# QUADCOPTER DRONE USING ARDUINO UNO

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**ABSTRACT: A quadcopter is classified as aircraft known as an unmanned aerial vehicle (UAV) means it does not need a pilot on board to fly it. Due to its stable flight performance, it can be used as for surveillance, aerial photography, field survey, weather broadcasting, etc. It can be operated remotely or can be autonomous. In this paper, we will learn about the design application and future scope of quadcopters. We are aiming to reduce the weight and size of the quadcopter to decrease the price by selecting suitable components.**

**KEYWORDS: Quadcopter, BLDC, Microcontroller, Transmitter - Receiver, Flight controller.**

## 1. INTRODUCTION

In recent years, the versatility and user-friendly nature of quadcopter drones has made them increasingly popular. They offer a broad range of applications, including surveillance, agriculture, and aerial photography. Quadcopter drones are generally operated through a wireless remote control and can perform several movements such as hovering, taking off, and landing. This paper outlines the design and creation of a quadcopter drone utilizing an Arduino Uno microcontroller.

A quadcopter drone is a popular unmanned aerial vehicle that can move and fly in the air using four rotors. With the use of an Arduino Uno microcontroller board, you can control various components of the drone, including its motors, sensors, and communication devices.

Before constructing a quadcopter drone with Arduino Uno, you must acquire all the essential components, such as the frame, motors, propellers, flight controller, battery, and radio receiver. Once you have the necessary parts, you must carefully assemble and connect them to ensure their seamless operation.

Once the hardware is assembled, you can program the Arduino Uno board using software like Arduino IDE. With this software, you can modify and regulate the quadcopter's motor speed, altitude, and direction, among other functions. Testing and calibrating your quadcopter drone before the flight is crucial to guarantee its safety and effectiveness. Moreover, it is crucial to comply with all relevant laws and regulations relating to the usage of drones to avoid any potential mishaps or legal ramifications.

## 2. LITERATURE REVIEW

Building a quadcopter drone using an Arduino Uno as a controller has become increasingly popular among hobbyists and enthusiasts. A wealth of resources, including tutorials, guides, and open-source code libraries, are available online to help individuals get started with the project.

Several studies have examined the feasibility of using an Arduino Uno as a flight controller for a quadcopter drone, concluding that it is a cost-effective and accessible solution for developing stable and responsive flight control. Additionally, the platform's ease of programming and sensor integration is a viable option for developing autonomous quadcopter drones using GPS and ultrasonic sensors. The literature emphasizes the flexibility and programmability of the Arduino Uno as a platform for controlling the various components of a quadcopter drone, such as the frame, motors, propellers, and sensors. Furthermore, the review article highlights the different control methods used in quadcopter drones, including manual, semi-autonomous, and autonomous control.

In summary, the literature suggests that using an Arduino Uno as a controller for building quadcopter drones is an accessible and customizable option for hobbyists and enthusiasts. However, the project can be challenging and complex, requiring knowledge and skills in electronics, programming, and mechanics.

## 3. DESIGN AND METHODOLOGY

Building a quadcopter drone with an Arduino Uno controller involves a series of crucial steps that require precision and technical expertise. First, the frame of the drone needs to be designed and constructed with lightweight and sturdy materials to support the motors, electronics, and batteries. Then, appropriate motors and propellers need to be selected and installed onto the frame, followed by the installation of necessary electronic components like sensors, GPS modules, motor controllers, and the Arduino Uno board.

Once all the components are installed, the battery needs to be tested to ensure it provides enough power for the motors and electronics to enable stable and responsive flight. Assembling and testing the drone is the next step, which involves conducting indoor and outdoor flight tests to check for any issues such as motor failure or malfunctioning electronics.

