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Solar Powered Drone

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Abstract: ***A solar powered drone is an unmanned aerial vehicle (UAV) that uses renewable solar energy to achieve longer and more efficient flight operations. It is equipped with solar panels that capture sunlight and convert it into electrical energy through the Photovoltaic Effect, which is then either used directly to power the drone or stored in a rechargeable battery for continuous operation during low-light conditions. The system includes essential components such as a charge controller for regulating power, a battery for energy storage, a flight controller for managing stability and navigation, and Electronic Speed Controllers (ESCs) that control motor speed. Sensors like gyroscope, accelerometer, and GPS provide real-time data to ensure accurate positioning and smooth flight. The motors and propellers generate the necessary lift and thrust, enabling the drone to take off, hover, and move efficiently. By integrating solar energy with intelligent control systems, solar powered drones offer increased flight endurance, reduced reliance on conventional fuels, and eco-friendly operation, making them highly suitable for applications such as surveillance, environmental monitoring, agriculture, and disaster management.***
Keywords: Electronic speed controller, micro controller unit, global positioning system, unmanned aerial vehicle.

I. INTRODUCTION

A solar powered drone is an advanced unmanned aerial vehicle (UAV) that uses solar energy as its primary power source to achieve longer and more efficient flight. It is equipped with solar panels that convert sunlight into electrical energy through the Photovoltaic Effect, which is then either used directly or stored in a rechargeable battery for continuous operation. Unlike traditional drones that depend only on battery power, solar powered drones can operate for extended periods with reduced need for frequent recharging. These drones integrate key components such as a flight controller, sensors, motors, and power management systems to ensure stable flight, navigation, and efficient energy usage. With the growing need for sustainable and eco-friendly technologies, solar powered drones are widely used in applications like surveillance, environmental monitoring, agriculture, and disaster management, making them an important development in modern drone technology.

II. SYSTEM OVERVIEW

A. Solar Power Generation

The PV Module (Solar Panel) converts sunlight into electrical energy.
This generated power is sent to the Bus Capacitor and Battery Module.
Workflow:
Sunlight → PV Module → Electrical Power

B. Energy Storage

The Battery Module stores the extra energy generated by the solar panel.
If solar power is low (cloudy conditions), the battery supplies power to the system.
Workflow:
PV Module → Battery Module → Power Backup

C. Power Stabilization

The Bus Capacitor stabilizes voltage and smooths the power supply.
It ensures steady power before sending electricity to the motor drivers.
Workflow:
PV Module / Battery → Bus Capacitor → Stable Power

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D. Power Management Controller

An Arduino Uno Microcontroller manages the power system.
It monitors:

- Solar panel output
- Battery charging
- Power distribution

Workflow:
Sensors → Arduino Uno → Control of battery & power flow

E. Flight Control System

The Arduino Mega 2560 acts as the main flight interface controller.
It communicates with the Flight Controller (iOS-based system

F. Drone Propulsion

Each motor driver controls a brushless motor.
The motors rotate propellers to lift and move the drone.
Workflow:
Motor Driver → Motor → Propeller Rotation → Drone Movement

G. Feedback System

Sensors and controllers send feedback signals to the microcontrollers.
This helps maintain:

- Stability
- Altitude
- Direction

III. WORKING PRINCIPLE

The drone is equipped with solar panels (photovoltaic cells) on its wings or body. These panels capture sunlight and convert it into electrical energy using the Photovoltaic Effect. Regulates voltage Distributes power to motors and electronics Decides whether to store energy in batteries or use it immediately

IV. ADVANTAGES

Solar panels continuously charge the battery using sunlight, allowing the drone to fly for longer durations compared to normal battery-powered drones. Solar powered drones use renewable solar energy, reducing pollution and carbon emission.

V. APPLICATIONS

Surveillance and Security – Used for continuous monitoring of borders, forests, and sensitive areas for long durations.
Environmental Monitoring – Helps in tracking pollution levels, climate changes, wildlife movement, and deforestation using energy from the Photovoltaic Effect.

VI. EXPERIMENTAL SETUP AND DISCUSSION

The experimental setup consists of the fully assembled motorized electric inline skating system integrated with all hardware components such as the Arduino Mega 2560, Arduino UNO, Sensor integration, Flight calibration and testing, Refinement. The system was tested under controlled conditions to evaluate its performance in terms of speed, stability, and load handling. The setup ensures proper alignment of mechanical components and stable power supply for smooth operation.

