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Self-Balancing Multipurpose Quadcopter for Surveillance System

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Abstract: ***The design of flying surveillance system in the form of quadcopter with automatic balance of level is presented in this paper. Here through special type of arrangement of different types of electronic components with proper programming the design has been implemented. The function of Gyroscope sensor is responsible for the balance of tilting of the system. The copter will serve as a surveillance system with advanced functioning facilities especially in the fields such as no-man's land to give the information of the situation in the borders. If this gets any obstruction it can balance itself by its own. Due to the presence of highly efficient functional methods such as computerized vision and location tracking with internet facilitated identification can create the ultimate system development.***

Keywords: Copter, Surveillance, Tilt, Gyroscope, Self-balance.

I. INTRODUCTION

Over the last few years a massive growth has been observed in the manufacture and sales of remote control drone or quad copter. In the standard format, two propellers spin in a clockwise direction while the other two propellers spin in an anti-clockwise direction allowing to fly in a designed direction. This is an auto-levelling quad-copter that is easy to build and has application based flying capability. Auto levelling means that, after releasing the control the quad copter can balance at centre position level by itself. This moderate level flight controller needs a simple and understandable code that to build an auto-level quad copter flight controller. This includes a battery, transmitter, charger, etc.

A Drone or Quadcopter is a vehicle with large potential for performing tasks that are dangerous for human beings such as the inspection of high structures, humanitarian purposes or search-and-rescue missions. One specific type of Drone is becoming increasingly more popular lately the quadcopter when visiting large events as professional quad copters can be seen that are used to capture video for promotional or surveillance purposes. A quadcopter can achieve vertical flight in a stable manner and be used to monitor or collect data in a specific region such as loading a mass. Technological advances have reduced the cost and increase the performance of the low power microcontrollers that allowed the general public to develop their own quadcopter. The design of this flying surveillance system in the form of quadcopter with automatic balance of level is presented in this paper. Here through special type of arrangement of different types of electronic components with proper programming the design has been implemented. The function of Gyro sensor is responsible for the balance of tilting of the system. The copter will serve as a surveillance system with advanced functioning facilities especially in the fields such as no-man's land to give the information of the situation in the borders. If this gets any obstruction it can balance itself by its own.