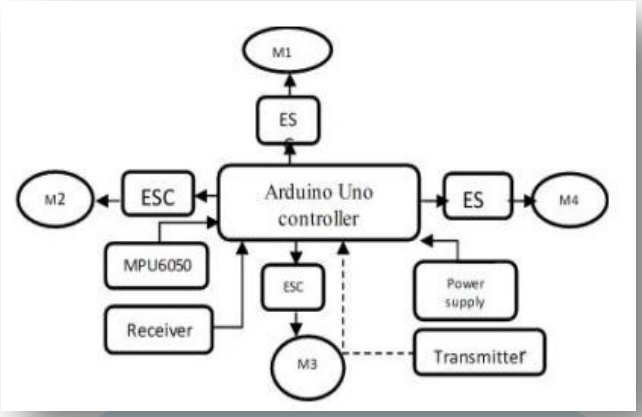


**Fig. 1 Block Diagram of Proposed Work**

The calibration process is essential to ensure that the drone's sensors and other components are adjusted correctly for stable and responsive flight control. Finally, the drone's control systems must be tested using a remote controller or through autonomous flight control systems to ensure stable and responsive flight.

Overall, building a quadcopter drone with an Arduino Uno controller requires expertise in electronics, programming, and mechanics, as the project can be challenging and complex.

**3.1 Arduino UNO**

In the world of quadcopter drones, Arduino Uno has become a popular choice as a microcontroller for its versatility and ease of use. The quadcopter drone's movement is controlled by the Arduino Uno, which is a circuit board equipped with sensors that can detect any orientation changes.

The Arduino Uno receives different commands from the user to control the speed of motors, ensuring that the quadcopter remains stable in fly mode. The controller board and Electronic Speed Controllers (ESCs) work together, with the flight control board giving commands to the ESCs. The ESCs, in turn, receive these commands from the microcontroller circuit board and further give commands to the motors for rotation. The flight control board generates various commands for ESC and motors according to the user's needs, controlling the entire system.

In addition to controlling the motors and ESCs, the Arduino Uno also includes an accelerometer and gyro meter, which help with the stabilization of the quadcopter drone. The microcontroller acts as the brain of the quadcopter, responsible for all actions a quad can perform, from take-off and landing to autonomous flight as well as camera and sensor control.

**3.2 ESC (Electronics Speed Controller)**

In the quadcopter drone design, Electronic Speed Controllers (ESCs) play a vital role in controlling the speed and direction of the brushless motors that drive the propellers. The ESCs receive the PWM signal from the flight controller or radio receiver, which is then converted into electrical power that is delivered to the motors. By manipulating the magnetic forces created by the windings and magnets within the motor, the ESCs can regulate the motor's speed and direction of rotation. In essence, the ESCs act as an intermediary between the flight controller and the motors, ensuring that the motors operate at the desired speed and direction, which is essential for achieving stable and responsive flight control.

**3.3 Gyro and Accelerometer (MPU6050)**

In a quadcopter drone, the MPU6050 sensor is an essential component that combines both a gyro and an accelerometer into a single package. The accelerometer measures linear acceleration and detects changes in the drone's speed and direction, while the gyro measures angular velocity and detects changes in the drone's orientation. It provides real-time data on the drone's movement and orientation, which is crucial for the flight controller to maintain stable and responsive flight control. By constantly analyzing the drone's orientation and movement, the MPU6050 helps to stabilize the drone during flight and compensate for external factors such as wind or turbulence.

The MPU6050 is an important sensor for maintaining the drone's position and orientation in the air, providing the flight controller with accurate data on the drone's movement and ensuring a stable and safe flight.

**3.4 Working Principle**

A quadcopter drone uses the principles of aerodynamics to achieve flight. It features four propellers that generate a high-pressure airflow, which results in an uplift force that counteracts the earth's gravitational pull, enabling the drone to fly. As the propellers rotate, they create a torque force that tends to rotate the drone in one direction. To maintain stability during flight, two propellers are rotated in a clockwise direction, while the other two are rotated in an anti-clockwise direction, canceling out the torque forces and keeping the system balanced.

