



SREEPATHY INSTITUTE OF MANAGEMENT AND TECHNOLOGY (SIMAT)

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Report on the Completion of ARDB Funded Project

POWER MANAGEMENT SYSTEM FOR ENERGY-EFFICIENT HYBRID POWER SOURCE FOR UAV
(ARDB Project ID: 1081994])

1. Introduction

We are very happy to submit the final report on the successful completion of the grant-in-aid project "POWER MANAGEMENT SYSTEM FOR ENERGY-EFFICIENT HYBRID POWER SOURCE FOR UAV. The project was funded by the Aeronautics Research and Development Board (ARDB) with a grant of ₹18.514 lakhs. The project work spanned two years, starting on [03/11/2024] and completed on [02/11/2023] with final presentation on 05/02/2024.

2. Objectives and Achievements

The main objective of the project was the development of an innovative *Hybrid Power Management System* for Unmanned Aerial Vehicles (UAVs), utilizing the recent technology based on a combination of super capacitors, batteries, and solar panels.

Our key objectives were to:

- **Extend flight endurance:** Achieve significantly longer flight duration compared to conventional battery-powered UAVs.
- **Improve efficiency:** Optimize energy management for minimal losses and maximize system efficiency.

We are happy to report that the objectives of the project successfully achieved. The salient feature of the present hybrid system, as demonstrated experimentally, is the enhancement of the flight duration by 56%, as compared to conventional power system with Li-Po battery alone.

3. Key Project Activities and Outcomes

- **System Design and Development:** The hybrid power management system was designed and implemented, integrating critical components like lithium-polymer battery, super capacitors, solar panels, and an intelligent Power Management Unit (PMU).
- **PMU Development:** The PMU, the central part of the system, intelligently controls and optimizes energy flow between components, ensuring efficient operation.
- **Prototype Integration and Testing:** The system was successfully integrated into a prototype UAV through rigorous Hardware-In-Loop-Simulation (HILS) tests, validating its functionality and performance.
- **Data Analysis and Reporting:** We collected and analyzed extensive data from testing, documenting the system's performance and potential impact.

4. Acknowledgements

We would like to express our sincere gratitude to Dr. S. P. Subramanian, Principal, for his unconditional support. We are particularly grateful to Prof. Sushma M for her expert advice and feedback on the technical aspects of the project. Mr. Sasikumar CK's help with securing the necessary funding was essential, and we appreciate his time and effort. Mr. Vishnu Namboothiri's willingness to share his expertise in the electronic circuit development was invaluable, and Mr. Gireesh's assistance with system administration was greatly appreciated.

We express our sincere gratitude to the ARDB for funding and continuous support for the project. The

support extended by Dr.P.V.S.Murthy, Chef Scientist and Head, UAV Division, CSIR-NAL and his colleagues throughout the work is gratefully acknowledged. We also extend our heartfelt appreciation to the college management for providing necessary infrastructure, resources, and unwavering encouragement. Finally, we thank our dedicated team members and staff whose valuable contributions were instrumental in the project's success.

5. Recommendations and Future Scope

The Hybrid Power Management System holds immense potential for various applications for drones in agriculture, including crop monitoring, precision spraying, and field surveillance. Based on our findings, we recommend further research and development in the following areas:

- **Higher energy density supercapacitors:** This could lead to even longer flight times and extended operational capabilities.
- **Advanced hybrid power management system for VTOL drones :** Exploring alternative energy sources beyond solar panels can enable wider operational environments.
- **Autonomic control algorithms:** Further advancements in control algorithms can optimize energy management and system performance further.

6. Conclusion

The ARDB-funded project on the hybrid power management system for UAVs has been a resounding success. The developed system offers significant improvements in flight time, efficiency, and payload capacity, demonstrating its potential to revolutionize various applications in surveillance and beyond. We believe this project has laid a strong foundation for further advancements in UAV technology.

Sincerely,

Dr. KT Madhavan
Head, R&D

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A handwritten signature in green ink, appearing to be "Sugesh M S", written over a horizontal line.

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