Single Arm Copter Project Report

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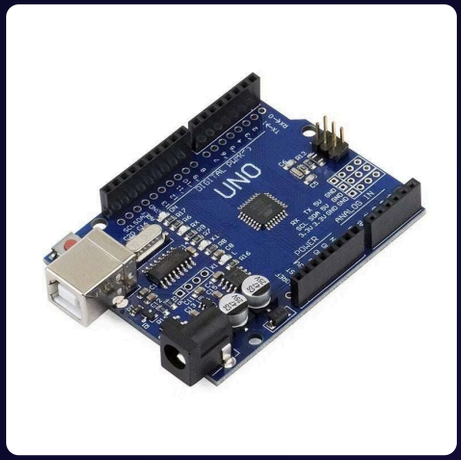
Components Used



Arduino Uno

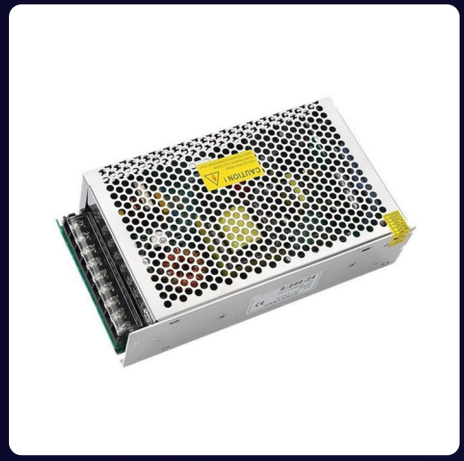
The Arduino Uno serves as the microcontroller for the copter. It processes sensor data and controls the brushless motor.

Wood Frame (18 cm)

An 18 cm long piece of wood acts as the main structural support for the copter. Its lightweight nature helps maintain an overall low weight for the UAV.

Brushless Motor (EMAX 1400KV - XA2212)

The EMAX 1400KV brushless motor provides the necessary thrust to lift the copter. Its high efficiency and power-to-weight ratio make it suitable for this application.



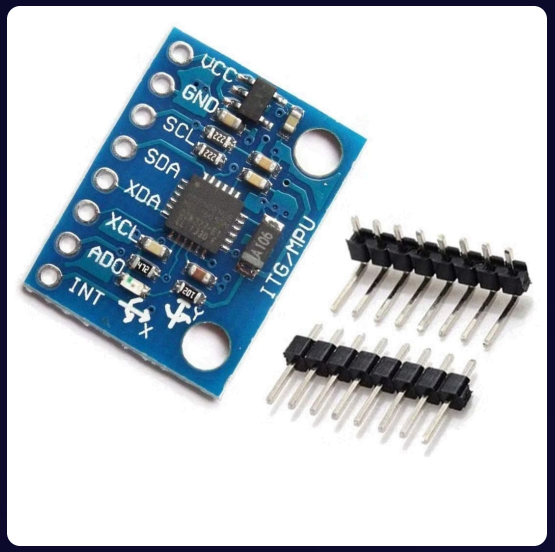
Power Supply (SMPS S-200-12)

The SMPS S-200-12 is a switching power supply that provides a stable 12V output, sufficient to power the motor and other electronic components. With a current capacity of 16.5A, it ensures reliable operation.

Components Used (Continued)

Propeller (EPP 10x4.5 Inch)

The EPP 10x4.5 inch propeller is designed for standard rotation, optimized for the thrust requirements of the motor. Its size and pitch contribute to the copter's lift and maneuverability.



GY-521 MPU6050 Accelerometer and Gyroscope Module

This module is essential for stabilization and navigation. It provides real-time data on orientation and acceleration, allowing the Arduino to make necessary adjustments for stable flight.

Design Considerations

1 **Weight Distribution**

Maintaining a balanced weight distribution is vital for stable flight. The placement of the motor, propeller, and sensors was carefully considered to ensure the copter remains level during operation.

2 **Power Management**

The choice of a high-capacity power supply ensures that the motor can operate at peak performance without draining the battery too quickly. Efficient power management is essential for extended flight times.

3 **Control Algorithms**

The integration of the GY-521 MPU6050 allows for the implementation of control algorithms that stabilize the copter during flight. This involves using feedback from the sensors to adjust the motor speed dynamically.

4 **Propeller Selection**

The propeller's size and pitch were chosen to match the motor's specifications, ensuring optimal thrust and efficiency. Testing different propeller configurations can lead to improved performance.

