone is small and highly manageable drone or flying machine that usually comes with an on-board video camera with SD card storage facilities of the image / videos. A drone has 4 propellers and motors that generate thrust which is necessary in lifting the aircraft. Mechanically, a drone is simpler as compared to traditional helicopter that needs a rotor tail in order to counteract the produced angular torque of the main rotor. These days, you may have already observed a flying drone. Drones are now becoming more and more common since it is becoming a hobby for many people. But with its many great brands and models, you may be wondering, what is the best drone to start your flying career. This paper is focused on developing a remotely operated quadcopter system. The quadcopter is controlled through Graphical User Interface (GUI). Communication between GUI and quadcopter is done by using wireless communication system. The quadcopter balancing condition is sensed by FY90 controller and IMU 5DOF sensor. For smooth landing, quadcopter is equipped with ultrasonic sensor. All signals from sensors are processed by Arduino Uno microcontroller board. Output from Arduino Uno microcontroller is used to control Quad copter propellers. GUI is designed using Visual Basic 2008 Express as interface between control base and Quad copter. The experiment shows that quadcopter can hover by maintaining its balance and stability. Quadcopter can accept load disturbance up to 250g during it hover condition. Maximum operated time of quadcopter is six minutes using 2200mAh Lipo battery and operate time can be increase by utilizing largest battery capacity.

KEYWORDS*:* Unmanned Aerial Vehicle (UAV), Quad copter, Video Streaming, Surveillance, wireless camera.

I. INTRODUCTION

Research and development of unmanned aerial vehicle (UAV) and micro aerial vehicle (MAV) are getting high encouragement nowadays, since the application of UAV and MAV can apply to variety of area for example, rescue mission, military, film making, agriculture and others. In U.S. Coast guard maritime search and rescue mission, UAV that attached with infrared cameras assist the mission to search the target. Quadcopter or quad rotor aircraft is one of the UAV that are major focuses of active researches in recent years. Compare to terrestrial mobile robot that often possible to limit the model to kinematics, quadcopter required dynamics in order to account for gravity effect and aerodynamic forces. Quadcopter operated by thrust that produce by four motors that attached to it body. It has four input force and six output states (x, y, z, θ, ψ, ω) and it is an under-actuated system, since this enable quadcopter to carry more load. Quad copter has advantages over the conventional helicopter where the mechanical design is simpler. Besides that,quadcopter changes direction by manipulating the individual propeller's speed and doesn't require cyclic and collective pitch control. quadcopter is an airborne vehicle that utilizations four rotors for lift, steering, and stabilization. Unlike Other aerial vehicles, the quadcopter can accomplish vertical flight in a more stable condition. The quadcopter is not influenced by the torque issues that a helicopter experiences due to the core rotor Furthermore, because of the quadcopter's cyclic design, it is calmer to construct. Day by day the technology becomes more advanced and more accessible to the public, many engineers and researchers have started designing and implementing quad-copters for different uses. Various groups such as the military, engineers, researchers, and hobbyists have been developing quad-copters to understand different technical areas. quadcopter Manufacture forreal-world uses by attributing a live camera to a small-scale, remote controlled, quad rotor, unmanned aerial vehicle (UAV). The video received will be transmitted

by digital or analog signals according to availability. If the bagged video is a correspondent signal format it must be converted to digital video after transmission. With a digital signal, the video can be effortlessly handled for investigation and storage.

The quadcopter controller requires direction control or a remote controller to control it. But we use processor for controlling the quad copter. This monitoring process of video is also done by the computer instead of using separate display. Controlling of the quad copter using separate control is a tedious process and it requires more practice. But, the control by the computer is a very easy process as it requires less practice. The quad copter can be organized by changing the speed of the four blades and no other mechanical linkages are required in varying the rotor blade pitch angles as compare to a conventional helicopter. The main applications include they can used for rescue missions, in military it can used for discovery of the mines by using confident metal indicator in the quad copter and made them hover over the area, in flick making, in agriculture and many others. The rest of this paper are organized as follows: Section III dedicates to describe the proposed method, and finally Section IV gives the conclusion.