II. METHODOLOGY

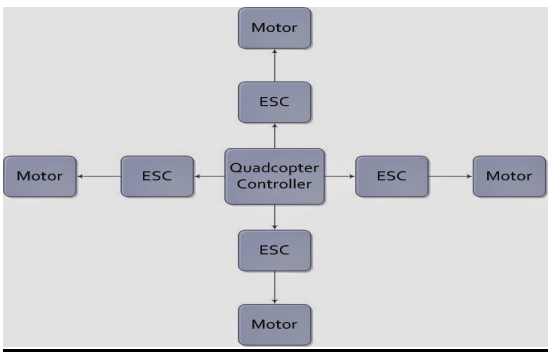


Fig. 1: Schematic Diagram of the Auto-balancing Quadcopter

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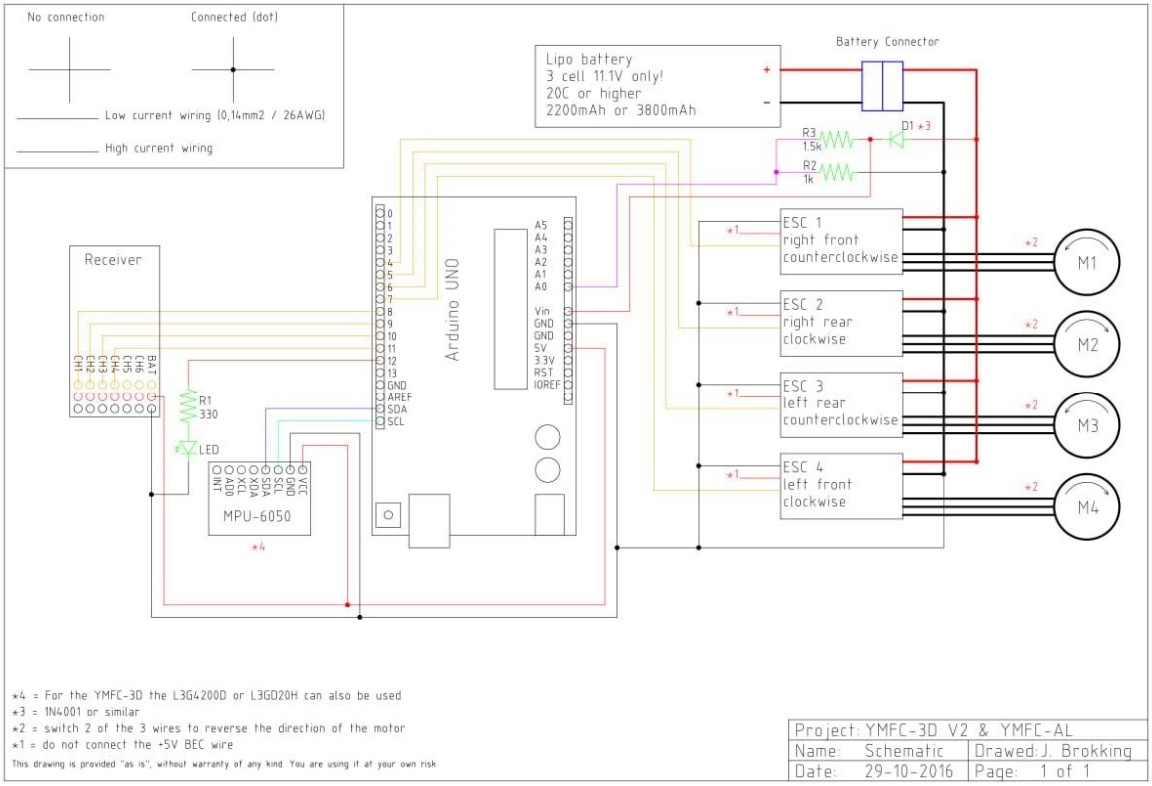


Fig. 2: Circuit Diagram of the Auto-balancing Quadcopter

For making a quadcopter basically APM2.8 is used as a flight controller but for this case Arduino Uno is used. This basic component list is sufficient to build the Self-levelling quadcopter. 450 size frame with integrated power distribution board, 1000kV motor / 10x4.5 props / ESC combo, 3S / 2200mAh / 30C lipo, Arduino Uno, MPU-6050 gyro / accelerometer, Flysky FS-T6 6-CH TX Transmitter, 2S/3S lipo battery charger. Some small parts such as three resistors (1.5kΩ & 1kΩ & 330Ω), a 1A diode (1N4001 or similar), LED, some wire, a connector for the flight battery, switch etc. are needed. The diode D1 protects the USB port of the computer when the Arduino is connected to the computer. This diode has an important function and cannot be excluded. The resistors divide the flight battery voltage by 2.5. In this way it is possible to control the battery voltage during flight. The LED will light up when the battery voltage gets to low and the motor rpm automatically increase to compensate the dropping battery voltage during flight. The 1kΩ and 1.5kΩ resistors need to be installed correctly otherwise the quadcopter will not fly perfectly. The only gyro / accelerometer that is supported by the YMFC-AL software within MPU-6050. This is because the auto-level feature requires an accelerometer and a gyro.

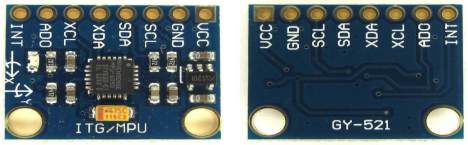


Fig. 3: MPU-6050 Gyro/Accelerometer

The orientation of the gyro is not important as long as the Z-axis is vertical (perpendicular to the surface) and the edges of the gyro are aligned with the edges of the quadcopter. The setup software will detect the gyro sensor's orientation and invert the gyro and accelerometer axis when necessary.

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Fig. 4: A2212 1000KV Brushless Motor for RC Airplane / Quadcopter



Fig. 5: 30A Brushless Motor ESC for Airplane Quadcopter



Fig. 6: 1045 Propeller 10in 10x4.5 for Drone



Fig. 7: DJI F450 Quadcopter frame Kit



Fig. 8: Arduino Uno R3 + Cable for Arduino Uno

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A. Setup & Calibration Steps

1) Run the setup software
2) Receiver and gyro check
3) Receiver input check
4) Gyro and accelerometer angle check
5) Calibrate the ESC's
6) Balancing the motors and props
7) Upload the flight controller software

III. RESULT AND DISCUSSION

The output results of the highly efficient quadcopter show proper movement control and self-balancing in the operational phase. The weight of the designed system is light because of the use of the light weighted components.



