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A Real Time Surveillance Application using Microcontroller Based Quadcopter

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Abstract - The quad copter security system based on Arduino developed for Private security and safety in particular areas like reserved forests and defence areas. The quadcopter system mainly consists of a thermal camera, bee alert, robotic arm, GPS tracking, and roller vehicle is to detect the trespass of humans and wild animals in the protected area. Thermal camera in the drone capture images and it makes bee alert in the border security areas if any trespass happens in the zone. Robotic rescue system in the drone helps to share the GPS location to the base station. In this the drone is not only a flying machine also it has a moving facility like roller vehicle and also it has a robotic rescue system covers a large area for a long time depending upon the power source. Also, the bee sound blows out. When the moving things like the animal (eg: elephant) or human begins both came across its restricted boundary in the forest area. Also the thermal detect and track continually the moving corresponding animal (or) human.

Key Words: Quadcopter, Robotic arm & roller, PID Controller, Navigation, Surveillance

I. INTRODUCTION

A past few years the quadcopter security system is familiar; it is also one of the interesting fields for safety & Security purpose. The first design quadcopter utilized by the French engineer Etienne Oehmichen in 1924. The quadcopter is an unmanned aerial vehicle, which can developed for the various applications such as industrial, security, army and agriculture. Over the past few years, the application of quadcopter has shifted from traditional to more modern. In this presents study a framework of the development for fully automated & advanced smart construction monitoring and reporting system based on the quadcopter. In a various field like that agriculture, defence, research area etc., In this work elaborate the design of quadcopter by pointing out several important factors associated with it. These include the challenge and risky that may come with the project and their solution as well. The system not only provides a convenient and smart way of site supervision and security management it provides a better operation. That project combines three mechanisms such a drone, moving vehicle and robot arm. The configure of quadcopter was (+) plus or (x) cross in design them.

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I will use (X) cross-section configure using them. The lift quadcopter in based on the three major axes (Pitch, Yaw, Roll) them. The closed loop control using that PID Algorithm based on the program and control them. Then attentional setup on the Arduino based to control the arm and moving roller,

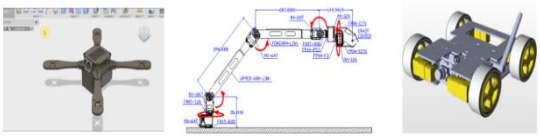
GPS navigation and bee sound speaker, camera operate them.

II. METHODOLOGY

The quadcopter operates in fairly simple but the aeronautic structure design is difficult for it's structure. The designed aeronautical is maintained its aerodynamic structure, it is very helpful for the quadcopter lift and flying. The unmanned Ariel quadcopter (UAQ) is designed by the hardware and software section which connected separately.

2.1 Hardware Design:

The UAQ have a different hardware such as roller, and robot arm. All the hardware are designed by AutoCAD and manufactured by CNC[1]. The three different combinations combine in the one vehicle to flying on the space and ground surface moving them and pick and place the object them. The hardware design of UAQ, robot arm and roller shown in Fig.1. following them.



(a) Prototype design ofUAQ(b)Robot arm
(c) Robot roller

Fig.1.Hardware design

2.2 Quadcopter Body,Roller& Arm:

The quadcopter frame is made by carbon fiber sheet or alloy material (aluminium, steel) with the help of CNC milling. The stand also using alloy material the weight reduction. The configure structure is designed by cross (x) section manner [4][6]. Aeronautic structure in the construct in the center position of weight balanced based design them. Fig.2 Block diagram of vehicle setup. The top side in the robot arm and quadcopter bottom side will be moving roller to plan in the body structure. The bee sound speaker and IR camera in the side angle fitting them. The robot will be an acrylic sheet to design UAQ because the weight reduction, high stability, elasticity, strong material and milling.