II. LITERATURE SURVEY

Achtelik *et.al.* (2009)[1] done research on control of Quad copter by visual tracking utilizing stereo camera. The motion of a Quad copter is control based on visual feedback and measurement of inertial sensor. In this examination, active markers were finely designed to improve visibility under various perspectives. Ashfaq Ahmad Mian *et.al.*(2007)[2] developed of nonlinear model and nonlinear control strategy for a 6-DOF Quad copter aerial robot. The nonlinear model of Quad copter aerial robot depends on Newton-Euler formalism. Model derivation comprises determining equations of motion of the Quad copter in three dimensions and seeking to approximate actuation forces through modelling of the aerodynamic. Santos et.al. (2010)[3] works on intelligent fuzzy controller of Quad copter. A fuzzy control is designed and implemented to control a simulation model of the Quad copter. The inputs are the desired values of the height, roll, pitch and yaw. The outputs are the power of each of the four rotors that is important to reach the specifications. Simulation results prove the efficiency of this intelligent control strategy is acceptable. Jun Li et.al. (2011)[4] is done research to analyse the dynamic characteristics and PID controller performance of a Quad copter. This paper is depict the architecture of Quad copter and analyses the dynamic model on it. Other than that, this paper also designs a controller which aim to regulate the posture (position and orientation) of the 6-DOF Quad copter.

III. PROPOSED SYSTEM

- To design Quad copter that can control wireless base on computer.
- To design Graphical User Interface to communicate and control Quad copter.
- To equip Quad copter with stereo camera to display video.
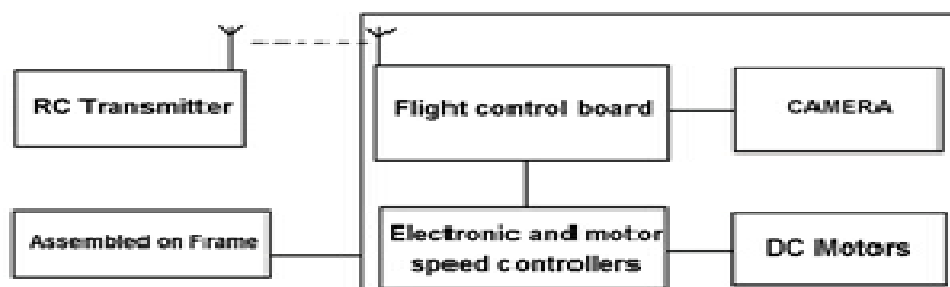- To test the performance of designed Quad copter.

A. Block Diagram

Fig.1. Block diagram of Quad copter

The basic block diagram for quad copter is shown above Fig.1. In the quad copter design the components are fixed on a frame. The quad copter is equipped with a stereo camera & 4 BLDC motors at every arm. To control the speed of motors ESCs are used. The receiver is also fixed on the Arduino Microcontroller. The transmitter is used to give the instructions to the controller.

B. COMPONENTS USED

- *Frame: -*
  Every quadcopter or other multirotor aircraft needs a frame to house all the other components. Things to consider here are weight, size, and materials. We are using the DJI Flame Wheel F450 or one of the many clones. These are great quadcopter frame.

- *Motors: -*
  Motors are rated by kilovolts, and the higher the kV rating, the faster the motor spins at a constant voltage. When purchasing motors, consider how many amps the ESC you pair it with should be and the size of propeller you should use.

- *Electronic Speed Control: -*
  The electronic speed control, or ESC, tells the motors how fast to spin at any given time. We need four ESCs for a quad copter, one connected to each motor. The ESCs are then connected directly to the battery through either a wiring harness or power distribution board.

