PROJECT PROPOSAL – 1

Advisor Name	Prof. Dr. Fırat HARDALAÇ
Project Title	AI-Based Threat Detection and Avoidance Systems in Autonomous Unmanned Aerial Vehicles (UAVs)
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	1. The project on "AI-Based Threat Detection and Avoidance Systems in Autonomous Unmanned Aerial Vehicles (UAVs)" addresses the growing challenge of ensuring flight safety in complex and dynamic environments where UAVs may face potential risks such as other aircraft, obstacles, or malicious threats. The problem lies in the limited capability of conventional UAV systems to autonomously detect and react to these threats in real time, which can compromise mission success and safety. 2. The main objective of this project is to design and implement an artificial intelligence-based system that can reliably detect, classify, and avoid potential threats during UAV operations. By the end of the project, it aims to demonstrate measurable improvements in threat detection accuracy, response speed, and collision avoidance efficiency, ultimately enabling UAVs to operate more safely in both civilian and defense applications. 3. To achieve these goals, the project will employ machine learning and computer vision techniques, supported by simulation tools and UAV test platforms. Deep learning models will be trained on threat-related datasets to identify obstacles or hostile objects, while real-time decision-making algorithms will be integrated into the UAV's control system to ensure timely evasive maneuvers. Tools such as Python, TensorFlow/PyTorch, and UAV simulation software (e.g., Gazebo, MATLAB Simulink) will be utilized throughout the development process. 4. The expected outcomes include a functional prototype system capable of real-time threat detection and avoidance, validated through both simulation and test flights. The project is anticipated to contribute not only a working technical solution but also academic findings on the performance of AI models in UAV safety applications. Deliverables will include the trained AI models, simulation results, a working UAV test platform, and a comprehensive project report documenting methodologies, results, and recommendations for future development.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	**Requirements**: The project requires the integration of reliable AI algorithms capable of real-time threat detection and avoidance, a UAV platform suitable for testing, and access to simulation tools for validation. Adequate datasets for training and testing AI models must be available, along with sufficient computational resources to develop and optimize the algorithms. Clear performance criteria such as detection accuracy, response time, and safe maneuver execution are essential for measuring success. **Constraints:** The project may face limitations in terms of dataset availability, as real-world threat scenarios for UAVs are difficult to replicate. Hardware restrictions, such as UAV flight time, sensor range, and onboard processing capacity, may affect system performance. Time constraints during the project lifecycle could limit the extent of real-world testing, while safety regulations and restricted airspace might also pose challenges to outdoor UAV experiments.

Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	This project naturally integrates Computer Engineering through the development of AI algorithms and real-time data processing, while Mechanical Engineering contributes to UAV aerodynamics, structural design, and maneuverability optimization. Collaboration between these disciplines ensures that the AI-based threat detection system is not only computationally efficient but also compatible with the UAV's physical dynamics, resulting in a robust and practical solution.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	**Goal 9: Industry, Innovation and Infrastructure** — The project promotes innovation in UAV technologies by developing AI-based threat detection and avoidance systems, enhancing industrial capacity and contributing to resilient technological infrastructure. **Goal 11: Sustainable Cities and Communities** — Autonomous UAVs equipped with safe navigation systems can support urban safety, disaster management, and infrastructure monitoring, thereby making cities safer, more resilient, and sustainable. **Goal 13: Climate Action** — By enabling more efficient and safer UAV operations in emergency response and monitoring tasks, the project helps reduce unnecessary fuel consumption, emissions, and human risks, supporting climate-friendly solutions. **Goal 17: Partnerships for the Goals** — The project encourages collaboration between different engineering disciplines, academic institutions, industry partners, and regulatory bodies, fostering partnerships that contribute to the achievement of sustainable development goals.
Team size (number of students)	☐ 3 ☐ 4 ☒ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 2

Advisor Name	Prof. Dr. Fırat HARDALAÇ
Project Title	Development of a Modular System Integrated into Aerial Platforms for Forest Fire Early Warning and Rapid Response with Thermal Imaging and AI-Based Mapping
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	1. The proposed project, titled *"Development of a Modular System Integrated into Aerial Platforms for Forest Fire Early Warning and Rapid Response with Thermal Imaging and AI-Based Mapping"*, addresses the critical challenge of detecting and responding to forest fires at an early stage. Current systems often suffer from delayed detection and limited situational awareness, leading to devastating environmental, social, and economic losses. The project aims to overcome these issues by leveraging thermal imaging and artificial intelligence–based mapping to enable rapid detection, localization, and response planning directly from aerial platforms. 2. The measurable objectives of the project are to develop a modular system capable of real-time fire detection with high accuracy, generate risk maps to guide intervention strategies, and validate the system's performance through simulations and prototype integration with aerial vehicles. These goals focus on reducing detection times, minimizing false alarms, and ensuring scalability for diverse forest environments. 3. To achieve these objectives, the project will employ an interdisciplinary approach that combines thermal imaging sensors for heat anomaly detection, AI algorithms for pattern recognition and fire propagation estimation, and mapping tools for dynamic risk visualization. UAVs or other aerial platforms will be used as carriers to expand monitoring coverage, while modular integration will allow flexibility and adaptability across different operational scenarios. 4. The expected outcomes include a functional prototype of the modular aerial system, validated AI models for early fire detection, and geospatial fire risk maps that enable fast and informed decision-making. In addition, the project anticipates delivering guidelines and a proof-of-concept framework that can support future large-scale deployments, ultimately contributing to more effective forest fire prevention and emergency response strategies.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	**Requirements**: For the project to be successful, it is essential to integrate thermal imaging sensors with sufficient sensitivity to detect early-stage fire heat signatures, alongside AI algorithms capable of real-time analysis and accurate mapping. The system must be modular to ensure adaptability across different aerial platforms and scalable to cover large forest areas. Reliable communication infrastructure and energy-efficient operation are also required to support continuous monitoring and rapid data transmission. **Constraints:** The project may face limitations such as restricted payload capacity and flight time of aerial platforms, which could affect system endurance and coverage. Environmental conditions like smoke density, weather variations, and terrain complexity may impact sensor accuracy and data quality. Additionally, resource availability, project budget, and regulatory restrictions on UAV operations could pose further challenges to implementation and large-scale deployment.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project	The project inherently requires collaboration across multiple engineering disciplines to ensure its success. While Electrical and Computer Engineering provides the foundation for AI algorithms, image processing, and sensor integration, contributions from Mechanical Engineering are essential for the design and optimization of the aerial platform, payload mounting, and thermal management of onboard electronics. In addition, Industrial Engineering can play a role in developing efficient monitoring workflows and optimizing resource allocation for large-scale

activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	deployment and emergency response coordination. This interdisciplinary approach ensures that the system is not only technologically advanced but also mechanically reliable, operationally efficient, and ready for practical field applications.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	**Goal 13: Climate Action** — Forest fires are both a cause and consequence of climate change. By enabling early detection and rapid intervention, the proposed system contributes to mitigating the adverse effects of climate change. **Goal 15: Life on Land** — Forests are critical ecosystems for biodiversity. Early fire warning and response help protect habitats, preserve species, and sustain healthy terrestrial ecosystems. **Goal 9: Industry, Innovation, and Infrastructure** — The project fosters technological innovation by integrating thermal imaging, AI algorithms, and aerial platforms, strengthening disaster management infrastructure and resilience. **Goal 11: Sustainable Cities and Communities** — Forest fires directly threaten nearby settlements, infrastructure, and communities. The proposed system enhances safety, resilience, and sustainability of cities and human settlements through effective disaster risk reduction.
Team size (number of students)	☐ 3 ☐ 4 ☒ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 3

Advisor Name	Prof. Dr. Fırat HARDALAÇ
Project Title	AC-DC 45-Watt Single Output Flyback Converter
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	1. Achieving high efficiency in power conversion, Complying with EMI (Electromagnetic Interference) and safety standards, Reducing physical size and cost, Ensuring stable and reliable operation under varying load conditions 2. The main objective of this project is to design and develop a reliable, efficient, and cost-effective 45-Watt single output AC-DC flyback converter. 3. Theoretical Analysis and Component Selection, Transformer Design, PCB Design and Layout, Prototyping and Testing 4. A fully functional 45-Watt single output AC-DC flyback converter prototype, A well-documented model and analysis report, A custom-designed and manufactured PCB, A detailed test and evaluation report
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	**Requirements**: Input Voltage Range (195V-265V), Output Specifications (15V-3A), Efficiency nearly %80, Thermal Management, The PCB and overall design should be compact and cost-efficient, suitable for mass production in consumer or industrial applications. **Constraints:** The converter must operate within a maximum output power of 45 Watts, which limits the choice of components and thermal design considerations. The physical dimensions of the PCB and components must fit within predefined space constraints, especially for integration into compact consumer devices.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines	ME will contribute to the thermal management and mechanical design aspects of the project. Efficient heat dissipation is crucial for the flyback converter's reliable operation. ME experts will assist in designing heatsinks, cooling solutions, and ensuring the structural integrity of the PCB enclosure. Additionally, vibration and shock resistance considerations for industrial applications will be evaluated. IE will support the project in optimizing the manufacturing process and cost-efficiency. Their expertise will be used to develop streamlined PCB assembly workflows, select cost-effective components without compromising quality, and plan for scalability in mass production.

will collaborate and contribute to the project activities.	
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	**Goal 7: Affordable and Clean Energy** The project aims to design a highly efficient power converter that reduces energy losses during AC to DC conversion. This contributes to lowering overall electricity consumption and supports access to clean and affordable energy solutions. **Goal 9: Industry, Innovation, and Infrastructure** By developing a compact, cost-effective, and reliable flyback converter, the project fosters innovation in power electronics and supports the creation of resilient and sustainable industrial infrastructure. **Goal 12: Responsible Consumption and Production** The design emphasizes the selection of cost-effective yet sustainable components and efficient manufacturing processes, reducing material waste and promoting environmentally responsible production practices. **Goal 13: Climate Action** Improved energy efficiency in power supplies contributes to reducing greenhouse gas emissions by lowering energy demand, thus supporting climate action efforts.
Team size (number of students)	☐ 3 ☒ 4 ☐ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 4

Advisor Name	**Prof. Dr. Müslüm Cengiz TAPLAMACIOĞLU**
Project Title	Frequency regulative inverter/converter design
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	The project is specialized in solving the problem about the undesired oscilations in the frequency that is created by the lack of energy in a electricity production and distribution sytem. The measurable goals the project aims to achieve through: -DC-DC converter design and capacitor compatibility -Grid-synchronized DC-AC inverter -Maintaining the frequency between 49.8 and 50.2 Hz System needs to ensure high efficiency, precise frequency matching, instantaneous response, and cost-effectiveness. For these requirements, a high-capacity battery and a supercapacitor are necessary. The project will be approached with a design from scratch to provide hybrid inverter features. The primary objective is to develop a functional prototype of a supercapacitor-supported inverter and bidirectional DC-DC converter system, aimed at stabilizing grid frequency fluctuations in PV-integrated systems. This will be achieved by implementing real-time frequency monitoring and control algorithms, supported by hardware integration and simulation-based validation.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• The project must be able to adjust the frequency as local standards. • The project must immediately response to voltage fluctuations • The project must be sent to the users for analysis. • The system must be appropriate to IEC standards (IEC 61800/ IEC 62109)
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	This project adopts a multidisciplinary approach involving Computer Engineering for embedded system programming, and Mechanical Engineering for thermal management and component housing. Industrial Engineering also contributes through cost analysis and system optimization for real-world applicability.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	7.B.) By 2030, in developing countries, particularly least developed countries, small island developing States and landlocked developing countries , expanding infrastructure and developing technology to provide modern and sustainable energy services to everyone within the framework of these countries' support programs
Team size (number of students)	☒ 3 ☐ 4 ☐ 5

