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INNOVATION IN ACTION: TURNING IDEAS INTO REALITY

Chapter 34
Solar SkyHaul Hybrid Drone

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ABSTRACT

Currently, the use of drones helps industries extensively, offering faster operations, improved efficiency, and access to hard-to-reach areas. The Solar SkyHaul, a hybrid solar-powered drone, is one of our products that was created to overcome the problems of traditional drones, including their short battery life, small payloads of capacity, and susceptibility to environmental factors. The drone's integration of lithium-Sulphur batteries and high-efficiency solar panels greatly increases flying time and lowers carbon emissions, both of which are in accordance with international sustainability objectives. Its objective is to provide more dependable and adaptable UAV solutions for delivery, surveillance, agriculture, and emergency response applications. A cargo capacity of up to 15 kg, adaptive mission planning, and real-time environmental sensors for danger identification are among its novel characteristics, which make it appropriate for crucial logistics in remote or disaster-affected locations. According to our survey of 31 respondents, there is considerable support (87.1%) for the use of drones for parcel delivery. Users acknowledge the efficiency and environmental benefits of this technology, although some are concerned about security and weather effects. The potential for commercialization of drones is significant, especially in the courier, medical, and humanitarian sectors where quick, self-sufficient delivery is crucial. By facilitating operations in areas with inadequate infrastructure and reducing operating expenses, Solar SkyHaul has the potential to revolutionize logistics and promote sustainable development objectives. As to conclude, this invention offers a forward-thinking solution for robust, environmentally friendly aerial transport systems by fusing renewable energy, intelligent automation, and sophisticated design.

Key Words: Hybrid drone; Solar power; Parcel delivery; Sustainability; Emergency logistics

1.0 INTRODUCTION

1.1 Objectives of the innovation

As the world looks for smarter and cleaner ways to use technology, drones are becoming more crucial than ever for deliveries, surveillance, farming, and even disaster relief. But most drones today still rely heavily on batteries that run out quickly, or fuel that's not exactly eco-friendly. With drastic delivery and renewable energy technological advances, we have welcomed innovative practices by investing in a solar SkyHaul. This innovative drone integrates solar power with traditional propulsion systems to enhance flight capabilities, reduce carbon emissions, and promote operational efficiency. However, Solar SkyHaul is a project focused on creating a hybrid drone powered by both solar energy and batteries, designed to fly longer, use less power, and help reduce environmental impact. The goal is to build a drone that's not only efficient and reliable but also versatile enough for doing deliveries, surveillance, agriculture, or emergency response. By combining clean solar power with smart batteries, Solar SkyHaul aims to solve the common problem of short drone flight times and constant recharging, while promoting more eco-friendly technology in the skies.

1.2 Problem statement

As in the early phases of existing drones, several restrictions impeded their overall functionality and how useful they are. These drones (UAVs) were revolutionary in the fields of air mobility and remote controlling, but they also had crucial drawbacks. Furthermore, to affect the effectiveness and range of drone operations, these flaws clearly stated that continuous technological development is required to increase the autonomy, adaptability, and dependability of drones. There are some problems or issues that have been stated in some articles or research on the existing drones they might face, such as battery life, reliance on manual control and minimal payloads.

Battery life is the first problem that can be identified from other existing drones. Its dependence on battery power, which severely limited flying time, was one of the main drawbacks of early drone technology. Battery-powered drones could typically only run for 20 to 40 minutes on a single charge. As this makes the existing drones less useful since they have to recharge their drones every time after making a few deliveries. (Milano, 2022). Next, the dependence on manual control. These existing drones lacked advanced autonomous systems which had to be operated with manual remote controllers. As technology progressed, sensors such as Global Positioning Systems (GPS) and Inertial Measurement Units (IMUs) were added to enable more autonomous flight capabilities. Until then, human control made processes more challenging and limited their scalability and reliability in some applications. (Daly, 2012). Last problem is small payloads. Due to the small payload capacity of the existing drones, which typically only allowed them to carry a few kilograms or less, existing drone models were frequently constrained. This significantly limited its ability to move big, go deliver a longer time or to carry bulky objects like delivery bundles, advanced cameras, or sensors. Due to their modest or small size, these drones were unable to incorporate larger motors or payload bays, which further limited their practical versatility. (Singleton, 2024)