  An electronic speed control or ESC is an electronic circuit with the resolution to fluctuate an electric motor's rapidity, its track and perhaps act as a dynamic brake. Brushless ESC organizations basically initiative tri-phase brushless motors by distribution arrangement of signs for rotation. Unrelatedly of the type used, an ESC deduces control data not as motorized gesture as would be the instance of a servo, but relatively in a scheme that diverges the swapping rate of a linkage of field effect transistors, or FETs. The speedy switching of the transistors is what origins the motorized the aforementioned to emit its distinguishing high-pitched wail, particularly perceptible at lower speeds. It also permits greatly slicker and additional accurate disparity of motor speed in a distant more well-organized way than the mechanical type with a resistive coil and moving arm once in common use.

- *Flight Control Board: -*
  The flight control board is the 'brain' of the quad copter. It houses the sensors such as gyroscopes and accelerometers that determine how fast each of the quad copter's motors spin. Flight control boards range from simple to highly complex. Here we are using Arduino Flight controller. A quad copter consists of four motors evenly distributed along the quad copter frame as can be. The circles represent the spinning rotors of the quad copter and the arrows represent the rotation direction. Motors one and three rotate in a clockwise direction using pusher rotors. Motor two and four rotate in a counter-clockwise direction using puller rotors. Each motor produces a thrust and torque about the midpoint of the quad copter. Due to the opposite spinning directions of the motors, the net torque about the centre of the quad copter is ideally zero, producing zero angular acceleration. This eliminates the need for yaw stabilization. Anuprightpotency is created by increasing the speed of all the motors by the similar quantity of throttle. As the vertical forces overcome the gravitational forces of the earth, the quad copter begins to Rise in altitude. Pitch is provided by increasing (or decreasing) the rapidity of the front or rear motors. This causes the quad copter to turn along the x axis. The whole erect thrust is the same as hovering owed to the left and right motors; hence only pitch angle quickening is changed.

- *Radio Transmitter and Receiver: -*
  The radio transmitter and receiver allow you to control the quad copter. There are many suitable models available, but we will need at least four channels for a basic quad copter with the KK2.0 control board. We are using a radio with 8 channels, so there is more flexibility for later projects that may require more channels. There are two methods to transmit video wirelessly: using analog transmission or digital transmission. Analog transmitters are

able to accommodate numerous receivers while digital transmitters can only be paired to a single receiver. Having several receivers could be valuable to distinct the quad copter controller screen from the video analysis performed by our computer. The drawback of analog transmission is that it is more susceptive to interference from common household technologies such as wireless routers, cordless land lines, and microwave ovens which basis static on the video feed. Digital wireless is a much more robust system that does not suffer from interference induced static. Advanced excellence video can be transmitted by means of a digital signal and can transmit over farther distances than analog. The digital systems are also larger and heavier than their analog counterparts, making them less ideal for mounting on a quad copter.

- *Video Recording and Transmission:-*
  The choice of video system is one of the most crucial decisions for the project. The camera needs to be light enough so that the UAV can fly unabated and compact enough so that it does not interfere with the landing gear and rotors. The video system must also be able to transmit a suitable distance over open space without interference or losing signal. For our prototype design we will consider 100m to be a suitable range, though many of the products we researched can transmit up to 1000m.

- *Propeller: -*
  A quad copter has four propellers, two "normal" propellers that spin counter-clockwise, and two "pusher" propellers that spin clockwise. For the quad copter configuration in this project, we're using 9×4.7 props.

- *Camera:-*
  There are many altered options for the camera. One of the initial keys is to mount an IP or raspberry pi camera to the fuselage of the quad copter which would be able to produce a high resolution image with its own transmitter. The downside to using such a camera is the necessity to be connected to a network; the system would not be able to function without an internet connection and would not be useful in wilderness areas. Digital cameras and helmet cameras with Wi-Fi connectivity like the Samsung SMART and Go Pro series were investigated. The cameras were designed to have a separate device, such as a smartphone, act as a viewfinder for the camera. Potentially, our viewfinder could display the live video to the operator while the camera records. One detriment to this method is not being able to easily transmit the video to a computer for post analysis.