PROJECT PROPOSAL – 5

Advisor Name	Prof. Dr. Müslüm Cengiz TAPLAMACIOĞLU
Project Title	Solar Tracking System with MATLAB-Based Monitoring and Clean Energy Storage
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	**Problem Statement** Fixed-position solar panels fail to follow the sun throughout the day, leading to significant energy losses. A cost-effective, dual-axis tracking solution with real-time monitoring and compliance with renewable energy standards is needed to maximize energy production and ensure reliable performance. **Objectives** ● Develop a dual-axis solar tracking system using LDR sensors and servo motors. ● Enable real-time monitoring and analysis with MATLAB visualization tools. ● Store generated energy efficiently using an MPPT/PWM charge controller and battery system. ● Ensure compliance with relevant Turkish and international standards for safety, renewable energy, and electrical systems. **Method** ● LDR sensors measure light intensity, and a microcontroller adjusts the panel orientation accordingly. ● Energy from the panel is stored via a charge controller in a suitable battery system. ● MATLAB software visualizes orientation, voltage, current, and energy data for performance analysis. ● The system will be designed following **IEC 61724 (Photovoltaic system performance monitoring)** and **IEC 60364 (Low-voltage electrical installations)** standards as adopted in Turkey by TSE (Turkish Standards Institution). **Expected Outcomes** ● A functional dual-axis solar tracker prototype. ● MATLAB-based data visualization and daily energy analysis. ● Compliance with **TSE EN/IEC renewable energy and electrical safety standards**. ● Measurable energy gains compared to fixed-position panels.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	**Requirements** ● Dual-axis servo tracking mechanism. ● Microcontroller-based control and data acquisition system. ● MPPT/PWM charge controller and compatible battery system. ● MATLAB visualization tools.

	● Compliance with **TSE EN 62446 (PV system documentation, commissioning, inspection)** for solar installations. **Constraints** ● Limited budget for solar panel, servos, and batteries. ● Weather-dependent outdoor testing. ● Time constraints for data collection and long-term analysis.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	The project integrates Electrical Electronics Engineering for solar energy conversion and control systems, Computer Engineering for MATLAB-based monitoring and data processing, and Mechanical Engineering for the dual-axis structure design and panel orientation mechanism.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	● Target 7.2 By 2030, increase substantially the share of renewable energy in the global ● Target 7.3 By 2030, double the global rate of improvement in energy efficiency ● Target 7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective programmes of support
Team size (number of students)	☐ 3 ☐ 4 ☒ 5

PROJECT PROPOSAL – 6

Advisor Name	Prof.Dr. Erkan AFACAN
Project Title	Drone Jammer
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	In our modern age, drones have been widely used in different areas. Besides being useful they some time become threat for safety. So, it becomes necessary to jam drones for some limited regions and for limited durations. The purpose of this project is to jam a region and so as to provide a secure environment. For the realization of the project an electronic hardware and the necessary software is necessary.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• System will be able to work in a fixed or mobile environment. • System will be effective in a region having at least 200 meter radius. • System will be able to work at least 20 minutes.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• The team requires expertise in *antenna engineering* to understand the requirements for drone operations. • The team needs expertise to develop a robust, user-friendly, and secure drone application (*Software Engineering*)
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	The project aims to strengthen the industry, innovation and infrastructure of the country.
Team size (number of students)	☒ 3 ☐ 4 ☐ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 7

Advisor Name	Prof.Dr. Erkan AFACAN
Project Title	ElGamal Encryption System
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	ElGamal encryption system is widely used in modern encryption technology. It is not so difficult to write a program for ElGamal encryption on a computer, but it creates some problems for electronic cards having limited memory and limited CPU power. The purpose of this project is to realize the mentioned system over an electronic card.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• For encryption and decryption it will be possible to use at least 32 bit numbers. • Project will be realized on electronic cards such as Arduino, Raspberry Pi. • For encryption and decryption different cards will be used. The two electronic cards will communicate with each other.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• The team requires expertise in *cryptograhy theory* to understand the requirements for the ElGamal system. • The team needs expertise to develop a robust cryptographic application (*Software Engineering*)
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	The project aims to strengthen the industry, innovation and infrastructure of the country.
Team size (number of students)	☒ 3 ☐ 4 ☐ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 8

Advisor Name	Prof.Dr. Erkan AFACAN
Project Title	Smart Antenna System
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	Antenna systems provide wide possibilities. But it is not so straightforward to design a special array antenna system maintaining all desired properties at the same time. The purpose of this project is to design an antenna array system, it will be possible to steer the main beam of the antenna in the desired directions and the sidelobe level of the system should be below a certain level.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• The main beam of the antenna array should be adjusted with 1 degree steps. • The sidelobe level should be adjusted to -30 dB. • In the project C/C++ programming language will be used. • For the designed antenna array, at least an 4x4 array should be produced.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• The team requires expertise in *antenna engineering* to understand the requirements for antenna systems. • The team needs expertise to develop a robust, user-friendly, and secure smart antenna system (*Electronics Engineering*)
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	The project aims to strengthen the industry, innovation and infrastructure of the country.
Team size (number of students)	☒ 3 ☐ 4 ☐ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 9

Advisor Name	Prof. Dr. Saffet AYASUN
Project Title	Prototype of Regenerative Braking System for Electric Vehicles
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	Energy efficiency is a critical issue in electric vehicles, especially in urban driving conditions with frequent stop-and-go traffic where a significant amount of kinetic energy is wasted as heat, leading to reduced vehicle range and shortened battery lifetime. To address this problem, the project aims to develop a small-scale prototype based on the principle of regenerative braking, where the kinetic energy generated during braking is converted into electrical energy, stored in a battery, and its storage efficiency measured. The system will first be modeled in MATLAB/Simulink to analyze energy conversion, after which a hardware prototype will be built using a small-scale electric motor, motor driver, and battery, with the motor operating in both drive and generator modes. A microcontroller (STM32/Arduino) will be used for motor control, current and voltage measurements, and data logging, ensuring accurate monitoring of the process. Simulation results will then be compared with experimental data to validate system performance. The expected outcomes include a working regenerative braking prototype, graphs and reports showing the amount of energy recovered and stored in the battery, comparative results between simulation and hardware, and analyses demonstrating the contribution of regenerative braking to range extension and overall energy efficiency in electric vehicles.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	The project requires a motor capable of bi-directional operation to function in both drive and generator modes, an energy storage unit such as a battery or supercapacitor, current and voltage sensors for monitoring and data acquisition, and a microcontroller-based control system to manage the process. Additionally, simulation and hardware results must be comparable to validate performance. However, the prototype will be small-scale and will not operate at real vehicle-level power. For battery safety, charging and discharging currents will be limited, and due to budget constraints, components suitable for laboratory conditions will be used. Finally, the project must be completed within the timeframe of one academic year.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities.	This project has a multidisciplinary structure, as it combines expertise from different engineering fields. Electrical and Electronics Engineering contributes through motor control, circuit design, and sensor integration, while Mechanical Engineering is

PROJECT PROPOSAL – 10

Advisor Name	Prof. Dr. Saffet AYASUN
Project Title	Design of PV Panel Cleaning and Damage Identification System
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	Photovoltaic (PV) panels are highly sensitive to environmental factors such as dust, dirt, bird droppings, and weather conditions, which can lead to efficiency losses and reduced energy output over time. Currently, cleaning operations are mostly carried out manually, which is inefficient, time-consuming, and costly. In addition, cracks, scratches, and other damages often go unnoticed, further decreasing panel efficiency and shortening their operational lifetime. To address these issues, this project proposes the design and development of an automated and unmanned PV panel cleaning and damage detection system, which combines a rail-mounted cleaning mechanism with a brushing and spraying unit to maintain surface cleanliness, while integrating a camera-based damage detection module supported by image processing methods. The system will employ a microcontroller (Arduino/ESP32) for control and automation, and will be powered directly by PV panels to ensure self-sufficiency, and tested on a small-scale prototype consisting of one or two panels in a laboratory environment. The expected outcomes include a functional prototype, measurable improvements in panel efficiency after cleaning, successful detection of surface damages, and documentation of performance results demonstrating the system's contribution to overall renewable energy yield.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	The proposed system requires a stable rail mechanism to enable smooth cleaning motion, a motorized brush and controlled spraying system for effective dust removal, and a camera module with sufficient resolution for capturing panel surface images. Electrical circuits, motor drivers, and PV-based power supply integration are essential for ensuring system functionality. For successful validation, the prototype must demonstrate a measurable increase in energy output before and after cleaning and provide accurate detection of surface damages. However, the project is constrained by the limited one-year academic timeline, restricted budget preventing the use of advanced industrial cameras and actuators, and the reduced scale of testing limited to one or two PV panels, which may make large-scale efficiency calculations more difficult. Additionally, installation and calibration of the cleaning and imaging systems pose significant technical challenges that must be carefully managed. The resolution of the sensors used may be limited, which could make the detection of some micro-damages difficult.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	The project combines several engineering disciplines in a collaborative framework. Electrical and Electronics Engineering plays a central role in designing control circuits, integrating sensors, and interfacing with PV panels for power management. Mechanical Engineering contributes to the design and fabrication of the rail-mounted cleaning mechanism, brush system, and moving components.

	Computer Engineering supports the image acquisition and processing tasks necessary for damage detection and analysis of panel conditions. Industrial Engineering contributes by optimizing cleaning frequency, minimizing resource usage, and conducting cost-performance analysis for potential scalability. Through the integration of these fields, the project ensures a well-rounded, practical solution with both technical and economic viability.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	1. 7.3: Improve energy efficiency — by increasing PV panel efficiency through regular cleaning and early damage detection. 2. 9.4: Upgrade infrastructure and industrial processes to be more sustainable — by reducing manual labor and water waste with automated systems. 3. 12.2: Ensure sustainable management and efficient use of natural resources by 2030 — by optimizing water and energy use during the cleaning process.
Team size (number of students)	☒ 3 ☐ 4 ☐ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 11

Advisor Name	Prof. Dr. Hasan Şakir BİLGE
Project Title	Multi-Camera Embedded Processing System for ADAS Services
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	Problem Statement: The growing adoption of Advanced Driver Assistance Systems (ADAS) requires efficient, real-time processing of data from multiple car-mounted cameras. Current solutions are often expensive, power-hungry, and dependent on centralized computing. There is a need for an embedded, low-power system capable of processing multi-camera data to deliver essential ADAS functionalities such as lane departure warning, collision detection, and traffic sign recognition. Objectives: • Design and implement a multi-camera embedded system capable of real-time image capture and processing. • Integrate algorithms for ADAS features including lane detection, object recognition, and driver alert systems. • Optimize hardware–software co-design for reduced latency and power consumption. • Demonstrate a working prototype in a test vehicle environment. Method: The system will integrate multiple camera modules connected to an embedded SoC with GPU/AI acceleration. Computer vision techniques and lightweight deep learning models (e.g., MobileNet, YOLO-lite) will be deployed for real-time detection. A software pipeline for multi-stream synchronization and sensor fusion will be developed. Testing will be conducted in simulated driving environments, followed by limited real-world scenarios. Expected Outcomes: • A functioning prototype capable of delivering core ADAS services in real time. • Reduced cost and power compared to centralized automotive computing solutions. • A modular platform that can be extended for additional ADAS features.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	Requirements • System must process input from at least two cameras simultaneously with <100 ms latency. • The embedded system must operate on automotive-grade low-power hardware. • The platform must provide reliable results under varied lighting and weather conditions. Constraints • Limited computational resources on embedded hardware may restrict model complexity. • Real-world testing is constrained by safety regulations and access to vehicles.