The automatic stand will be in the ground nearest UAQ the stand will be on the condition in particular height, UAQ closed the stand with the near field. The suspension also the pressure in absorb them. The stand-in attaches the camera. The stand is closed and open in the flying time. Three different types of motor

i. BLDC Motor – quadcopter (2-clockwise and 2-counter clockwise)
ii. Servo Motor – robot arm (pick and place the object)
iii. Gear motor – roller (front, back, left and right direction moving the roller)

2.3 Motors And Controller Or Drivers:

BLDC Motor and Electronic Speed Controller:

The BLDC motor mainly consist of two parts rotor (rotate magnets) and stator (winding the coil). In the center of the rotor of the motor is contain with two poles permanent magnet. And three-phase winding and hall sensor placed in 120 degrees. The motor rotate in two sides clock and antilock, the CW rotation for phase 1 to 2 then CCW rotation in 2 to 1 them. The working motor in that two wire in attach the multimeter produce the sound that result is motor fine condition them. The electronic speed controller (ECS) is used to regulate the speed of the BLDC motor. The N-Channel power MOSFET principle working them. The features. Speed control mainly translates a pilot's control into precise instruction sent to the motors to control movement. The features of N-Channel MOSFET of low ON resistance, 4.5 V drive and halogen-free compliance large current, slim package and protection diode them. Main features of ESC: implanting a sensorless FOC algorithm (better torque control, vibration reduction, noise reduction). A standard flight control unit consist of (PWM or CAN), temperature overheating production. Output peak current: 30 Amps. Root means Square current: 20 Amps.

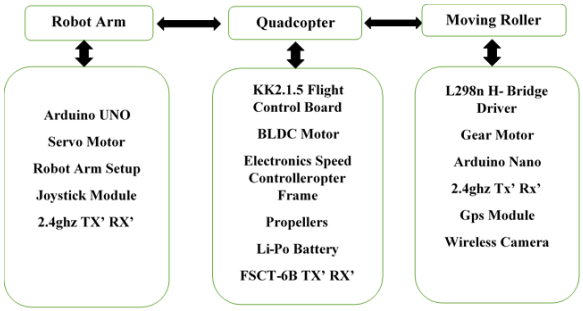


Fig.2 Block diagram of vehicle setup

2.4Gear Motor &L298N Dual H-bridge Driver

The roller in the body constructs to alloy aluminum in a thickness of 2mm the width & length of roller 130mm * 130mm. The two gear motor with the 300 RPM -12v in torque range of 2kg. The L298N dual h-bridge driver will control the motors the coding for Arduino IDE in the left-right & front-back movement in condition to operate the driver.

2.5 Power Supply:

The li-Po (Lithium Polymer) 11.1v and 5000mAh power storage battery is used in UAQ. The battery capacity is 5200mAh at 5Ah shown in Fig.3. 5000mAh Li-Po battery. It works out the charge current at max level. The three cells in series are equal to the nominal voltage 3*3.7=11v them. The BLDC motor has the higher RPMwhich means more power. The compact weight and high current & voltage them. The quadcopter and roller using power distribution in the Li-Po battery in range of 11.1v -5200mAh rating in them. Then the robotic arm (servo motors) and IR camera and bee sound in power to 12v to the 5v converter in servo motors operate them.

Fig.3. 5000mAh Li-Po battery

III. WORKING ANALYSIS AND DISCUSSION

Quadcopter system works on the principle of air-lifting actions with high pressure. The create a forces the plane to downward with high pressure, as a result, a noble force has been created and the whole functional reaction law is used in the entire system as a result. When the gravitational power of the earth dominates this supreme power, the whole system will fly in the air. But there is a problem in the cycle of cycles. If we rotate the cycle in clockwise directions depending on this cycle, it will be used in one direction and in one direction in one direction. Likewise, if we rotate the cycle in the direction of the compass curve, the entire system and the whole system start to rotate in advance. To cope with this problem, we rotate two terminals in the direction of rotating, twisting two strokes. This phenomenon produces torque in the opposite direction and the computer is stable when they get the balance and are flying. Shown in Fig.4. Block diagram of surveillance robot.