2.0 LITERATURE REVIEW

2.1 Key features and uniqueness

The Solar SkyHaul Drone is an intelligent, energy-efficient drone released into the air. It uses a hybrid energy system that combines lightweight lithium-sulfur batteries for backup power with monocrystalline solar panels, which are recognized for their high efficiency. For safety, the drone has real-time environmental sensors made by durable polycarbonate casings, featuring MEMS and RF/ optical sensors that detect weather hazards such as heavy rain and thunderstorms, and are linked with gold and copper circuitry for stable operation. With a solid yet lightweight carbon fiber structure, the drone can carry up to a maximum 15 kg.

Existing product

Solar SkyHaul drone

Due to the combination of three key features, this product can be classified as unique that sets it apart from other existing drones on the market. First of all, the Solar SkyHaul has a hybrid energy system that uses solar panels to generate electricity during the day and effortlessly switches to its battery backup system when sunlight is lacking. This greatly increases its flying time and enables continuous operation even when there are no recharging locations nearby. The second is that the drone is equipped with real-time environmental sensors that constantly monitor weather-related data, including wind speed, temperature and air pressure. The unique feature of the drone is that it uses data to detect any potential hazards, such thunderstorms or hurricanes, and can locate and land itself in a secure area to seek shelter until the weather clears up. This greatly reduces the probability of the parcel to be damaged and protects the payload. Lastly, compared to many other drones in its category, this one is capable of lifting objects up to 15 kilograms due to its maximum payload capacity. This feature enables the drone to transport emergency relief or medical supplies in just one trip without sacrificing efficiency or stability.

3.0 METHODOLOGY

3.1 Instruction on How to Use the Product

Step 1, takeoff. A 15 kg payload is sealed and secured. Batteries are fully charged, and GPS sets a 30 km route factoring in restricted airspace and weather. The drone ascends using battery power, then shifts to solar-assisted flight via its hybrid power system. Step 2, Mid-Flight Energy Management: During flight, solar panels on the wings generate power and recharge batteries. In low sunlight or cloud cover, backup power ensures steady flight through

dynamic energy switching.Step 3, Descent and Approach: Nearing the destination, the drone begins a controlled descent using GPS, timing sensors, and visual cameras to locate the landing zone precisely. Step 4, Delivery and Return: The drone lands in the designated area and releases the 15 kg payload. It then performs a system check and either returns to base or heads to a charging station, guided by its hybrid system.

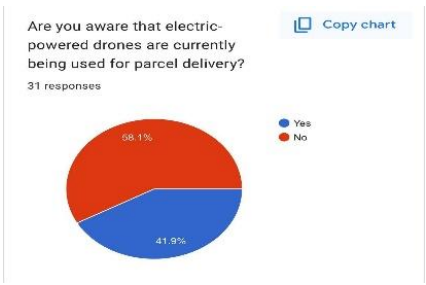
3.2 Target users and Application Areas

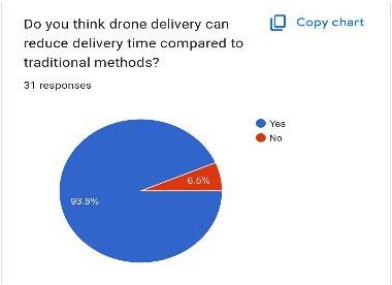
Our drone invention is excellent for customers and industries who require reliable, efficient delivery in unreachable areas. Target users include military units, emergency assistance organizations, healthcare organizations, and logistics companies that work in developing nations. For example, the drone can be used to deliver essential medical supplies like blood, vaccines, or kits for emergencies to hospitals and health departments in rural or disaster-affected areas on time. The drone's ability to deliver information or technical equipment to isolated bases without exposing personnel is crucial to military units. Moreover, it can be used by emergency relief organizations for carrying supplies of food, water, and shelter to areas trapped by landslides, earthquakes, or floods.