	• Synchronization of multiple camera streams poses technical challenges.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• Computer Engineering: Embedded systems design, software optimization, AI integration. • Mechanical Engineering: Camera mounting, vibration isolation, and system integration into vehicle architecture.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	**SDG 11**: Make cities and human settlements inclusive, safe, resilient, and sustainable (through safer transport). **SDG 9**: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.
Team size (number of students)	☒ 3 ☐ 4 ☐ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 12

<table>
<tr><td>Advisor Name</td><td>Prof. Dr. Hasan Şakir BİLGE</td></tr>
<tr><td>Project Title</td><td>Optimized FPGA-Based Hardware Accelerator for Deep Learning Applications</td></tr>
<tr><td>Project Description
1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement)
2. Define the measurable goals the project aims to achieve through project lifetime (Objectives).
3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method).
4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).</td><td>Problem Statement: Deep learning models demand high computational resources, typically provided by GPUs. However, GPUs consume significant power and are not always suitable for edge deployments. There is a need for an FPGA-based hardware accelerator that optimizes computation efficiency, power consumption, and flexibility for different neural network architectures.
Objectives:
• Design an FPGA-based hardware accelerator optimized for CNN and Transformer models.
• Develop custom datapath architectures for parallel processing and efficient memory access.
• Compare FPGA performance (latency, throughput, energy efficiency) with GPU benchmarks.
• Deliver a hardware–software co-design platform with FPGA integration for real-world ML tasks.
Method: The project will employ High-Level Synthesis (HLS) to design hardware accelerators in FPGA for convolution, matrix multiplication, and attention mechanisms. Quantization and pruning will be applied to optimize model size and speed. A hardware–software co-design approach will allow flexibility, with drivers and APIs enabling integration with existing deep learning frameworks (e.g., TensorFlow Lite).
Expected Outcomes:
• FPGA prototype capable of accelerating deep learning inference with reduced power consumption.
• Demonstrated speedup for selected neural networks (e.g., ResNet, BERT).
• Published performance benchmarks comparing FPGA vs GPU vs CPU.</td></tr>
<tr><td>Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful.
Constraints: Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.</td><td>Requirements:
• FPGA must support parallel execution of at least two different deep learning layers.
• The design must demonstrate measurable improvements in latency and power over a CPU baseline.
• Development must integrate with an open-source ML framework for validation.
Constraints:</td></tr>
</table>

	• FPGA resource limitations (LUTs, BRAM, DSP slices) restrict the scale of deployable models. • Development time for HLS and hardware verification is significantly higher than software-only approaches. • Achieving compatibility with diverse ML frameworks may require compromises.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• Computer Engineering: FPGA design, hardware acceleration, deep learning model optimization. • Industrial Engineering: Application of optimized FPGA accelerators for industrial edge AI deployments (e.g., predictive maintenance, quality control).
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	SDG 9: Foster innovation and sustainable industrialization through efficient AI hardware. SDG 7: Ensure access to affordable, reliable, sustainable, and modern energy (through energy-efficient computing).
Team size (number of students)	☒ 3 ☐ 4 ☐ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 13

Advisor Name	Prof. Dr. Nursel Akçam
Project Title	Energy-Efficient X-Band Beamforming RF Chain: Single-Channel Design and Simulation Focused on a Passive 4-Bit Phase Shifter
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	The project addresses the challenge of costly and power-hungry X-band phased array systems by proposing a low-cost, energy-efficient, and modular single-channel RF chain based on a passive 4-bit phase shifter, aiming to provide an accessible beamforming solution for defense, satellite communication, climate monitoring, and educational applications. The primary objective is to design and simulate a single-channel X-band beamforming RF chain, consisting of a low-noise amplifier, a passive phase shifter, and a power amplifier, to show enough gain, low noise, high efficiency, system's stability, and precise phase control, ultimately validating the feasibility of an energy-efficient and cost-effective beamforming solution. The project will employ circuit-level and electromagnetic simulations common using industry-standard tools, integrating phase shifter design with LNA and PA modeling, supported by optimization and calibration techniques to evaluate system-level beamforming performance. The project is expected to deliver a validated design and simulation framework for a single-channel X-band beamforming RF chain, including phase shifter optimization, integrated system analysis, and a final report highlighting its potential as an energy-efficient and cost-effective solution.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful.	The design must show phase shifting in the X-band while the phase shifter itself does not use DC power. The system should have an LNA and a PA to provide enough gain. Software tools like ADS/AWR (for circuit) and CST (for EM) must be available. MATLAB or Python is needed for optimization and calibration. The project will only cover design and simulation; no chip fabrication or hardware tests will be done. Results depend on the accuracy of simulation models and the software we can use. Time is limited to one academic year, so the scope will stay at single-channel level. Antenna hardware or multi-channel implementation is outside the project scope because of cost and resources.

Constraints: Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	The project connects Electronics/Communication Engineering with Computer Engineering. Electronics part focuses on RF design and simulation of LNA, phase shifter, and PA. Computer part supports optimization, calibration, and data analysis using MATLAB/Python. Together, these disciplines make the project more complete and realistic.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	The project supports SDG 4: Quality Education because the project gives students hands-on experience with RF design and modern simulation tools. It also supports SDG 9: Industry, Innovation, and Infrastructure by developing skills and designs for advanced communication and radar systems.
Team size (number of students)	☐ 3 ☒ 4 ☐ 5

PROJECT PROPOSAL – 14

Advisor Name	Prof. Dr. Ali KARA
Project Title	Non-Invasive Blood Glucose Level (BGL) Monitoring Device Using Microwave Sensing
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	The project addresses the challenges of current blood glucose monitoring methods by proposing a non-invasive, portable, and low-power device to replace painful, invasive techniques. The primary objective is to develop a functional prototype of a dual-frequency microwave resonator sensor, which will measure blood glucose levels by detecting subtle dielectric shifts in fingertip tissue. This will be achieved by integrating a custom-designed sensor with a wireless communication system and a smartphone application for real-time data visualization and calibration. The project is expected to produce a scalable, system-integrated biosensing solution, demonstrating the potential for practical, non-invasive glucose monitoring, though further in vivo testing is required for clinical application.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• The device must be able to passively detect glucose-related dielectric variations in fingertip tissue without breaking the skin. • It must have a BLE-enabled wireless module for transmitting data. • A custom smartphone application is required to support real-time data visualization. • The final device must be portable and operate on a low-power budget.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• The team requires expertise in *biomedical engineering* to understand the biological and physiological aspects of glucose detection. • The team needs this expertise to develop a robust, user-friendly, and secure smartphone application for real-time data visualization and management (*Software or Computer Engineering*)
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	3D Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.
Team size (number of students)	☐ 3 ☒ 4 ☐ 5

PROJECT PROPOSAL – 15

Advisor Name	Prof. Mehmet ÇİYDEM
Project Title	Planar Antenna Array Design for 5G Base Stations
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	The project addresses the design and implementation of planar (2-dimensional, rectangular) antenna array for 5G Base stations. Project stages are as follows: a) Design of dual-polarized single element patch antenna (modeling and simulations suspended patch with proper excitations) b) Implementation of (a) (prototyping, test and measurements) c) Design of 4x8=32 (4 column, 8 row) element dual polarized planar antenna array (modeling and simulations) d) Implementation (c) (prototyping, test and measurements) e) Documentation and Reporting
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **--** **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• Knowledge/study of antenna theory and design • Knowledge/study of antenna array theory and design • Knowledge/study of S-parameters, VSWR • Familiarity with CST modeling and simulation software tool. -- • Dual polarization, 3400-3800 MHz 5G frequency band • Half power beamwidth HPBW=65°±5° for a column in horizontal plane • Half power beamwidth HPBW=18°±2° for a column in elevation plane • Input matchings ($\|s_{11}\|, \|s_{22}\| < -15dB$), Isolation ($\|s_{21}\| < -20dB$) • Gain 17±1dB for a column
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• None
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	• Nitelikli Eğitim • Sanayi, Yenilikçilik ve Altyapı
Team size (number of students)	☒ 3 ☒ 4 ☐ 5

PROJECT PROPOSAL – 16

Advisor Name	Prof. Mehmet ÇİYDEM
Project Title	Antenna Array Design for Satellite S-Band Telemetry
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	The project addresses the design and implementation of antenna for Satellite S-Band Telemetry applications. f) Design of circularly polarized crossed dipole single antenna element (modeling and simulations suspended patch with proper excitations) g) Implementation of (a) (prototyping, test and measurements) h) Design of antenna array (modeling and simulations) i) Implementation (c) (prototyping, test and measurements) j) Documentation and Reporting
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. -- **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• Knowledge/study of antenna theory and design • Knowledge/study of antenna array theory and design • Knowledge/study of S-parameters, VSWR • Familiarity with CST modeling and simulation software tool. -- • Circular polarization, 2200-2400 MHz S-Band Telemetry • Half power beamwidth HPBW=80°±5° for a single element in horizontal and elevation plane • Input matchings ($\|s_{ii}\|, < -15dB$), Isolation ($\|s_{ij}\| < -20dB$) • Gain 7.5±1dB for a single element
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• None
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	• Nitelikli Eğitim • Sanayi, Yenilikçilik ve Altyapı
Team size (number of students)	☒ 3 ☒ 4 ☐ 5

PROJECT PROPOSAL – 17

Advisor Name	Prof. Mehmet ÇİYDEM
Project Title	Antenna Array Design for Satellite X-Band Telemetry
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	The project addresses the design and implementation of antenna for Satellite X-Band Telemetry applications. k) Design of circularly polarized crossed dipole single antenna element (modeling and simulations suspended patch with proper excitations) l) Implementation of (a) (prototyping, test and measurements) m) Design of antenna array (modeling and simulations) n) Implementation (c) (prototyping, test and measurements) o) Documentation and Reporting
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. --- **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• Knowledge/study of antenna theory and design • Knowledge/study of antenna array theory and design • Knowledge/study of S-parameters, VSWR • Familiarity with CST modeling and simulation software tool. --- • Circular polarization, 8000-8400 MHz X-Band Telemetry • Half power beamwidth HPBW=80°±5° for a single element in horizontal and elevation plane • Input matchings ($\|s_{ii}\|, < -15dB$), Isolation ($\|s_{ij}\| < -20dB$) • Gain 7.5±1dB for a single element
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• None
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	• Nitelikli Eğitim • Sanayi, Yenilikçilik ve Altyapı
Team size (number of students)	☒ 3 ☒ 4 ☐ 5

PROJECT PROPOSAL – 18

Advisor Name	Prof. Dr. Ertuğrul AKSOY
Project Title	Early Pattern Detection System for Algorithmic Trading in Stock Market
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	This project aims to develop a tool that can detect some technical patterns before the pattern ending in stock market. The primary objective is to develop an algorithm and software to identify predefined technical patterns before the pattern is complete and produce stock market trade signals. In this project current supervised and unsupervised AI techniques will be tried to be implemented to a simple trade algorithm in order to automate the trading action. In this way, an attempt will be made to develop a more profitable trade system.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• The system must produce both transaction signals • The system is expected to make an overall positive profit over a six-month time period and must be produce statistically 60% profitable signals. • The transaction commissions must be included to the trading actions.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• The team requires expertise in *economics* to understand the behavior of stock market. • The team needs this expertise to develop a robust, user-friendly, and secure software application (*Software or Computer Engineering*)
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	Since this projects also aims to develop a financial literacy, it can be considered under decent work and economic growth SDG goal.
Team size (number of students)	☒ 3 ☐ 4 ☐ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 19

