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WEBINAR

FLYING NON-STOP AROUND THE WORLD: A GLOBAL OUTREACH

SPEAKER:
Ir. Assoc. Prof. Ts. Dr. Parvathy Rajendran

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SYNOPSIS

Various studies have been done in recent years on unmanned solar-powered aircraft for non-stop flight at a specified location or area. However, if an unmanned solar-powered aircraft (SUAV) able to achieve a non-stop flight around the world, it may lead to the possibility of a pseudolite (i.e., pseudo-satellite) operation. These SUAVs capable of operating as a satellite enables sustainable aviation that provides cheaper communication accessibility especially to those countries still under development. In order to achieve continuous flight, SUAV collects energy from sunlight during day time and store up the excessive energy in battery for power consumption during night. The excess energy for night usage must be sufficient to sustain the flight, which requires extensive data simulation and analysis. Here, the total energy collected is highly subjected to the 1) available solar irradiance intensity, 2) latitude, longitude, and altitude of the operating location, 3) efficiency and positioning of the solar module system, 4) aircraft flight performance characteristic and also 5) aircraft mission path planning. However, the first elements stated are beyond control when the cloud cover over the sky of operating area affects the available solar intensity. Apart from that the geological coordinate positioning and its altitude also a rigid factor in this study. Thus, in recent years, more focus has been given to improve flight endurance by optimizing aircraft performance and also planning the mission flight. Nevertheless, no work has been done to study the solar irradiance intensity along the flight path. Therefore, this investigation analyses solar irradiance intensity data worldwide at each hour over 24 hours in order to plan a delicate flight path and achieve non-stop flight. Hence, a worldwide database for solar irradiance intensity and digital elevation data has been developed. The flight path optimization generally targets for the battery status along the flight path to maintain the minimum required power to sustain level flight together with ground elevation. At the moment, two flight patterns namely zigzag and spiral were formulated in preliminary work, where the zigzag has outperformed the spiral pattern. This simulation also takes into account the effect by varying the starting flight time, and also the time taken for one complete cycle every region of the world. Analyses show that the significant parameters in non-stop solar-powered flight are the flying altitude, flying velocity, solar panel efficiency, battery capacity, and flight pattern. The findings show that in order to sustain a non-stop flight around the world, it is recommended to fly with altitude around 1km, velocity with minimum power required (21km/hr.), highest available solar panel efficiency (45%) and battery capacity (441Whr). Besides, results also identified the date and time of beginning a mission is a crucial factor for a successful continuous flight. In summary, the energy management for SUAV is the crucial strategy to enable non-stop flight around the world.

ABOUT SPEAKER

Ir. Assoc. Prof. Ts. Dr. Parvathy Rajendran is currently an academic lecturer in the School of Aerospace Engineering at Universiti Sains Malaysia (USM) since 2013. She completed her Ph.D. in Aerospace Engineering from Cranfield University, United Kingdom in October 2012. Her research includes UAV design, development, and flight testing and UAV's systems development and testing. She has also been involved as a system and flight test engineer in various UAV projects in the UK, which all successfully flown. Her appointment as the Head of System and Design Research Cluster and as the Laboratory Manager for UAV Laboratory in the School of Aerospace Engineering provides further recognition to her credibility. In 2016, she received awards for excellence in work and excellence in high impact publications from USM. Besides, she has attained the titles Professional Engineer from the Board of Engineers Malaysia and currently serves as EAC Engineering Program Auditor. In addition, she also attained Chartered Engineer (CEng.) from the Engineering Council in United Kingdom and Professional Technologist (Ts.) from Malaysian Bord of Technologists (MBOT). She was honored with an international award "Outstanding Women in Engineering" in 2017 from Venus Foundation. As a young research academician, Parvathy Rajendran has produced many high-impact publications. She has also been appointed by few international journals to be an editor-in-chief, guest editor, international advisor and member of the reviewer board. She has been the chairman and member of the technical conference committee of various international conferences. Also, she has maintained various internal and external grants, which totals more than RM 1 million. Thus, she has contributed well to the development of human capital. Her active involvement in teaching, research, consultancy, and service to the university and community has emphasized her enthusiastic academician nature with high potential to contribute to the aerospace engineering field