- *Battery: -*
  Quad copters typically use Li-Po batteries which come in a variety of sizes and configurations. 3S1P batteries are used, which indicates 3 cells in parallel. Each cell is 3.7 volts, so this battery is rated at 11.1 volts.

IV. FLOW CHART

Flow chart Designs of Quad copter are divided into two stages that is part design in first stage and full interface at second stage. Flow chart of Quad copter design is described in Figure below:
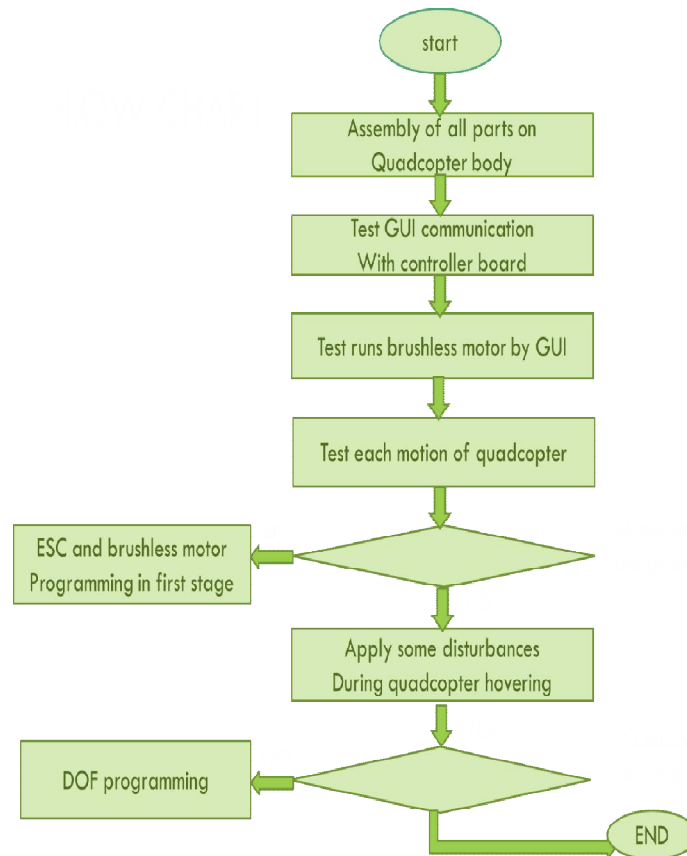
Fig.2.Flow chart of Quad copter

Application
- Coastal surveillance
- Surveillance of large events
- Deployment against human trafficking – monitoring & surveillance
- Traffic surveillance
- Monitoring volcanic eruptions

Advantages
- Acts As Life saver : Drones have come a long way in saving the lives of military personnel, as they are unmanned and even if they are hunted down, no lives are lost.
- Reduced Risk : Drones pose lesser threats to military hardware, due to their smaller size than mainstream aircrafts. They can also fly at a much lower altitude.
- A Great Tool for Surveillance: It is only recently that drones are used in warfare, but before that they were successfully used in spying and helped in aiding military intelligence.
- Easier to Deploy: Deploying drones is much easier than other available options.

V. CONCLUSION

The presented model and control strategies were tested only with simulations. Real experimental prototype of a quad copter should be constructed to achieve more realistic and reliable results. Even though the construction of a real quad copter and the estimation of all the model parameters are laborious tasks, a real quad copter would bring significant

benefits to the research. With a real prototype, the theoretical framework and the simulation results could be compared to real-life measurements. This paper did not include these highlighted matters in the study but presented the basics of quad copter modelling and control. This paper can hence be used as a stepping-stone for future research in more complex modelling of the quad copter.

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