The flight controller is responsible for regulating the speed and direction of each propeller, allowing for control of the drone's movement. This control is achieved through the use of sensors such as the MPU6050, which provide real-time data on the drone's orientation and movement. By analyzing this data and making adjustments to the propeller speed and direction, the flight controller can maintain stable flight and allow the drone to perform various maneuvers.

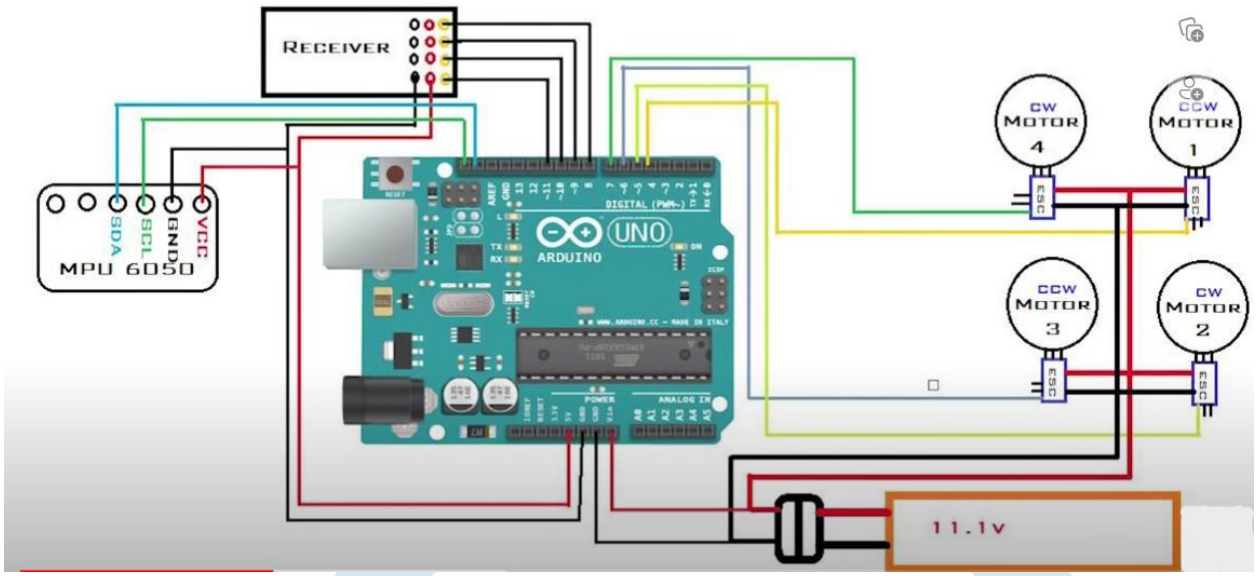


**Fig. 2 Circuit Diagram of Quadcopter Drone Using Arduino Uno**

## 4. CONCLUSION

In summary, utilizing an Arduino Uno as a controller for a quadcopter drone can be a fascinating and fulfilling project for enthusiasts and hobbyists alike. The Arduino platform provides an adaptable and customizable solution for handling the drone's motors, sensors, and other components.

However, constructing a quadcopter drone can be challenging, requiring expertise and proficiency in electronics, programming, and mechanics. It is essential to meticulously design and assemble the drone, subject it to rigorous testing, and adhere to safety protocols to prevent accidents or equipment damage.

Furthermore, it is important to recognize that there are numerous other platforms and technologies accessible for constructing drones, and the selection of Arduino Uno may be influenced by specific requirements or preferences. All things considered, constructing a quadcopter drone using Arduino Uno can be an exciting and informative experience for those with an interest in the field of robotics and automation.

This paper has demonstrated the development and execution of a quadcopter drone through the use of an Arduino Uno microcontroller. The drone was capable of executing multiple movements, such as takeoff, hovering, and landing, responding to user commands from the wireless remote control. The quadcopter drone design proposed in this study offers an affordable option for creating a drone suitable for a variety of purposes.

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