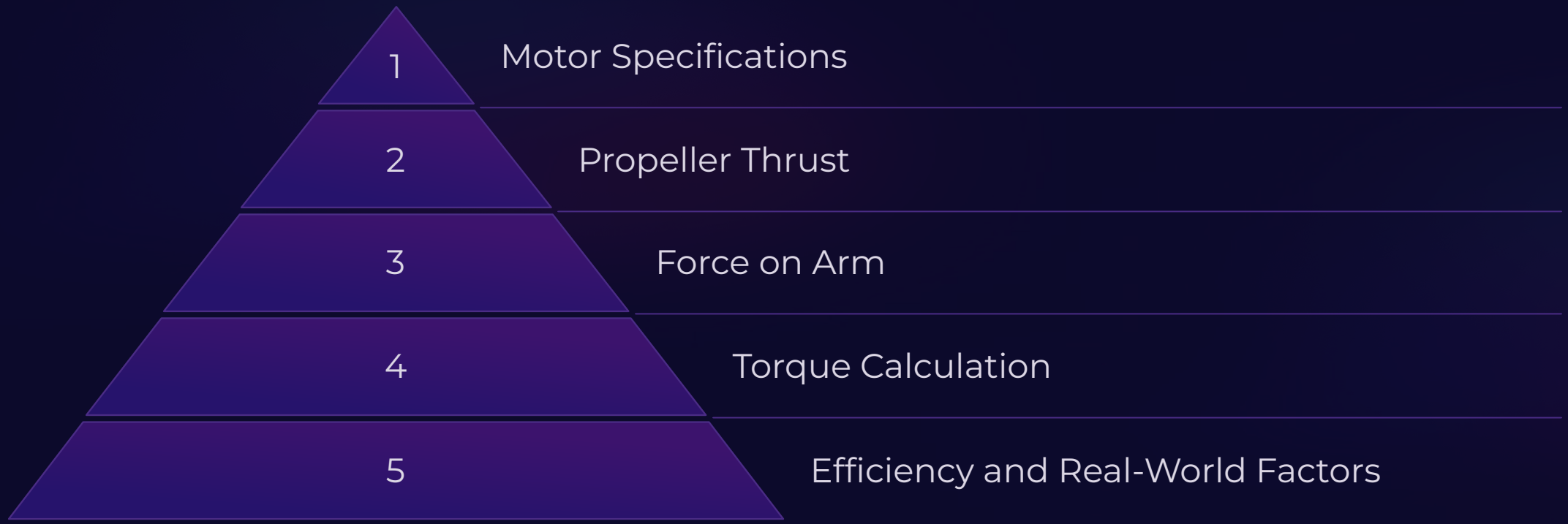
Total Weight

The total weight of the copter, including all components, is approximately 300 grams. This lightweight design is crucial for achieving flight capability while ensuring efficient power consumption.

The single-arm copter project successfully integrates various components to create a functional UAV. With its lightweight design and efficient power management, the copter demonstrates the potential for further developments in aerial technology. Future work could involve enhancing the control algorithms, exploring different frame materials, and adding additional sensors for improved navigation and stability.

Torque Calculation

To calculate the torque of a brushless motor like the EMAX 1400KV, you can follow these steps:



Torque Calculation (Continued)