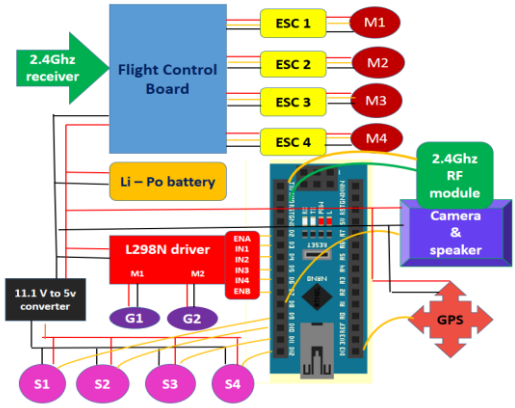


Fig.4. Block diagram of surveillance robot

Two basic phenomena used for movement quadcopter, thrust and torque. The Quadcopter uses its four propeller engines, which creates an increase and helps quadcopter to increase the height. The quadcopter movement is defined by input values (x, y, z, θ, ϕ, ψ). Four motor coupled with the proprietors rotate in two motors clock wise (CW) in the direction of the other two counter clockwise direction (CCW).

Quadcopter's movement is mainly controlled by three movements. These movements are classified

Yaw Rotation (ψ)

The movement of the left or right or quadcopter is defined as the movement and is controlled by the transmitter's throttle stick. Yaw decides the direction of quadcopter.

Pitch Cycle (θ)

Pitch is defined as the whole movement of the Quad-poker in the forward or backward direction. This is controlled by the rheumatic tiredness. The quadcopter moves in the rear directions when the quadcopter moves while moving forward in the direction of moving forward in direction [2].

Roll Rotation (ϕ)

The movement about the longitudinal axis of quadcopter is known as roll motion. Left or right motion of throttle stick is followed by quadcopter, it moves in towards right when throttle move to right and moves to left when throttle stick moves in left direction. This parameter thus makes quadcopter to fly in left or right direction. [2].

The Drone-based kk2.1.5 air control board flying PID control and inhaled gyro sensors on board. Package point error will automatically adjust them to the pitch, yaw, and roll in the variant. The error occurred in the area of the side pinch way to increase or decrease the speed of the movement. The aircraft control board is very easy to operate and user friendly. Remote control t o adjust the values found easily by using the remote testing option. The four BLDC Motor Control Board connects UAQ motars. Four motors and cameras can be adjusted using the gyro level, using 4 wings rather than the other two propellers and Brushless motor transformer to work for electronic speed control and accurate broadband modulation. Wireless Night Vision Camera to capture the image and broadcast to display the laptop in the range of 30m. The control over the remote control receiver is controlled by the RF module and the controlling vehicle and control of the robot hand signal (ESC). Arduino UNO is used to capture the page due to higher analog and digital pins. Arduino UNO was used to hand and vehicle movement to control the joystick.

3.1 Flight Control Board

The KK2.1.5 FCB Air Control Panel is used for the flight control operations because it consists of PID closed loop controller. The main advantage of gyroscope to build the board in a stable condition. The process of using ATMEL mega 644p and 344p[5]. The 8bit AVR RISC based microcontroller includes 64 MB memory. ATmega328 is used for quadcopter, which takes the signal of the gyroscope (pitch, yaw, and roll) in three axis control ATMEL mega 328p. The LCD display adjust the value.

3.2 Communication System

Here all the communication system mainly based on (RF) radio frequency. The UAQ will work on the frequency of 2.4 GHz. PCM and PWM generated in the Air Control Board and Electronic Speed Controller has controlled and then the Arduino vehicle also controlled by RF hand move using RF Module 2.4GHz to transmit and receive signals shown in Fig.5. Flysky 6-channel & configuration. GPS for Navigation can use the location to monitor and find out the location of the trespass to easily reach the spot. Night view camera captures within a 30-meter view range [3].

