



INSTITUT TEKNOLOGI SEPULUH NOPEMBER (ITS)
FAKULTAS TEKNOLOGI ELEKTRO DAN INFORMATIKA CERDAS
DEPARTEMEN TEKNIK ELEKTRO
Program Studi Sarjana (S1) Teknik Telekomunikasi

1	Nama Mata Kuliah : Sistem Komunikasi Wahana Nirawak
2	Kode Mata Kuliah : EL234715
3	Kredit : 3 SKS
4	Semester : Pilihan

Deskripsi Mata Kuliah

UAV telah dimanfaatkan pada banyak aplikasi dan bidang, misal: pemetaan dan pemotretan udara, pengantar barang secara udara, berkat perkembangan dari berbagai teknologi pendukung dan ketersediaannya secara luas. Selain itu, pada beberapa tahun terakhir pemanfaatannya pada bidang telekomunikasi juga menunjukkan potensi yang besar dan memberi dampak yang signifikan. Pada mata kuliah, mahasiswa akan mempelajari karakteristik dan konsep dasar dari berbagai macam UAV, serta aspek aerodinamikanya pada saat terbang. Selanjutnya akan dipelajari karakteristik dan model-model kanal komunikasi pada sistem komunikasi nirkabel yang menggunakan UAV. Pada bagian berikut, mahasiswa akan mempelajari berbagai permasalahan sistem dan jaringan komunikasi nirkabel yang melibatkan UAV, beserta teknik dan metode yang digunakan.

Capaian Pembelajaran Lulusan (CPL) Yang Dibebankan Mata Kuliah

1. (CPL-02) Mampu mengkaji dan memanfaatkan ilmu pengetahuan dan teknologi dalam rangka mengaplikasikannya pada bidang Teknik Telekomunikasi, serta mampu mengambil keputusan secara tepat dari hasil kerja sendiri maupun kerja kelompok dalam bentuk laporan tugas akhir atau bentuk kegiatan pembelajaran lain yang luarannya setara dengan tugas akhir melalui pemikiran logis, kritis, sistematis dan inovatif.
2. (CPL-04) Mampu menerapkan ilmu pengetahuan alam dan matematika serta teknologi dan rekayasa informasi untuk memperoleh pemahaman komprehensif pada bidang Teknik Telekomunikasi.
3. (CPL-08) Mampu mengetahui dan mengaplikasi metode dan keahlian sesuai perkembangan terkini di bidang ilmu pengetahuan dan teknologi untuk menyelesaikan permasalahan di bidang Teknik Telekomunikasi dengan mengedepankan nilai-nilai universal

Capaian Pembelajaran Mata Kuliah

1. Mampu menjelaskan karakteristik berbagai macam UAV beserta kemampuan terbangnya
2. Mampu menjelaskan gaya-gaya yang bekerja pada UAV dan aspek-aspek aerodinamika UAV
3. Mampu menjelaskan karakteristik dan model kanal komunikasi nirkabel yang melibatkan UAV

4. Mampu mengimplementasikan sistem komunikasi nirkabel dengan IoT pada platform UAV di laboratorium
5. Mampu menjelaskan berbagai konsep dan permasalahan sistem komunikasi nirkabel yang didukung UAV, misalnya: simpul relay terbang, mobile collector untuk jaringan sensor, pengisi energi secara nirkabel, dan mobile base station.

Pokok Bahasan

1. Pengantar dan taksonomi UAS
2. Gaya-gaya aerodinamik dan momen pada UAV
3. UAS Airframe Design
4. UAS Propulsion System Design
5. Model Lintasan and Penggunaan Energi pada UAV
6. Pemodelan kanal untuk UAV
7. UAV dan Jaringan Seluler
8. IoT dan UAV
9. Praktikum: sistem komunikasi IoT berbasis UAV
10. WPT berbasis UAV untuk jaringan sensor
11. Pemulihan Jaringan pada daerah bencana
12. Deteksi dan Identifikasi UAV
13. Keamanan pada Jaringan UAV

Prasyarat

Sistem Komunikasi, Persamaan Diferensial, Jaringan Komunikasi Nirkabel

Pustaka

Utama :

1. W. Saad, M. Bennis, M. Mozaffari, & X. Lin, "Wireless Communications and Networking for Unmanned Aerial Vehicles," Cambridge University Press, 2020.
2. M.H. Sadraey, "Design of Unmanned Aerial Systems," John Wiley & Sons, 2020.
3. Y. Zeng, I. Guvenc, R. Zhang, G. Geraci, & D.W. Matolak, eds., "UAV Communications for 5G and Beyond," John Wiley & Sons, 2021.