Fig. 9: Pictorial representation of the designed Quadcopter

IV. CONCLUSIONS

While the initial goal of creating an autonomous quadcopter capable of sensing obstacles was not reached, still the learning process is continuing for a substantial amount about robot design, fabrication, control, and Arduino programming. These information is used for quadcopter frame down selection and control. The translation in the XYZ-axes can be implemented. The dust sensors for dust monitoring in the climate can be added and preventing this by awaking people to stay alert form that heavily polluted places as the initial goal. GPS tracker, image processing, QR scanners can be implemented in this design to get the service of parcel delivery in the emergency time or special areas especially for today's scenario of COVID19.

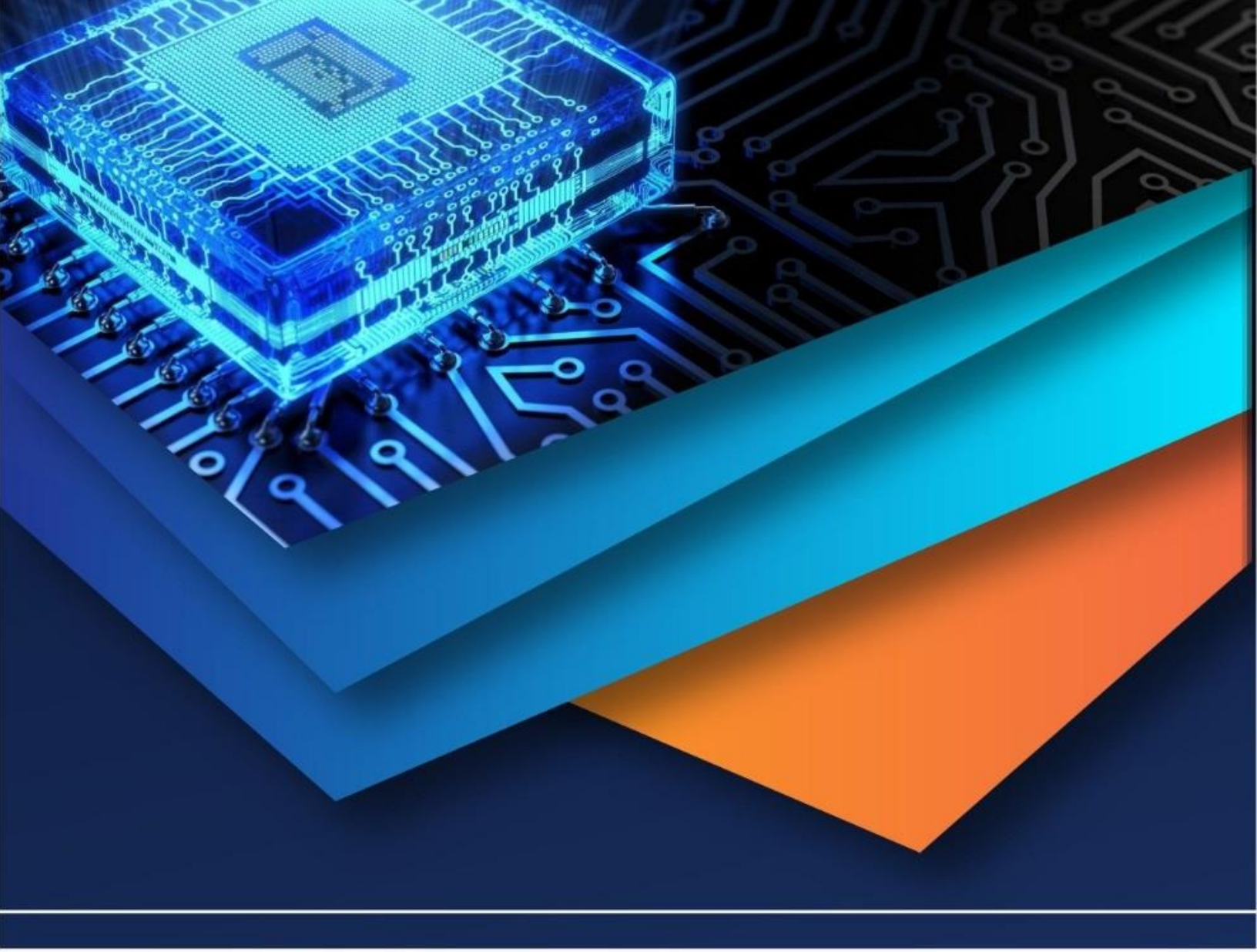
V. ACKNOWLEDGMENT

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