VII. FUTURE SCOPE

The future scope of solar powered drones is highly promising due to rapid advancements in renewable energy, battery technology, and intelligent systems. With the development of high-efficiency solar panels and advanced energy storage solutions such as solid-state batteries, these drones are expected to achieve longer flight durations, potentially enabling continuous or multi-day operations.

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VIII. CONCLUSION

The solar-powered drone project demonstrates an innovative approach to improving the efficiency and sustainability of unmanned aerial vehicles by utilizing renewable energy. By integrating solar panels based on the Photovoltaic Effect, the drone is capable of extending its flight duration and reducing dependence on conventional battery power.

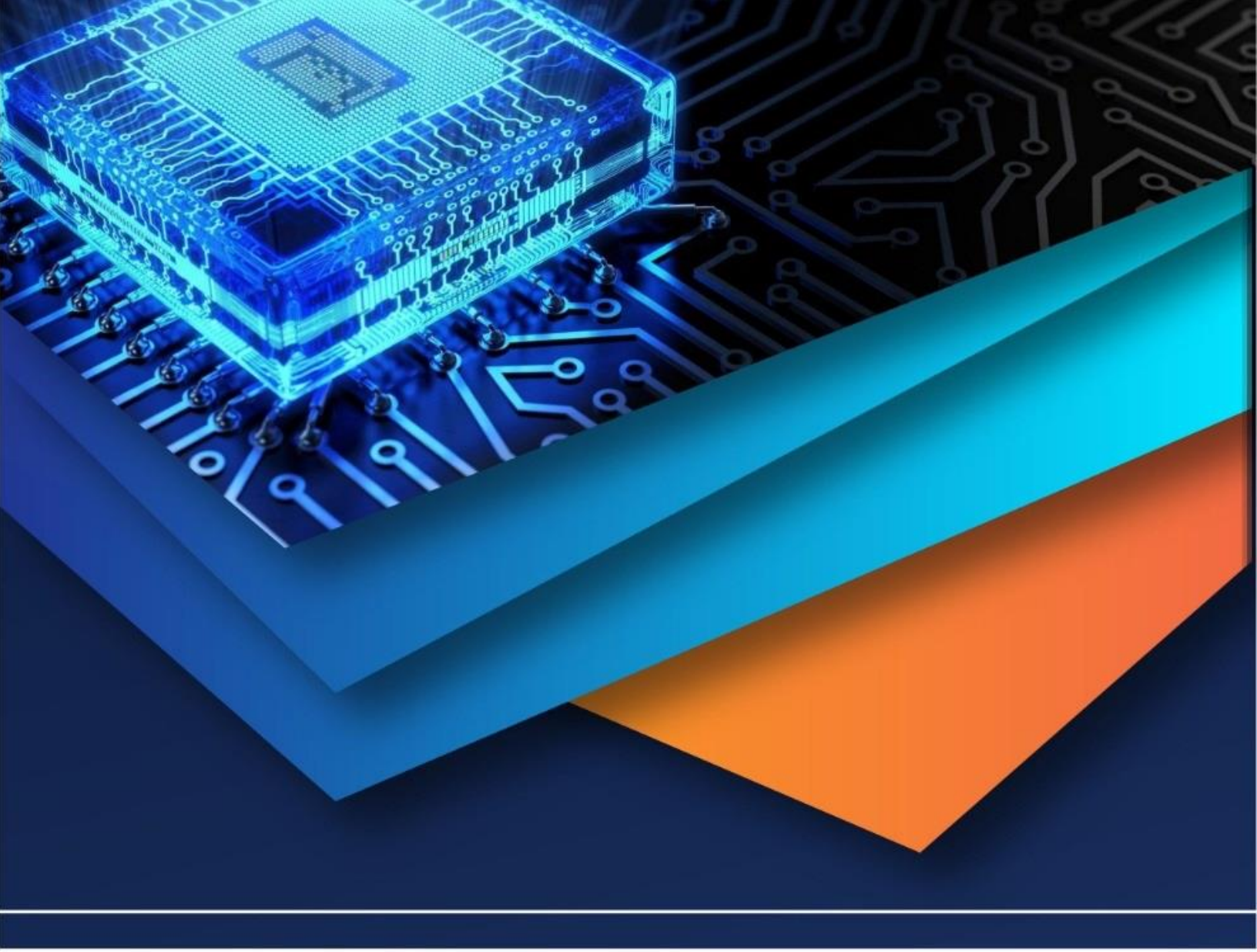
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