Fig.5. Flysky 6-channel and configuration

IV. GENERAL FIELDS OF USE:

Quadcopter system mainly detects humans and wild animals in a protected area, by the use of such parameters like thermal camera, bee alert, robot arm, GPS tracking, and roller vehicle. In the drone capture films by the thermal camera and any obstacle occur in the zone, which warns the bee alert in the border areas. The forest enters the human settlement, flying into the quadcopter to find the night time in the forest to enter the wild elephant or other wild animals. The human and wild animal prevents the GPS being sent to the control center. The 'sounding sound' of the bees run by the loudspeakers are irritating to the elephant away from that place. The roller moves them to the surface of the underground surface to be covered.

4.1 GPS Navigation:

Quadcopter has GPS navigation to detect violation of humans and wild animals in the protected area. If drone capturing films in protected area zone, the bee awareness occurs in the border protection areas. The robot recovery system in the drone helps to share the GPS location to the base station. Shown in Fig.6. IDE serial monitor output for GPS location & Google map at location.

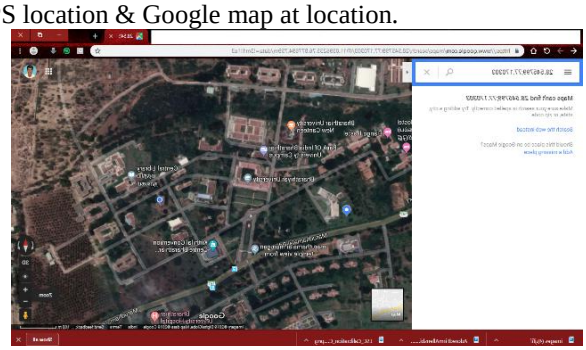


Fig.6. IDE serial monitor output for GPS location & Google map at locaion

4.2 Control Algorithm

The PID controller is used for quadcopter has closed loop controller, which used to control and an automatic errata control. Shown in Fig.7. Flow Chart Control algorithm. The main parameters of the goats, which are automatically balanced in the angle. The current error is the B-reaction, the latest error I am going to do to calculate the D-fault mathematically to the aerodynamic standard [2].

$$u(t) = k_p e^t + k_i \int_0^t e(\tau)d\tau + k_d\, de/dt$$

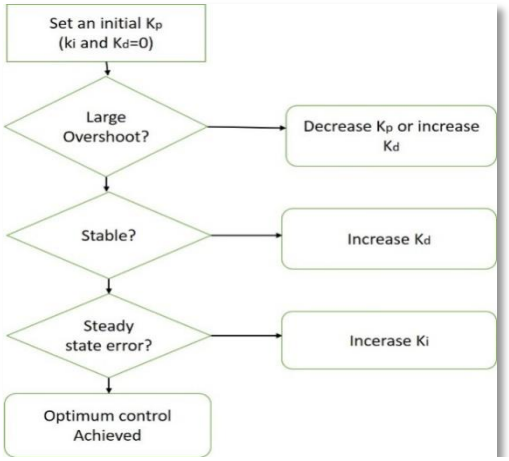


Fig.7. Flow Chart Control algorithm

4.3 Quadcopter Control Mixing:

The quadcopter controller that combines the mixture with the mix is mixed to some parameter (θ, Ψ, ϕ, Z) from the control of each rotor. Quadcopter them dynamic balance. The cross (x) layout control signal is followed on the motor following them.

$$mc_1 = z_c - \theta_c - \phi_c - \Psi_c$$

$$mc_2 = z_c - \theta_c + \phi_c + \Psi_c$$

$$mc_3 = z_c + \theta_c + \phi_c - \Psi_c$$

$$mc_4 = z_c + \theta_c - \phi_c + \Psi_c$$

V. CONCLUSION

This research work provides an inexpensive and affordable cost for the successful development of the Arduino Uno-based Quadcopter. Quadcopter which is easy to generate unit components. It can be used as a low price alternative for many applications, such as pesticide spraying, monitoring of other transmitters such as safety at the transmitter's RF range, monitoring of other key areas such as national border, and mapping through remote sensing with high Precision.

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