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Report: XXD A2212/6T brushless motor kv2200 Test

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1) Introduction:

This experiment focuses on determining the thrust required for a wall-climbing robot to maintain static equilibrium at various angles of inclination. A linear relationship between throttle and thrust was developed for precise control of the robot's propeller-driven thrust mechanism.

Experimet Setup:

- **Robot Weight**: 650 g.
- **Thrust Mechanism**:
  - 6-inch, 3-blade propeller driven by a motor and 50A ESC.
  - Powered by a 3-cell, 3200 mAh LiPo battery (35C).
- **Data Collection Tools**:
  - Thrust: Measured using a digital scale.
  - RPM: Measured using an IR sensor connected to an Arduino.
  - Throttle: Controlled and measured using a FlySky transmitter and receiver.

2) Methodology

Throttle vs. Thrust Data Collection

- Thrust was recorded for throttle inputs ranging from 10% to 100% using a **digital scale**.
- The **FlySky transmitter** was used to control the throttle levels, and the **Electronic Speed Controller (ESC)** regulated the motor speed accordingly.

Speed Measurement

- The rotational speed of the motor was measured using an **infrared (IR) sensor** connected to an **Arduino**.
- The IR sensor detected interruptions caused by a marker on the motor shaft, which was used to determine the frequency of revolutions.
- The frequency was then converted into **RPM** using the formula:

  RPM=Frequency (Hz)×60 / Number of Pulses per Revolution.

Thrust Calculation for Inclination Angles

- For a robot driving on an inclined plane, the gravitational force (weight, W) is decomposed into two components:
- Parallel to the incline: **W.sin(θ)**
- Perpendicular to the incline: **W.cos(θ)**
  Where (**θ**) **theta** is the angle of the incline.
- The normal force is equal to the perpendicular component of the weight:

  Fnormal = W.cos(θ)

  This is a well-established relationship in physics for inclined planes (Physics Classroom).

  The above calculation was used to determine the thrust required for different inclination angles (from 0° to 90°).

Throttle Setting for Specific Angles

- A **linear regression model** was applied to determine the throttle values corresponding to the calculated thrust levels for different inclination angles.
- This ensured the robot operated efficiently, using the optimal throttle settings to avoid power wastage, especially under power limitations, while maintaining high accuracy in motor and gyro coordination.

3) Purpose and Benefits

- Power Optimization: By determining the optimal throttle setting for various angles, the experiment helps ensure that the robot uses the least amount of power required to ascend or navigate different inclines. This is crucial for applications with limited power resources.
- Motor and Gyro Coordination: The test aims to enhance the synchronization between the motor and the gyro system, improving the robot's control and performance on inclines.

4) Conclusion

This experiment successfully measured the thrust at different throttle levels, verified RPM readings, and calculated the necessary thrust for robot movement on an inclined plane. The results will aid in setting the optimal throttle values for specific angles, reducing power consumption while ensuring precise operation.

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