4.0 RESEARCH AND METHODOLOGY

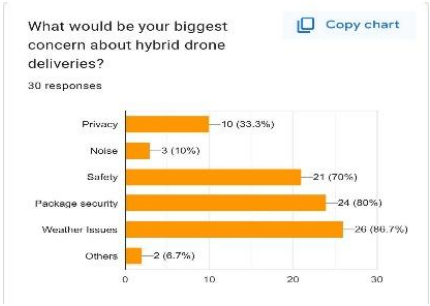
4.1 Survey and feedback

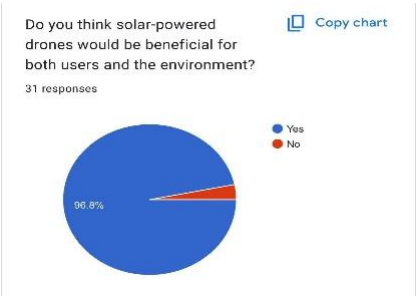
Our group has conducted a survey on our innovation the Solar SkyHaul hybrid drone which includes 31 respondents that involves both gender male and female. There are 6 questions that we provide in our survey related to our innovation. Here are some of the results that we collected from each question from our respondent.





The data shows that 58.1% of respondents are aware of electric-powered drones for parcel delivery, while 41.9% are unaware of hybrid drones. Next, data also shows that drones can save time compared to traditional methods, with 29 respondents agreeing and 2 disagreeing, suggesting they may make delivery faster.





The pie chart shows that 96.6% of respondents believe hybrid drones can benefit users and the environment, with 30 people agreeing. However, concerns about weather, package security, noise, and privacy are the top concerns for consumers when using hybrid drones for parcel delivery. Therefore, based on the survey we innovated solar SkyHaul to make it easier for the user to ship out their parcel and also provide a good shipping service to the customer as most of them prefer to order products online. It shows that half of the respondents agreed with our innovation to be put in the parcel delivery.

5.0 COMMERCIALIZATION AND IMPACT

5.1 Potential for Commercialization

Hybrid drones are being commercialized in the courier industry to meet customer demands for faster delivery times and cost-effectiveness. These drones can reach geographically challenging or expensive areas, allowing new markets and consumers. They also provide operational flexibility without the need for large car companies or extra drivers. Logistics stakeholders are exploring drone technology to lower operating costs, cut emissions, and meet consumer demands for immediate and on-demand delivery. Drone integration helps courier businesses remain creative and competitive in a rapidly changing market by establishing relationships with technology companies and creating new logistics models.

5.2 Benefits to the community for End Users

The Solar SkyHaul drone offers substantial benefits to users by offering reliable, energy-efficiency, and autonomous transport. By using solar energy as its main power source, it greatly reduces operating costs and delays, particularly in rural areas. Its hybrid battery backup maintains uninterrupted operation in poor weather. This drone offers a maximum to 15-kilogram capacity, makes it perfect for logistics, and can deliver standard items such as medical supplies, equipment, or other necessities to unreachable areas by car (World Health Organization, 2021). Real-time environmental sensors improve decision-making by monitoring weather. This enables the drone to reroute during storms, crucial for emergency aid (United Nations Development Programme, 2023). From a community perspective, the Solar SkyHaul promotes sustainability and disaster protection. The use of renewable solar energy helps reduce carbon emissions compared to typical fuel-based or fully battery-reliant drones, supporting the International Energy Agency's worldwide climate goals (IEA,2022). It

can be a lifesaver in emergency situations, isolated flood zones, or rural areas. Such functions are crucial for environmental monitoring, healthcare access and rural development (World Health Organization, 2021).

6.0 CONCLUSION AND RECOMMENDATION

In conclusion, green delivery and transportation benefit significantly from the development of hybrid solar drone shipping systems. Solar-powered drones become more reliable for power management when they combine traditional energy storage methods like batteries or fuel to overcome weather and energy obstacles. Hybrid drones obtain the capacity to operate longer journeys and maintain flexibility and reliability through their dual power supply mechanisms thus their suitability for most delivery usages extending from distant territories to underserved areas (Ghadeer, 2024).Solar SkyHaul aims to develop integration of Adaptive Mission Planning AI technology. The AI system achieves routing optimization through sensor input from cameras and LiDAR equipment in addition to weather instrumentation to perform obstacle avoidance while re-routing for adverse weather situations. The real-time adaptability capability serves as an essential element for reaching peak performance along with durability and self-operation in solar-powered drones regardless of unexpected environmental conditions (Bharadwaj, 2025).

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