Step 1: Understand the Motor Specifications

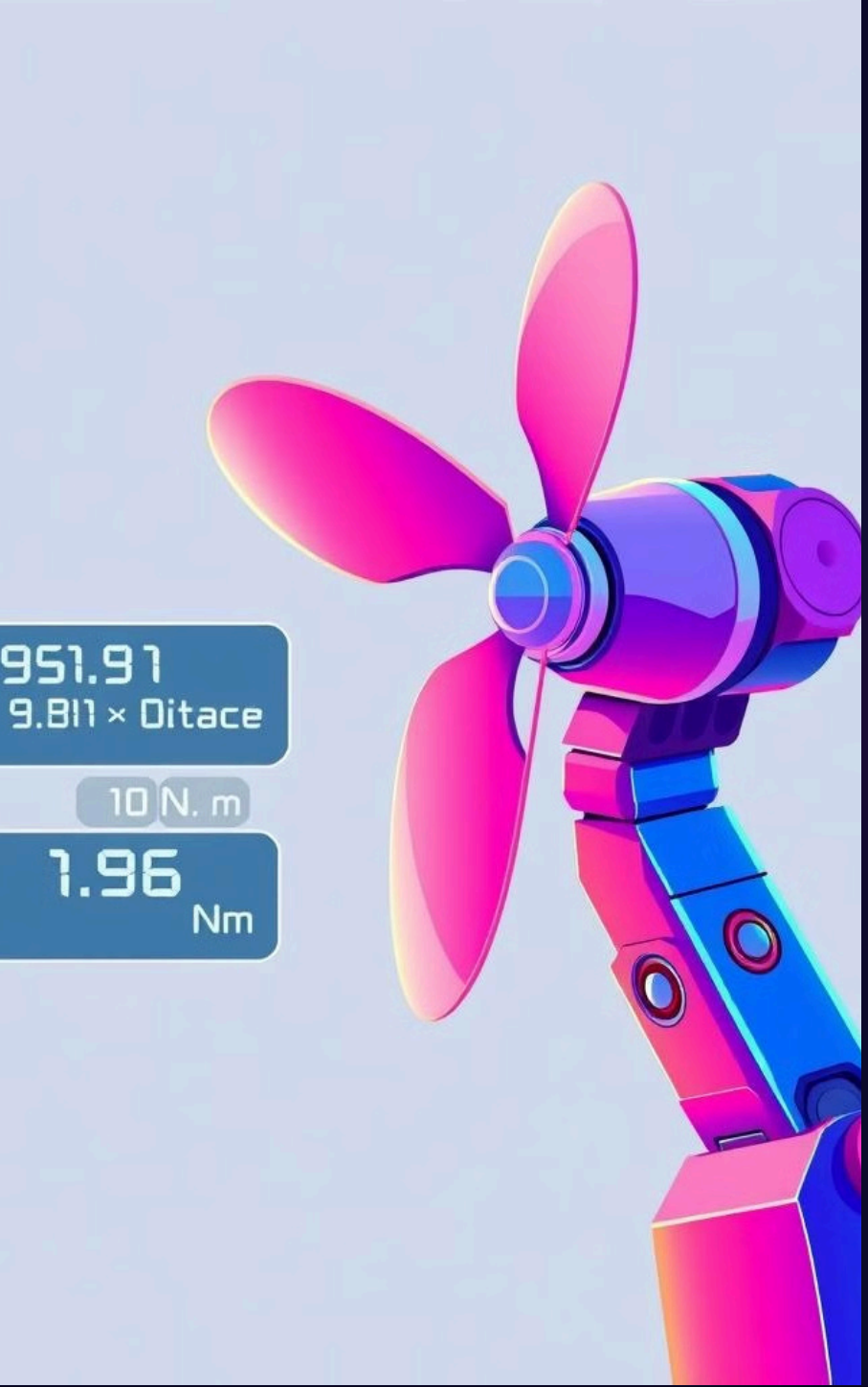
- Motor KV Rating: The EMAX 1400KV means the motor will spin at 1400 RPM for every volt applied. At 12V, the theoretical maximum RPM is: RPM = 1400*12 = 16800 RPM

Step 2: Calculate the Propeller Thrust

1. Propeller Characteristics: The thrust produced by the propeller can be estimated using thrust tables or empirical formulas. For a 10x4.5 propeller, thrust can vary based on RPM, but for rough calculations, you might assume a thrust of about 1 kg (1000 g) at full throttle.

Step 3: Determine the Force Acting on the Arm

- Weight of the Copter: The total weight of your copter is 300 g, which needs to be lifted by the motors.



Step 4: Calculate the Torque

Torque can be calculated using the formula:

Torque = Force * Distance

Where:

- Force is the thrust in Newtons (N).
- Distance is the length of the arm (18 cm = 0.18 m).

1. Convert thrust from grams to Newtons: Force = (1000 g /1000) * 9.81 m/s^2 = 9.81
2. Now, plug in the values: Torque = 9.81 N * 0.18 m ≈1.76 Nm

Step 5: Consider Efficiency and Real-World Factors

- In real-world applications, consider motor efficiency, propeller efficiency, and any losses in the system. You may want to reduce the calculated torque by a certain percentage (e.g., 20-30%) to account for these factors.

Conclusion

The estimated torque required to lift the copter using the EMAX 1400KV motor with a 10x4.5 propeller is approximately 1.76 Nm. Adjust this value based on real-world testing and efficiency considerations.