Pendukung :

1. K. Namuduri, S. Chaumette, J.H. Kim, & J.P.G. Sterbenz, eds., "UAV Networks and Communications," Cambridge University Press, 2018
2. M.A. Imran, O. Onireti, S. Ansari, & Q.H. Abbasi, eds., "Autonomous Airborne Wireless Networks," John Wiley & Sons, 2021.
3. R.K. Barnhart, D.M. Marshall, & E.J. Shappee, eds., "Introduction to Unmanned Aircraft Systems," 3rd ed., CRC Press, 2021.



INSTITUT TEKNOLOGI SEPULUH NOPEMBER (ITS)
FACULTY OF INTELLIGENT ELECTRICAL AND INFORMATICS TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING
Undergraduate Study Program (S1) Telecommunication Engineering

1	Course Name	: Unmanned Vehicle Communication System
2	Course Code	: EL234715
3	Credit	: 3 CREDITS
4	Semester	: Options

Course Description

UAVs have been utilized in many applications and fields, e.g. aerial mapping and photography, aerial delivery of goods, thanks to the development of various supporting technologies and their wide availability. In addition, in recent years, their utilization in the field of telecommunications has also shown great potential and made a significant impact. In the course, students will learn the characteristics and basic concepts of various UAVs, as well as their aerodynamic aspects during flight. Furthermore, the characteristics and models of communication channels in wireless communication systems using UAVs will be studied. In the following section, students will study various problems of wireless communication systems and networks involving UAVs, along with the techniques and methods used.

Graduate Learning Outcomes (SLOs) Charged Courses

1. (CPL-02) Able to study and utilize science and technology in order to apply it in the field of Telecommunication Engineering , and be able to make decisions appropriately from the results of their own work and group work in the form of a final project report or other forms of learning activities whose output is equivalent to the final project through logical, critical, systematic and innovative thinking.
2. (CPL-04) Able to apply natural science and mathematics as well as technology and information engineering to gain a comprehensive understanding of the field of Telecommunication Engineering.
3. (CPL-08) Able to know and apply methods and expertise according to the latest developments in the field of science and technology to solve problems in the field of Telecommunication Engineering by prioritizing universal values.

Course Learning Outcomes

1. Able to explain the characteristics of various kinds of UAVs and their flight capabilities
2. Able to explain the forces acting on UAVs and aspects of UAV aerodynamics
3. Able to explain the characteristics and channel models of wireless communication involving UAVs

4. Able to implement wireless communication system with IoT on UAV platform in the laboratory
5. Able to explain various concepts and problems of wireless communication systems supported by UAVs, for example: flying relay nodes, mobile collectors for sensor networks, wireless energy chargers, and mobile base stations.

Subject matter

1. Introduction and taxonomy UAS
2. Aerodynamic forces and moments on UAVs
3. UAS Airframe Design
4. UAS Propulsion System Design
5. Trajectory Model and Energy Usage in UAVs
6. Channel modeling for UAVs
7. UAVs and Mobile Networks
8. IoT and UAV
9. Practicum: UAV-based IoT communication system
10. UAV-based WPT for sensor networks
11. Network restoration in disaster areas
12. UAV Detection and Identification
13. Security on UAV Networks

Prerequisites

Communication Systems, Differential Equations, Wireless Communication Networks

Library

Main:

1. W. Saad, M. Bennis, M. Mozaffari, & X. Lin, "Wireless Communications and Networking for Unmanned Aerial Vehicles," Cambridge University Press, 2020.
2. M.H. Sadraey, "Design of Unmanned Aerial Systems," John Wiley & Sons, 2020.
3. Y. Zeng, I. Guvenc, R. Zhang, G. Geraci, & D.W. Matolak, eds., "UAV Communications for 5G and Beyond," John Wiley & Sons, 2021.

Supporters:

1. K. Namuduri, S. Chaumette, J.H. Kim, & J.P.G. Sterbenz, eds., "UAV Networks and Communications," Cambridge University Press, 2018.
2. M.A. Imran, O. Onireti, S. Ansari, & Q.H. Abbasi, eds., "Autonomous Airborne Wireless Networks," John Wiley & Sons, 2021.
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