Advisor Name	Prof. Dr. Bünyamin Tamyürek
Project Title	Development of a 4-Channel PWM-Based DDV Valve Driver for Airborne Flight Control Actuators
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	Direct Drive Valves (DDVs) are essential in flight control actuators, yet no commercial multi-channel, high-reliability DDV driver exists for avionics test environments. This gap limits SEL and Iron Bird systems. The project aims to design a 4-channel PWM-based DDV driver (0–40 V, 0–3 A continuous per channel, 5 A peak) with adjustable PWM (10 Hz–20 kHz, 0–100% duty, ≥12-bit), supporting ARINC 429 and ±10 V analog control. Key features include closed-loop current feedback, isolation, and full protection, compliant with MIL-STD-704 and environmental standards. The approach involves requirement analysis, simulation, MOSFET/IGBT-based power stage development, EMI/EMC-compliant PCB design, and testing under load, temperature, vibration, and shock. Expected outcomes are a functional novel prototype, reduced dependency on foreign solutions, modular/scalable architecture for avionics labs, and student experience in power electronics, avionics communication, and system integration.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	- **4 independent channels** (0–40 V, 0–3 A, ≥12 A total). - **PWM:** 10 Hz–20 kHz, 0–100% duty, ≥12-bit resolution. - **Control:** ARINC 429 + ±10 V analog. - **Supply:** 28 V DC (MIL-STD-704). - **Environment:** -40 °C to +70 °C, vibration/shock resistant. - **Telemetry:** Current, voltage, temperature, faults. Power converter test setup required. ARINC 429 needs specialized HW/SW. EMI/EMC requires advanced PCB/shielding. Limited time and budget for qualification tests.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	**Electrical/Electronics:** Power electronics, driver circuits, PCB. **Computer Engineering:** ARINC 429 communication, telemetry software. **Mechanical Engineering:** Thermal design, vibration/shock resistance.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	**Goal 9:** Industry, Innovation, Infrastructure – local aerospace technology development. **Goal 12:** Responsible Consumption and Production – sustainable, cost-effective local solution.
Team size (number of students)	☐ 3 ☐ 4 ☒ 5 Emre Erçin, Baran Dolançay, Münevver Baba, Alişan Özkaya, Şamil Atar

PROJECT PROPOSAL – 20

Advisor Name	Prof. Dr. Özgür ERTUĞ
Project Title	Smart Home Integrated Earthquake Early Warning and Safety System
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	Earthquakes can cause fires, explosions, and gas leaks when electricity and gas lines remain active. Current smart home systems lack real-time responses to seismic events, creating a need for an integrated safety solution. This project aims to design a system that automatically disconnects gas and electricity lines when an earthquake is detected and alerts residents through smart platforms. The goal is to develop a reliable, cost-effective prototype compatible with smart home infrastructures. The system will combine earthquake detection sensors with a control unit that triggers automatic shutoff mechanisms and sends notifications via IoT or mobile applications. A prototype will be tested on a small-scale smart home model. The project is expected to deliver a functional prototype that ensures automatic line disconnection, real-time alerts, and reduced post-earthquake risks. The solution will be modular and adaptable for future integration into smart homes.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	The proposed system must be able to reliably detect earthquakes through sensor integration and automatically cut off gas and electricity lines to ensure household safety. It should operate with low power consumption while incorporating IoT-based communication for real-time notifications to residents. However, the project faces several limitations: real earthquake conditions cannot be fully simulated in the laboratory, the cutoff mechanisms will be demonstrated only at prototype scale, and budget and time restrictions may prevent the inclusion of more advanced features.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• Computer Engineering (COMPE): IoT communication, mobile app development. • Mechanical Engineering (ME): Design of gas valve cutoff mechanism. • Electrical/Electronics Engineering (EEE): Sensor integration, circuit design, and control algorithms.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	This project supports SDG 3 (Good Health and Well-being), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 11 (Sustainable Cities and Communities) by enhancing household safety and resilience against earthquakes.
Team size (number of students)	☐ 3 ☒ 4 ☐ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 21

Advisor Name	Prof. Dr. Özgür ERTUĞ
Project Title	A Design Of The End-To-End Wireless Communication System Based On Autoencoder And Adalm-PLUTO
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	The application of deep learning in the field of wireless communication is a research hotspot in current academia. Especially, the research of end-to-end wireless communication technology based on autoencoder is gradually carried out, but there are few engineering cases. Therefore, this project proposes a design scheme of end-to-end wireless communication system based on autoencoder and ADALM-PLUTO, which can be used for prototype verification and wireless communication. A wireless communication system will be constructed by using computers, ADALM-PLUTO SDR platforms and wireless communication neural network trained based on autoencoder which uses the SDR software kernels of signal transmitting and receiving. Lastly, the training data will be constructed and the experiments will be carried out. The results expected should show that the proposed scheme can achieve better end-to-end wireless communication in an indoor environment.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	**Requirements:** A wireless communication system will be constructed with the end-to-end wireless communication neural network represented by AEW which is derived from Autoencoder and Wireless, signal preprocessing modules, computers and ADALM-PLUTOs. The transmitting module mainly includes a computer containing a signal transmitting neural network represented by Transmitter, a signal transmitting preprocessing module, and an ADALM-PLUTO containing antennas. The receiving module mainly includes a computer containing a signal receiving neural network represented by Receiver, a signal receiving preprocessing module, and an ADALM-PLUTO containing antennas. The computer and ADALM-PLUTO implement interactions between software and hardware through the USB data lines and PlutoSDR support package. It should be specially explained that the AEW includes Transmitter, Channel and Receiver corresponding to the autoencoder's structure. Based on the data-driven mode, it jointly learns the sub-module functions of traditional wireless communication systems such as channel coding, constellation mapping and signal modulation through end-to-end training. **Cnsstraints:** Although autoencoder deep learning algorithm is well known in literature, its design and working tests in such and SDR communication system may take longer than as expected in the project schedule.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	Computer Engineering (COMPE): Deep learning autoencoder algorithms

Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	This project supports SDG 9 (Industry, Innovation and Infrastructure) by implementing innovative deep learning autoencoder based end-to-end wireless communication systems for industrial infrastructure.
Team size (number of students)	☐ 3 ☐ 4 ☐ 5 Team Size: 2-The algorithmic and implementation size of the project workload is reasonably appropriate for a team of size 2 students.

PROJECT PROPOSAL – 22

Advisor Name	PROF. DR. TUĞBA SELCEN NAVRUZ
Project Title	Camouflaged Mobile Air Defense System Vehicle
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	Problem Statement The project addresses the need to develop a system capable of detecting and tracking small aerial threats (e.g., drones) from a mobile platform with low observability. Objectives 1. Develop a portable prototype that processes multi-sensor data and integrates core image processing with intelligent control algorithms. 2. Implement both manual and autonomous target tracking modes with operator override capability. 3. Demonstrate an optional emergency escape/withdrawal behavior on the platform. 4. Validate detection/tracking performance in controlled test scenarios using non-harmful symbolic engagement methods. Method • Design and integrate sensor suite (optical cameras, optional acoustic/radar sensors) and an embedded mission computer (Jetson Nano class or equivalent). • Implement image processing and sensor-fusion pipelines for real-time detection and tracking. • Develop control algorithms for manual and autonomous tracking, and an emergency stop / optional withdrawal behavior. • Perform algorithm validation first in simulation, then in controlled field tests using non-harmful targets (LED markers, water/soft balloons, or simulation playback). Expected Outcomes • A working, energy-efficient, portable prototype platform capable of detecting and tracking small aerial targets. • Demonstration of both manual and autonomous tracking modes and an optional emergency withdrawal behavior under controlled test conditions. • Documentation including BOM, firmware, software stack, test reports, and a web-based dashboard for telemetry and visualization.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	**Requirements** • The system must reliably detect and track both stationary and moving aerial targets using sensor fusion. • It must support both manual and autonomous operation modes and allow immediate operator intervention.

	• An accessible Emergency Stop button must be provided to immediately halt all motion in abnormal situations. • The vehicle’s exterior design must be camouflaged to reduce visual detectability in the operational environment. • Optionally, the system should provide a triggerable autonomous withdrawal/escape behavior. • An embedded mission computer (Jetson Nano class or equivalent) must be used to enable high-resolution image processing and on-device inference. • Power must be supplied by rechargeable batteries; battery protection, charging procedures, and energy management must be documented. • Physical “engagement”/neutralization tests must be performed using non-harmful/symbolic methods (LEDs, visual markers, or simulation); weaponized/harmful mechanisms will not be implemented. **Constraints** • Due to portability and mobile usage requirements, the system’s size and weight are limited; a compact and easily transportable design should be targeted. • Since battery capacity and available energy are limited, a careful balance must be maintained between processing load, sensor usage, and operating time. • Real-time operation of autonomous algorithms is constrained by the processing capacity of the embedded mission computer (Jetson Nano class); models must be optimized for embedded hardware. • Cost and manufacturing constraints may limit the use of high-performance/advanced sensors; the design must balance performance with budget. • Regulatory, safety, and ethical requirements prohibit the development and testing of lethal/harmful functions. • Real-world datasets for small aerial targets may be limited; synthetic data generation and controlled recordings may be necessary to provide sufficient data.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	The project requires collaboration across multiple engineering disciplines. • **Computer Engineering (COMPE):** responsible for image processing algorithms, sensor fusion software, embedded programming, and dashboard development. • **Mechanical Engineering (ME):** focuses on the mobile platform’s mechanical design, camouflaged exterior structure, vibration isolation, and integration of the sensor payload. • **Industrial Engineering (IE):** contributes to system-level planning, reliability testing, resource optimization, and cost-benefit analysis of the proposed design. • **Electrical & Electronics Engineering (EE core):** handles power management, embedded system integration, sensor interfacing, and hardware implementation.

Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	• **SDG 9 – Industry, Innovation, Infrastructure:** contributes to resilient sensing and autonomous monitoring solutions. • **SDG 11 – Sustainable Cities & Communities:** supports safer monitoring and situational awareness in civilian contexts. • **SDG 12 – Responsible Consumption & Production:** encourages energy-efficient sensing and system design.
Team size (number of students)	☐ 3 ☒ 4 ☐ 5

PROJECT PROPOSAL – 23

Advisor Name	Müjdat Balantekin
Project Title	Footsteps into Electricity
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	• This project is about developing ideas to meet current energy needs in a practical way without harming the environment, depleting natural resources and endangering the needs of future generations. • The aim of this project is to develop an electricity generation and storage system that can be used in places with heavy pedestrian traffic such as shopping malls, metro stations, bus stops, schools, hospitals and business centers. • The kinetic energy generated by footsteps will be converted into electricity by the electromechanical system that will be placed in busy walking areas. • Considering efficiency/cost, flywheel or piezoelectric material will be used for the energy conversion. • How much electrical energy is obtained from each footstep will be measured and on average, how much electrical energy can be produced annually will be calculated. • In order to design and produce mechanical parts, it is necessary to have knowledge about CAD tools and 3D printing. • At the end of the project, a tested and ready-to-use prototype is expected.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• The designed system must be able to store the generated electricity and make it available for use when needed. • The prototype should be designed to be ready for safe use in places such as shopping mall entrances, metro stations, hospitals, schools, etc. • The mechanical design must be able to maintain its function under adverse weather and environmental conditions. • The cost of the prototype must be affordable. • The mechanical design must be able to withstand the pressure of 50 kPa.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	The team needs expertise in mechanical engineering to develop and produce the mechanical parts of the system.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	7B Expand infrastructure and develop technology in developing countries, particularly least developed countries, small island developing states and landlocked developing countries, to provide modern and sustainable energy services to all within the framework of their support programmes by 2030.
Team size (number of students)	☐ 3 ☒ 4 ☐ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 24

Advisor Name	Doç. Dr. Süleyman Sungur TEZCAN
Project Title	Analysis of the Impacts of Solar Power Plants (SPPs) on Distribution Networks and Development of Mitigation Proposals (Supported by EnerjiSA)
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	Problem Statement: The integration of Solar Power Plants (SPPs) into distribution networks alters load characteristics, causing voltage rise/drop, power quality disturbances, and potential instability. These issues adversely affect consumers and the overall reliability of the grid. Objectives: - Identify and quantify voltage-related and power-quality issues caused by grid-connected SPPs. - Develop technically feasible and regulation-compliant mitigation measures. - Propose practical recommendations to enhance power quality and network stability. Method: - Literature and regulation review. - Collection and analysis of distribution network measurement data. - Time-domain and steady-state simulations and modeling (e.g., MATLAB/Simulink, DIgSILENT PowerFactory). - Scenario analysis under varying generation/load profiles and formulation of solution alternatives. Expected Outcomes: - A technical report characterizing SPP impacts on the distribution network. - Regulation-compliant mitigation proposals and implementation guidelines. - Simulation results and recommended technical measures to improve power quality.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	Requirements: - Access to anonymized grid measurement and topology data. - Simulation software licenses (e.g., MATLAB, DIgSILENT). - Access to relevant national regulations and standards. Constraints: - Limited availability of field measurement data and confidentiality constraints. - Software license and computational resource limitations. - Simulation-based results may require field validation.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities.	- Electrical and Electronic Engineering: grid modeling and simulations. - Industrial Engineering: statistical data analysis and risk assessment.

Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	- Mechanical/Asset Engineering: evaluation of SPP equipment impacts (e.g., inverter thermal behavior).
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	SDG 7: Affordable and Clean Energy SDG 9: Industry, Innovation and Infrastructure SDG 13: Climate Action
Team size (number of students)	4

PROJECT PROPOSAL – 25

Advisor Name	Doç. Dr. Süleyman Sungur TEZCAN
Project Title	Engineering Measures to Prevent Electric Shock in Low Voltage (LV) Distribution Networks (Supported by EnerjiSA)
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	Problem Statement: Leakage currents and insulation failures in LV distribution networks can create electric shock hazards for users and maintenance personnel. This represents a critical safety issue affecting occupational safety, customer protection, and service continuity. Objectives: - Identify primary sources and conditions that produce leakage currents leading to electric shock in LV networks. - Perform engineering calculations (grounding, leakage current, fault current) to quantify risks. - Propose protection device configurations and design modifications to minimize shock risk. Method: - Field data review and risk factor analysis. - Engineering calculations for earthing, leakage currents and fault scenarios. - Evaluation and selection of protective devices (RCDs, fuses, isolation transformers) and system design recommendations. - Simulation and scenario tests to validate proposed measures. Expected Outcomes: - Calculations and design guidelines to reduce electric shock risk in LV installations. - Recommended protection device configurations and implementation steps. - Technical report supporting improved occupational safety and reduced accident risk.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	Requirements: - Access to LV network parameters and leakage current measurements. - Electrical calculation and simulation tools. - Relevant standards and compliance documents (IEC, TSE, national regulations). Constraints: - Restricted access to complete field datasets. - Limited opportunity for full laboratory testing of protection devices within project timeframe. - Recommendations may initially be simulation-based requiring phased field validation.

Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	- Electrical and Electronic Engineering: protection design and analysis. - Mechanical Engineering: mechanical safety aspects of protection equipment. - Industrial Engineering / Safety Engineering: risk analysis and occupational safety optimization.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	SDG 3: Good Health and Well-being SDG 7: Affordable and Clean Energy SDG 9: Industry, Innovation and Infrastructure
Team size (number of students)	4

PROJECT PROPOSAL – 26

Advisor Name	Mehmet Feyzi Akşahin
Project Title	Pilot Health Monitoring System
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	The project addresses the problem of not having real-time monitoring of pilots' health and cognitive conditions during flights, which poses a significant safety risk as it may lead to fainting, loss of attention, or fatigue. The primary objective is to develop a comprehensive prototype system capable of continuously tracking pilots biometric and cognitive states. This will be achieved by integrating biometric sensors (heart rate, oxygen saturation, body temperature, sweating), camera-based monitoring (facial emotion recognition, eye movement tracking), and artificial intelligence algorithms for fatigue and attention detection. The system will visualize all collected and analyzed data through an interactive desktop interface and integrate the results into popular flight simulators such as Microsoft Flight Simulator, DCS World, or FlightGear to evaluate performance in different flight scenarios. The project is expected to produce a working prototype that allows continuous monitoring of pilots' health conditions, artificial intelligence-based stress and fatigue detection algorithms, and a simulation-integrated testing environment to validate system performance under various scenarios.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• Real-time collection of biometric signals such as heart rate, oxygen saturation, and body temperature using wearable sensors. • A camera-based system capable of emotion analysis and eye movement detection. • Signal processing techniques to filter and prepare raw data for AI algorithms. • Artificial intelligence models (deep learning, machine learning) for stress, fatigue, and attention level estimation. • A desktop application for real-time visualization of data and analysis results. • Integration with flight simulators to provide a realistic testing environment. • High hardware costs of biometric sensors and camera systems. • Limitations in conducting real in-flight testing due to safety and authorization issues. • Computational demands of AI algorithms requiring GPU-enabled processing. • Project timeline restrictions limiting long-term or large-scale testing.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• Computer Engineering (COMPE): Development of artificial intelligence algorithms, signal processing, and desktop application interface. • Mechanical Engineering (ME): Human-machine interaction, integration of hardware components, and simulator setup. • Industrial Engineering (IE): Evaluation of pilot performance data, ergonomics, and system usability analysis.

Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	• Goal 3: Good Health and Well-being – Protecting pilots' health and ensuring early detection of risks. • Goal 9: Industry, Innovation and Infrastructure – Developing innovative health monitoring systems. • Goal 11: Sustainable Cities and Communities – Contributing to safer and more reliable air transport systems.
Team size (number of students)	☐ 3 ☒ 4 ☐ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 27

Advisor Name	Doç. Dr. Mehmet Feyzi Akşahin
Project Title	Camouflaged Mobile Air Defense System
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	The project addresses the limitations of existing mobile air defense systems by proposing a versatile solution capable of both autonomous and manual target engagement while maintaining low visibility against ground threats. The primary objective is to develop a functional prototype of a mobile air defense system that can detect and neutralize stationary and moving targets using advanced sensors, image processing techniques, and intelligent control algorithms. This will be achieved by integrating a camouflaged vehicle platform with a manual control interface, autonomous targeting system, and optionally, an emergency escape mechanism, all powered by rechargeable batteries to ensure mobility and sustainability. The project is expected to produce a fully functional, system-integrated prototype demonstrating the feasibility of a portable, dual-mode (manual and autonomous) air defense solution with low detectability, though further testing will be necessary to validate operational performance in real-world scenarios.
• **Requirements**: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. ○ **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes. (-)	• The system must be able to detect and neutralize both stationary and moving targets. • It must support dual-mode operation, allowing both manual and autonomous control. • A camouflaged design is required to ensure low visibility against ground threats. • The movement mechanism must be controllable manually. • The system must be portable and operate using rechargeable batteries. ○ System design must comply with current technology and material limitations. ○ Energy consumption is limited by battery capacity, requiring low-power operation. ○ Weight and size must be constrained to maintain mobility. ○ Integration of manual and autonomous control mechanisms is limited by hardware and software compatibility. ○ Optional emergency escape mechanism may increase design complexity and cost.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	▪ The team requires expertise in Mechanical Engineering (ME) to design and optimize the vehicle platform, movement mechanisms, and structural components. ▪ Computer Engineering (COMPE) or Software Engineering expertise is required to implement the autonomous control algorithms, user interface, and data visualization system for manual and autonomous operation.

Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	▪ The project aligns with SDG 16: Peace, Justice, and Strong Institutions by enhancing the capacity of countries to strengthen national security, early threat detection, and risk management for defense purposes. ▪ By providing a mobile and versatile air defense solution, the project contributes to improving preparedness and resilience against potential threats, supporting national and regional stability.
Team size (number of students)	☐ 3 ☐ 4 ☒ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 28

Advisor Name	Assoc. Prof. Derya Yılmaz
Project Title	Automated Material Feeding and Distribution System
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	In small and medium-scale production lines, material flow is mostly carried out manually, which leads to time loss and material waste. Since directing parts to the correct lines at the right time is difficult in current systems, production efficiency decreases. The aim of this project is to design an automated system that integrates multiple feeder belts into a single main conveyor. The system will enable two operators to work synchronously on the same line, increasing production speed and ensuring efficiency in workforce and space utilization. With a low-cost prototype, a scalable solution will be created, and material waste will be reduced by at least thirty percent. For system control, an ESP32-based microcontroller will be used. Materials will be directed to the main conveyor through sensors and servo gates installed on the feeder belts. Sensors on the main conveyor will ensure gap detection, while product selection will be made directly through a small display. This structure will provide a simple and reliable solution offering real-time control and ease of use. At the end of the project, a working prototype that integrates multiple feeder belts into a single main conveyor is expected to be obtained. The system will regulate material flow, reduce errors and waste, enable two operators to work more efficiently, and establish the foundation for a scalable production infrastructure.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• The system must be able to automatically transfer parts from multiple feeder belts onto the main conveyor. • IR sensors must detect the readiness of parts and identify gaps on the main conveyor. • Servo gate mechanisms must release parts one by one without collision. • The operator must be able to select products through a small display, and the system must execute these commands. • All components must be low-cost and compact. • The prototype must be developed with a limited budget.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	In this project, mechanical engineering will contribute to the design of the conveyor belts and diverter mechanisms, ensuring the durability of the system. Industrial engineering will play a role in organizing material flow and reducing waste to support operator efficiency. Computer engineering will be integrated to design the simple display interface for product selection and to develop the embedded software.

Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	● **Goal 9: Industry, Innovation and Infrastructure** The project aims to improve industrial efficiency and contribute to modern production infrastructure by developing innovative and low-cost automation solutions in production lines. ● **Goal 12: Responsible Consumption and Production** The system regulates material flow, reduces errors and waste, and enables more efficient use of resources.
Team size (number of students)	☒ 3 ☐ 4 ☐ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 29

Advisor Name	Assoc. Prof. Dr. Derya YILMAZ
Project Title	Autonomous Fire Detection Network
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	1. Due to climate change, the frequency and severity of wildfires have increased worldwide, including in our country. Delayed detection and intervention often lead to significant loss of life and property, as well as irreversible damage to natural ecosystems. Current wildfire detection methods (observation towers, aerial patrols, public reporting, etc.) are often inadequate and fail to ensure early-stage containment. This project aims to provide early wildfire detection to significantly reduce response time. 2. The project aims to reliably detect wildfire threats at an early stage by combining sensor and image-based analysis. By evaluating fire probability through smoke density and image processing, the system will provide accurate detection. To ensure wide-area coverage, long-range wireless communication will be enabled via the LoRa network. The device will achieve uninterrupted and sustainable operation using solar energy and battery backup, making it suitable for deployment in remote environments. Finally, the system is designed to be portable, low-cost, and scalable, ensuring practical usability and widespread adoption. 3. The project will employ a multi-sensor (smoke sensor, camera) and computer vision-based approach. Sensor data will be evaluated using threshold values, while camera images will be processed using Python and the OpenCV library. In the initial phase, wildfire detection will be carried out using deep learning-based object detection algorithms such as YOLO to improve accuracy. Devices will communicate via the LoRa network, and daisy-chain communication will enable coverage of large areas. Power will be supplied by solar panels, with batteries ensuring continuous operation during nighttime. 4. The project is expected to deliver a prototype system capable of early wildfire detection, supported by a LoRa-based wireless communication infrastructure. The solution will include a portable device design powered by solar panels and battery, ensuring continuous operation. On the software side, the system will feature fire recognition algorithms developed with computer vision techniques such as and YOLO. Overall, the project will result in a cost-effective and sustainable solution that enables faster response and intervention in wildfire scenarios.

Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	**Requirements:** • Reliable detection of wildfire indicators (smoke and flames). • Integration of sensors (smoke sensor, camera) with computer vision algorithms. • Long-range wireless communication using LoRa. • Continuous operation via solar energy and battery backup. • Portable, weather-resistant, and low-cost design. **Constraints:** • Limited battery capacity under low sunlight conditions. • Restricted communication range requiring multiple devices for large areas. • Possible false alarms from environmental factors (fog, dust, lights). • Budget and hardware availability. • Computational limits of Raspberry Pi for advanced algorithms.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	This project integrates Computer Engineering (COMPE) alongside Electrical and Electronics Engineering. COMPE contributes mainly through image processing and machine learning algorithms such as YOLO. Collaboration between the disciplines ensures that while the hardware and sensors provide accurate data collection, computer engineering methods enable advanced analysis, improving the reliability of wildfire detection.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	This project aligns with the following UN Sustainable Development Goals (SDGs): • SDG 7: Affordable and Clean Energy – Utilizes solar power as a clean and renewable energy source for continuous operation. • SDG 13: Climate Action – By enabling early wildfire detection, the project reduces climate-related risks and supports disaster resilience. • SDG 15: Life on Land – Protects forests, biodiversity, and ecosystems from the devastating effects of wildfires.
Team size (number of students)	☐ 3 ☒ 4 ☐ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 30

Advisor Name	Assoc. Prof. Dr. Derya YILMAZ
Project Title	Detection of Flatfoot Disease Using Artificial Intelligence and Image Processing
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	Flatfoot (pes planus) is a disorder where the foot arch collapses, leading to pain and mobility issues. Current diagnosis relies on clinical observation or costly imaging methods, which are not always accessible. There is a need for a non-invasive, automated, and affordable diagnostic tool to support early detection. The project aims to develop an AI-based system to detect flatfoot from foot images. Goals include creating a custom dataset, training machine learning models—particularly deep learning approaches—for classification, and evaluating their performance. A prototype application will also be prepared. The project will follow a general machine learning workflow. First, foot images will be collected to form a dataset. Then, data preprocessing and feature extraction techniques will be applied to prepare the images for analysis. Machine learning and deep learning methods will be explored for classification, and their performance will be compared using standard metrics. Finally, a simple prototype will be developed to demonstrate the system's usability. The project will deliver a labeled image dataset, a trained AI model for flatfoot diagnosis, and a prototype application. These results will demonstrate the feasibility of AI in musculoskeletal disorder detection and provide a basis for future clinical validation.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	The system must be able to analyze foot images and extract features relevant to flatfoot detection. A sufficient dataset collected under controlled conditions is required for training and validation. The project also requires access to computing resources with GPU support for model development. Ethical approval and anonymization procedures must be ensured for all collected images. The dataset may be limited in size and diversity, which can restrict the model's ability to generalize. Deep learning methods require significant computational resources, potentially slowing down training and testing. Ethical considerations in medical image collection may also limit the pace of data acquisition. Finally, full clinical validation is beyond the project scope and will remain a future step.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	The project integrates multiple disciplines. Computer Engineering contributes by developing AI algorithms, training deep learning models, and designing the prototype application. Electrical and Electronics Engineering supports image preprocessing, feature extraction, and system integration. And Medicine (Medical) discipline provides the medical perspective, ensuring clinical relevance of the dataset and validating diagnostic outcomes.

	This collaboration enables the project to achieve both technical robustness and medical applicability.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	This project aligns with SDG 3: Good Health and Well-Being by supporting early detection of musculoskeletal disorders through AI-based diagnostic tools, contributing to preventive healthcare and improved accessibility in line with the UN's global health targets.
Team size (number of students)	☒ 3 ☐ 4 ☐ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 31

Advisor Name	**Doç. Dr. UĞURHAN KUTBAY**
Project Title	VisionLink: AI Powered Smart Glasses for Real Time Assistance and Connectivity
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	1. Problem Statement Visually impaired people struggle with navigation, text access, and digital interaction. Existing devices are costly or limited to single functions, restricting independence and equal access to information. 2. Objectives Design and prototype affordable smart glasses (< $200) with three functions: scene understanding, voice assistant, and real-time web/API access. Ensure modularity for future extensions and deliver a working prototype by year's end. 3. Method Hardware: Raspberry Pi 4, camera, microphone, speaker, buttons, and battery. Software: Gemini Live API (vision + language), Google Vision OCR, external APIs (OpenWeather, Tavily, Twilio) via FastAPI backend. Interaction: Button-based modes for scene description, voice assistant, and API queries. 4. Expected Outcomes A working prototype providing real-time scene description, voice interaction, and internet queries, with documented backend integration and a final report on results and improvements.

Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful.
Constraints: Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.
	Requirements
	
	• **Total Cost**: The complete prototype (hardware + essential software licenses) must not exceed **$200**.
	• **Weight**: Final wearable unit must weigh **≤ 350 grams** (including frame, Raspberry Pi, camera, and battery).
	• **Processing Latency**:
	• **Scene Understanding Response Time**: ≤ 3**.0 seconds** (from camera capture to spoken output).
	• **Voice Command Response Time**: ≤ 3**.0 second** (from voice input to response initiation).
	• **Battery Runtime**: Device must support **≥ 2.5 hours** of continuous usage on a single charge.
	• **Accuracy Metrics**:
	• OCR (printed text recognition) accuracy ≥ **85%** for standard fonts and lighting conditions.
	• Scene description correctness (evaluated on test set of 50 scenes) ≥ **80% user-rated relevance**.
	• **Connectivity**: Must operate reliably on **Wi-Fi ≥ 5 Mbps** upload/download speeds.
	• **User Interaction**: Each mode (A–C) must be triggered by a **dedicated physical button** with response confirmation (audio beep or vibration).
	• **Prototype Delivery**: A **fully functional working prototype** (hardware + backend + demonstration software) must be ready by **May 2026** (end of academic year).
	
	Constraints (Limitations & Risks)
	
	1. **Hardware Processing Power**:
	  a. Raspberry Pi 4 (4GB RAM) cannot handle heavy real-time ML models locally.
	  b. ≥ **80%** of AI computation must be offloaded to cloud APIs (Gemini, Google Vision, etc.).
	2. **Internet Dependency**:
	  a. Stable Wi-Fi connection required.
	  b. If connection drops below **5 Mbps**, latency may increase beyond target.
	3. **Battery Capacity**:
	  a. Estimated **5,000 mAh** power bank gives ~2.5 hours continuous runtime.

	b. Power consumption ≈ **3.5–4.0 W** under load. 4. **Budget Restriction**: a. Limited to $200 → may require trade-offs in camera resolution (e.g., 5MP instead of 12MP) or speaker quality. 5. **Timeframe**: Prototype development and testing must be completed **within 9 months** (Sept 2025 – May 2026). 6. **Environmental Conditions**: Device designed for **indoor and mild outdoor** use. a. Not weatherproof (rain, dust protection not included at prototype stage). 7. **User Testing Limitations**: Evaluation will be performed on a **small-scale sample (5–10 test users)**, not a full population.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	**Multidisciplinary and Interdisciplinary Aspects** • **Computer Engineering (COMPE):** Backend software, API integration, natural language processing, and system architecture. • **Mechanical Engineering (ME):** Glasses frame design, ergonomics, heat dissipation, and integration of electronics into a wearable form. • **Industrial Engineering (IE):** User experience optimization, workflow analysis, and cost performance trade offs. Together, these disciplines ensure the system is functional, ergonomic, cost effective, and user friendly.
Alignment with UN Sustainable Development Goals:indicate the specific goal/goals from the SDGs list(*)	**Alignment with UN Sustainable Development Goals (SDGs)** • **Goal 3:** Good Health and Well being improving quality of life for visually impaired individuals. • **Goal 10:** Reduced Inequalities providing affordable assistive technology. **Goal 11:** Sustainable Cities and Communities enabling independent mobility and safer integration into urban environments.
Team size (number of students)	☐ 3☑ 4☐ 5

	Justification: The project requires multiple components (hardware integration, backend/API development, software logic, user interface, documentation). A team of **4 students** ensures proper distribution of tasks and allows interdisciplinary collaboration.

PROJECT PROPOSAL – 32

Advisor Name	Doç.Dr. Korhan Kayışlı
Project Title	Hybrid Solar Inverter with MPPT, Bidirectional DC-DC Converter, and IoT Monitoring
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	Current standalone and low-cost solar power systems suffer from poor efficiency and reliability. The absence of MPPT control prevents maximum energy harvesting from PV panels, while fixed charging strategies and lack of bidirectional converters limit effective battery management. Additionally, most systems lack real-time IoT monitoring, resulting in weak data collection, delayed fault detection, and inefficient maintenance. Develop a solar DC-DC converter with MPPT to maximize power extraction under varying sunlight conditions. Design a bidirectional DC-DC converter for intelligent battery charging and discharging. Implement a grid-tied DC-AC inverter to ensure stable power delivery. Integrate IoT-based real-time monitoring for performance tracking, fault detection, and remote supervision. Demonstrate the system in simulation and hardware using STM32 control and suitable software tools (e.g., MATLAB, PSIM, or Proteus). The project will be carried out in three main stages. First, a solar DC-DC converter with MPPT control will be designed to ensure maximum energy harvesting from the PV array. Next, a bidirectional DC-DC converter will be implemented to manage battery charging and discharging intelligently, maintaining system stability. Finally, a grid-tied DC-AC inverter will be developed to supply power efficiently. An STM32 microcontroller will be used for real-time control, while simulation tools such as MATLAB or PSIM will validate system performance before hardware implementation. IoT integration will enable continuous monitoring and data collection, supporting smart supervision and fault detection. The expected outcome is a modular hybrid solar inverter system that achieves higher efficiency, better energy utilization, and reliable remote monitoring compared to conventional low-cost designs.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• The PV input stage must efficiently track maximum power point. • Bidirectional converter must handle both charging and discharging with CC-CV control. • The inverter stage must produce stable AC (50 Hz, low THD). • IoT system must transmit real-time parameters reliably. • Power level restricted to 100–200 W for classroom safety.. • Grid-tied features may be simulated rather than implemented due to safety/regulations.

Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• Electrical/Electronics Engineering**:** Power electronics design, control, and embedded systems (STM32 programming). • Computer/Software Engineering: IoT platform development, mobile dashboard, and possible AI-based optimization. • Sustainability/Industrial Engineering: Energy efficiency, cost analysis, and sustainable design integration.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	By encouraging effective solar energy collecting, storage, and usage using a hybrid inverter system, this initiative advances SDG 7 (Affordable and Clean Energy). By lowering carbon emissions and promoting cleaner energy transitions with clever renewable energy management, it also advances SDG 13 (Climate Action).
Team size (number of students)	☒ 3 ☐ 4 ☐ 5

PROJECT PROPOSAL – 33

Advisor Name	Doç.Dr. Korhan Kayışlı
Project Title	Active Power Factor Correction with Different Control Techniques
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	**Problem Statement** Modern power electronic devices and non-linear loads introduce significant harmonics into AC power systems, resulting in low power factor, increased losses, and reduced efficiency. Conventional rectifiers without proper correction fail to comply with international standards (e.g., IEC 61000-3-2) and cause additional stress on the grid. There is a need for compact, reliable, and high-performance Active Power Factor Correction (APFC) circuits capable of improving input current quality while maintaining stable DC output. **Objectives** • Design and implement a boost converter-based APFC system. • Compare different control methods (e.g., PI control, Average Current Mode Control, Sliding Mode Control, and Fuzzy Logic Control). • Achieve near-unity power factor (>0.98) under varying load and input conditions. • Reduce Total Harmonic Distortion (THD) of the input current to below 5%. • Validate the design through MATLAB/Simulink simulations and hardware implementation. **Method** The project will be carried out in three stages. First, a boost converter topology will be selected as the APFC circuit due to its wide adoption and robustness. Next, different control strategies will be applied to regulate the input current and output voltage. Simulations will be conducted using MATLAB/Simulink to compare dynamic response, THD, efficiency, and power factor improvement. Finally, a hardware prototype will be developed using STM32 or DSP-based control. Experimental measurements will verify simulation results. **Expected Outcomes** • A functional APFC prototype capable of improving input current quality. • Comparative analysis of different control methods with performance metrics (PF, THD, settling time, efficiency). • MATLAB/Simulink models and hardware test results. • A comprehensive report highlighting advantages and trade-offs of each control technique.

Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	**Requirements** • The APFC must achieve PF ≥ 0.98 under nominal conditions. • Input current THD ≤ 5%. • Stable DC output voltage (e.g., 400 V DC from 220 V AC input). • Reliable control implementation on STM32/DSP. • Safety-compliant design limited to 100–200 W for laboratory demonstration. **Constraints** • Limited power rating due to classroom safety regulations. • Grid connection simulated where required to comply with laboratory safety standards. • Hardware complexity and component cost may restrict the number of tested control methods.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• **Electrical/Electronics Engineering:** Converter design, control implementation, power quality analysis. • **Computer/Software Engineering:** DSP/STM32 programming, digital control algorithms, data acquisition. • **Industrial Engineering:** Efficiency evaluation, cost analysis, and optimization of design for sustainable use.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	This project contributes to **SDG 7 (Affordable and Clean Energy)** by improving the efficiency of power conversion systems, enabling more sustainable energy usage. It also supports **SDG 9 (Industry, Innovation, and Infrastructure)** through the development of advanced power electronics solutions for modern grids, and **SDG 13 (Climate Action)** by reducing energy losses and associated emissions.
Team size (number of students)	☒ 3 ☐ 4 ☐ 5

PROJECT PROPOSAL – 34

<table>
<tr><td>Advisor Name</td><td>Doç.Dr. Korhan Kayışlı</td></tr>
<tr><td>Project Title</td><td>Active Ripple Suppression in Low-Voltage DC Bus Systems</td></tr>
<tr><td>Project Description

1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement)
2. Define the measurable goals the project aims to achieve through project lifetime (Objectives).
3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method).
4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).</td><td>Problem Statement

Modern low-voltage DC distribution systems, such as those in renewable energy microgrids, electric vehicles, and power electronic converters, often suffer from significant voltage ripple due to load transients and rectification harmonics. Traditional passive filtering requires bulky electrolytic capacitors, which increase cost, size, and reduce reliability over time. This project addresses the challenge of suppressing bus voltage ripple actively, with reduced passive components, improving system stability and extending lifetime.

Objectives

Design and implement an active ripple suppression circuit for a 24 V DC bus. Reduce bus voltage ripple amplitude by at least 50% compared to conventional passive filtering. Demonstrate stable operation under varying dynamic load conditions. reduction in required bulk capacitance.

Method
The proposed approach is based on a shunt active filter topology that senses bus voltage, extracts the ripple component through high-pass filtering, and injects a counteracting current using a bidirectional DC-DC converter. A digital controller will implement a proportional-resonant or adaptive algorithm targeting dominant ripple frequencies.

• Simulation: MATLAB/Simulink and LTspice to design and verify control algorithms.
• Hardware: MOSFET-based DC-DC converter , real-time controller , voltage and current sensors.
• Validation: Oscilloscope-based time-domain and frequency-domain measurements, comparing baseline and active suppression.

Expected Outcomes

• A working laboratory-scale prototype of an active ripple suppression system.
• Measured reduction of ripple amplitude .
• Comparative results showing reduced need for bulky electrolytic capacitors.</td></tr>
</table>

	• Technical report and demonstration video for evaluation.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	**Requirements** • Prototype must operate at 24 V, 3–5 A DC bus level. • Ripple suppression of at least 10–20 dB in target frequency band. • Safe operation with short-circuit, overcurrent, and thermal protections. • Demonstrated stability under sudden load changes. **Constraints** • Limited to low-voltage laboratory-scale hardware . • Component cost must remain within a student project budget . • Control implementation constrained by processing capability of chosen microcontroller/DSP. • EMI and switching noise management will require careful PCB layout.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	**Multidisciplinary and Interdisciplinary Aspects** • **Electrical & Electronics Engineering (EEE):** Power electronics topology design, controller implementation, experimental validation. • **Computer/Software Engineering:** Implementation of digital control algorithm, data acquisition, and GUI for real-time monitoring.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	**Alignment with UN Sustainable Development Goals** • **Affordable and Clean Energy** – Improving power quality and efficiency in renewable and microgrid systems. • **Industry, Innovation and Infrastructure** – Developing innovative electronic solutions for more reliable DC systems. • **Responsible Consumption and Production** – Reducing reliance on bulky, short-lifetime electrolytic capacitors, lowering electronic waste.
Team size (number of students)	☒ 2 ☐ 3 ☐ 4 ☐ 5

PROJECT PROPOSAL – 35

Advisor Name	Doç. Dr. Korhan Kayışlı
Project Title	Multimodal Quality Control and Product Sorting System
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	Modern manufacturing lines often rely solely on vision-based inspection systems to perform quality control. However, such systems are highly sensitive to changes in illumination, reflections, and surface variations, which can lead to unreliable or inconsistent results. In addition, defects related to physical parameters such as weight, temperature, and humidity remain undetected when only image data is considered, resulting in lower overall accuracy and reduced process efficiency. To address these challenges, our project proposes a multimodal quality inspection and product separation system that combines camera-based deep learning with multiple physical sensors. A Raspberry Pi processes images through a lightweight CNN model while simultaneously collecting data from a load cell, infrared temperature, and humidity sensors. The fused decision ensures that only products meeting all criteria are accepted, while defective items are automatically removed from the line using a mechanical rejection mechanism. The system records product IDs, sensor values, images, and decisions to provide full traceability, and a web-based dashboard presents real-time statistics, defect rates, and key performance indicators. Furthermore, an adaptive thresholding mechanism enables the system to improve its decision-making capability over time. This integrated approach increases robustness against environmental variations, reduces defective output, and supports the development of smarter, more reliable industrial quality control solutions.
Requirements: • Achieve at least 95% classification accuracy (OK/NOK). • Keep inspection cycle time below 1.5 seconds per product. • Provide full traceability with product ID, timestamp, sensor values, decision, and image storage. • Integrate camera with at least three physical sensors (weight, temperature, humidity). • Ensure fail-safe operation (default NOK in case of AI delay or malfunction). • Provide a real-time dashboard with live monitoring, statistics, and KPI visualization.	**Objectives:** • Achieve at least 95% accuracy in product classification (OK/NOK). • Ensure inspection cycle time below 1.5 seconds per product. • Provide full traceability by recording product ID, timestamp, sensor data, decision, and captured image. • Integrate multimodal data (camera + weight, temperature, humidity sensors) for robust decision-making. • Implement an adaptive thresholding mechanism that updates with collected production data. • Develop a web-based dashboard to monitor real-time results, statistics, and KPI indicators. • Design and prototype a mechanical rejection system to automatically separate defective products. **Method:**

Constraints: • No PLC will be used; all control is managed directly by Raspberry Pi. • Mechanical rejection system will be designed at prototype scale. • Limited hardware budget and availability of industrial-grade equipment. • Testing will be conducted in laboratory conditions rather than real production environments. • CNN model size and processing must remain lightweight to ensure real-time operation.	• Vision Processing: Raspberry Pi with CNN (TensorFlow Lite) processes images captured by an industrial camera for defect detection. • Sensor Integration: Load cell, infrared temperature sensor, and humidity sensor provide complementary physical measurements. • Decision Fusion: Multimodal data (image + sensors) combined to produce final OK/NOK decision. • Actuation: Mechanical rejection system (servo/pneumatic) removes defective products from the conveyor line. • Data Logging: Product ID, timestamp, sensor data, decision, and captured image stored in local database. • Dashboard: Web-based interface displays real-time results, defect rates, and KPI indicators. • Adaptive Thresholds: Statistical analysis of collected data used to update sensor thresholds over time. • Testing: Laboratory experiments with controlled variations in lighting, temperature, and product parameters. **Expected Outcomes:** • Prototype of a multimodal quality inspection system integrating camera and physical sensors. • Reduced error rate in product classification with robust OK/NOK decisions. • Safe, reliable, and laboratory-tested system with real-time monitoring.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how these different disciplines will collaborate and contribute to the project activities.	• **Electrical/Electronic Engineering:** Integration of sensors (load cell, temperature, humidity), camera interface, and control of the rejection mechanism. • **Computer/Software Engineering:** Development of CNN model, image processing algorithms, adaptive thresholding, and web-based dashboard. • **Mechanical Engineering:** Design of the conveyor structure, mechanical rejection system, and adjustable lighting setup. • **Industrial Engineering:** KPI analysis, process efficiency evaluation, and statistical quality control.
Alignment with UN Sustainable Development Goals: Indicate the specific goal/goals from the SDGs list (*)	This project supports SDG 9 (Industry, Innovation and Infrastructure) by developing an innovative multimodal quality inspection system that integrates vision-based AI with multiple physical sensors for robust decision-making in production lines. It also contributes to SDG 12 (Responsible Consumption and Production) by reducing defective output, minimizing waste, and improving resource efficiency through more accurate quality control. In addition, the project aligns with SDG 8 (Decent Work and Economic Growth) by enhancing manufacturing productivity, reducing human error, and supporting the transition towards smarter and more reliable industrial processes.
Team size (number of students)	☐3 ☒ 4 ☐ 5

PROJECT PROPOSAL – 36

Advisor Name	Doç.Dr. Korhan Kayışlı
Project Title	Intelligent Solar Energy Management System: MPPT Control, Battery Storage, and IoT Monitoring
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	Current small-scale solar energy systems face significant challenges in efficiency, battery lifetime, and monitoring capabilities. The absence of advanced MPPT control reduces the amount of energy harvested from photovoltaic panels under changing irradiance, while basic charging strategies limit battery health and system reliability. Moreover, the lack of IoT-based monitoring prevents effective data collection, timely fault detection, and smart supervision. To address these limitations, this project aims to design and implement an intelligent solar energy management system that integrates MPPT control, battery storage, and IoT monitoring. A solar DC-DC converter with MPPT will be developed to maximize energy extraction, while a bidirectional DC-DC stage will manage battery charging and discharging intelligently. The system will be controlled by a suitable microcontroller platform, and IoT connectivity will be provided through a wireless-enabled module (e.g., ESP32 or similar) to ensure real-time data monitoring of voltage, current, and state of charge. The methodology will follow three stages: (1) Design and Simulation - development and testing of MPPT algorithms and battery management strategies using appropriate software tools (e.g., MATLAB/Simulink or PSIM) before hardware prototyping; (2) Prototype Implementation - construction of the hardware system including PV input stage, bidirectional converter, and IoT module, together with embedded software development; (3) Testing and Validation - evaluation of system efficiency, reliability, and IoT monitoring performance through laboratory experiments. IoT integration will enable remote visualization through a dashboard for system parameters and alerts. The expected outcome is a modular smart solar energy system that ensures higher efficiency, improved battery utilization, and reliable remote monitoring, offering a more sustainable and effective solution compared to conventional low-cost designs.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• The PV stage must track the maximum power point with around 85% accuracy under varying irradiance. • The bidirectional DC-DC converter must perform both charging and discharging with CC-CV control for safe battery management. • The system must deliver stable DC output to supply the load reliably. • The IoT module must transmit real-time parameters (voltage, current, SOC, temperature) reliably. • The total system power is limited to 100–200 W for laboratory safety. • Grid-tied operation will be simulated only due to safety limits.

Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• Computer Engineering (COMPE): Responsible for developing the IoT platform and embedded software, enabling real-time monitoring, data logging, and dashboard visualization for system supervision. • Mechanical Engineering (ME): Provides expertise in thermal management and mechanical design of enclosures, ensuring proper heat dissipation and safe integration of solar panels and battery modules. • Industrial Engineering (IE): Contributes by evaluating system cost, efficiency trade-offs, and sustainability aspects, optimizing resource use and project management within the academic timeline.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	• SDG 7: Affordable and Clean Energy – The project promotes renewable energy adoption by improving efficiency, reliability, and accessibility of small-scale solar systems. • SDG 9: Industry, Innovation, and Infrastructure – By integrating MPPT control, battery management, and IoT monitoring, the project contributes to innovative energy technologies and resilient infrastructure. • SDG 13: Climate Action – Enhanced energy utilization and smart monitoring support the reduction of carbon emissions, aligning with global efforts to mitigate climate change.
Team size (number of students)	☒ 3 ☐ 4 ☐ 5

PROJECT PROPOSAL – 37

Advisor Name	Prof. Dr. Korhan Kayışlı
Project Title	Smart Line-Following Robot with Memory
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	In modern industry and education, mobile robots are playing an increasingly important role in enhancing automation and efficiency. Line-following robots are widely used due to their simple structure and low cost; however, existing systems are often limited to only basic line-tracking functionality. This limitation prevents robots from being employed in more complex tasks, reduces their flexibility, and restricts their functionality in practical applications. The proposed Smart Line-Following Robot with Memory will not only follow a line but also record the path it has traveled, reproduce it when necessary, and determine alternative routes when encountering obstacles. In this way, the robot will go beyond the capabilities of conventional line-following robots and become an intelligent system with the ability to learn and repeat. The potential applications of such a system are quite broad. In factories and production facilities, it can be used as a material-handling robot, memorizing and repeating specific routes to transport parts or products between production lines. In the storage and logistics sector, it can optimize intra-warehouse material flow, record and reuse paths between shelves, and provide automated transport solutions. In hospitals and laboratories, it can deliver medicines, medical supplies, or samples safely and efficiently. In educational institutions, it can serve as a teaching tool for students to learn about smart algorithms, memory management, and embedded systems in robotics courses. Furthermore, in R&D centers, it can act as a test platform for research on path planning, learning algorithms, and intelligent control systems. The goal of this project is to develop an energy-efficient, low-cost, and modular line-following robot suitable for both academic and industrial use. The system will be designed using an Arduino Uno microcontroller board, with infrared (IR) sensors for line tracking and ultrasonic sensors for obstacle detection. In addition, an external EEPROM module will be used to enable the robot to record and reproduce its paths. In conclusion, the developed smart line-following robot will have the potential to be used not only in educational and research environments but also in industrial automation, logistics, healthcare, and service robotics. Thus, the project aims to create a system that is both instructive for engineering students and applicable in real-world scenarios.

Requirements: Deliver up to 15 W wireless power per charging pad, provide a minimum of 100 Wh onboard energy, ensure safe operation with BMS and thermal monitoring (<42 °C), achieve IP67-level water and dust protection, maintain ballistic protection integrity. **Constraints:** Efficiency decreases with coil misalignment, metallic armor plates may affect magnetic field distribution, added system cost compared to conventional vests, and power level restricted to safe low-voltage operation.	**Objectives:** • To design and develop a line-following robot equipped with memory. • To enable the robot to record and reproduce the paths it follows. • To implement obstacle detection and alternative route selection functions. • To achieve an energy-efficient, low-cost, and modular design. **Method:** • **Sensors:** Infrared (IR) sensors for line detection and ultrasonic sensors for obstacle detection. • **Control:** Arduino Uno microcontroller for processing sensor data and managing memory functions. • **Memory:** External EEPROM or SPI Flash for storing route information. • **Motor Driver:** DC motors controlled via L298N motor driver module. • **Simulation & Testing:** MATLAB/Proteus simulations for software and hardware verification, followed by prototype implementation and field testing. **Expected Outcomes:** • A functional prototype of a memory-supported line-following robot. • A system capable of reproducing stored routes and selecting alternative paths when necessary. • A cost-effective and adaptable solution suitable for education, R&D, and industrial applications.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how these different disciplines will collaborate and contribute to the project activities.	• **Electrical/Electronic Engineering:** Sensor integration, motor drivers, and microcontroller-based control. • **Computer/Software Engineering:** Embedded software development, memory management algorithms, and path reproduction functions. • **Mechanical Engineering:** Robot body design, mechanical assembly, and balance optimization. • **Industrial Engineering:** Cost analysis, efficiency optimization, and evaluation of suitability for industrial applications.
Alignment with UN Sustainable Development Goals: Indicate the specific goal/goals from the SDGs list (*)	• **SDG 9 (Industry, Innovation and Infrastructure**): Contributing to industrial automation by developing smart robotic technologies. • **SDG 4 (Quality Education):** Developing a low-cost, educational robot for learning purposes.

PROJECT PROPOSAL – 38

Advisor Name	Assoc. Prof. Mahmut Emin ÇELİK
Project Title	3D Segmentation with Deep Learning in Dentistry
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	This project aims to develop an automated 3D segmentation framework to improve accuracy, consistency, and efficiency in dental imaging workflows. Objectives: (1) Develop an automated 3D segmentation algorithm tailored for dental imaging data (e.g., CBCT, intraoral scans), (2) Achieve clinically acceptable accuracy (e.g., Dice Similarity Coefficient > 0.7). The project will employ a data-driven approach using deep learning-based 3D image analysis techniques to achieve automated segmentation of dental structures. To improve accuracy, the method will integrate data augmentation, transfer learning, and post-processing techniques. Expected Outcomes: (1) A functional automated 3D segmentation model capable of accurately identifying and separating dental structures from CBCT and intraoral images, (2) Demonstrated improvement in segmentation accuracy (e.g., DSC > 0.7).
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	The segmentation model must achieve clinically acceptable accuracy (e.g., DSC > 0.7). Training 3D deep learning models requires significant GPU/TPU resources, which may impact project cost and timeline.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	This project integrates multiple disciplines to ensure both technical robustness and clinical applicability. Computer Engineering contributes expertise in deep learning and image processing, while Dentistry provides clinical requirements, annotated datasets, and validation. Their collaboration ensures the system is technically sound, clinically relevant, and applicable in real-world dental practice.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	3D Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.
Team size (number of students)	☐ 3 ☐ 4 ☒ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 39

Advisor Name	Assoc. Prof. Mahmut Emin ÇELİK
Project Title	Gesture-Controlled Navigation in an Augmented Reality Environment Using Wearable IMU Sensors
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	AR applications typically rely on touchscreen or handheld controllers for interaction, which can feel unnatural. A gesture-controlled glove with embedded accelerometer and gyroscope (IMU) sensors enables intuitive, hands-free navigation. Objectives: (1) Design and build a wearable glove with IMU sensors, (2) Capture hand orientation/motion data and process it in real time, (3) Integrate the control system with an AR application (e.g., ARCore/Unity app). The system will be implemented using a wearable glove equipped with an IMU sensor (e.g., MPU6050) connected to an Arduino or ESP32 microcontroller, with wireless communication enabled via Bluetooth. Sensor data will be captured, calibrated, and mapped to predefined gestures, which are then transmitted in real time to an AR application developed in Unity with AR Foundation. Finally, the AR environment will integrate these gestures for navigation functions, followed by testing for accuracy, responsiveness, and usability. Results: (1) A working prototype glove that sends real-time hand movement data, (2) An AR application where users navigate without touching the screen.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	The project requires a reliable wearable setup with an IMU sensor, microcontroller, and Bluetooth module to ensure accurate motion tracking and real-time data transmission. Additionally, the AR application must correctly interpret gesture inputs and provide smooth, responsive navigation for a functional and user-friendly experience. The project may be constrained by hardware limitations such as sensor drift, limited battery life, and potential latency in wireless communication. Additionally, development time, budget restrictions, and the availability of compatible AR devices may impact the scope and overall performance of the system.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	This project is inherently multidisciplinary, combining electrical and electronics engineering for sensor integration and hardware development, computer engineering for data processing and wireless communication, and software engineering for AR application design and implementation.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	3D Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.
Team size (number of students)	☐ 3 ☐ 4 ☒ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 40

Advisor Name	Assoc. Prof. Hıdır Düzkaya
Project Title	Solid State Transformer
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	The project addresses the limitations of traditional transformers, which are heavy, bulky, and inefficient under varying load conditions, as well as their lack of compatibility with modern smart grid systems. These challenges create the need for a more compact, efficient, and controllable solution for future energy distribution. The measurable goals of the project include developing a **1 kVA Solid-State Transformer (220 V input)** with multiple outputs: **24 V DC, 48 V DC, 24 V AC, and 48 V AC**. The design targets an overall efficiency of **≥95%**, power losses below **50 W**, and a maximum output current of **5 A**. To achieve these goals, the project will employ power electronics design and simulation tools such as LTspice and MATLAB/Simulink. A microcontroller will be programmed to implement real-time control, monitoring, and protection functions. The prototype will be validated through laboratory testing, supported by proper thermal management and safety mechanisms to ensure reliable performance. The anticipated outcomes include a compact and functional SST prototype capable of efficient and reliable power transfer, improved controllability compared to traditional transformers, and integrated monitoring features that allow remote access to voltage, current, and temperature data. These results will demonstrate the feasibility of SST technology for integration into modern smart grid applications.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• The SST must deliver an output power of **1 kVA** with efficiency ≥95%. • Total power losses must remain below **50 W** at rated load. • The system must provide multiple outputs: **24 V DC, 48 V DC, 24 V AC, and 48 V AC**. • The output current must be limited to **≤5 A** with automatic protection against overcurrent and overheating (>80 °C). • High-voltage testing (>1 kV) is restricted due to limited laboratory facilities, so the prototype will focus on low-to-medium voltage levels (≤400 V).
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• The team requires expertise in computer engineering to develop embedded software that controls the power electronic converters and ensures reliable system operation.

	• The team requires expertise in computer engineering to design monitoring and communication interfaces that enable fault detection, data collection, and remote control.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	This project supports UN SDGs by improving energy efficiency and enabling smart, sustainable power distribution.
Team size (number of students)	☒ 3 ☐ 4 ☐ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 41

Advisor Name	Hıdır Düzkaya
Project Title	Aircraft Electrical Power Distribution System Design
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	**1. Problem Statement** Electrical power distribution systems used in aircraft (such as airplanes and UAVs) are critically important in terms of reliability, light weight, efficiency, and ease of maintenance. Current systems face issues such as excessive weight, complex cabling, energy losses, and difficulties in fault detection. This project aims to design an optimized electrical power distribution system that enhances the operational safety and energy efficiency of aircraft. **2. Objectives** •To design a system that provides electrical power distribution with minimum losses. •To reduce system weight and cabling complexity. •To develop a fault detection and isolation mechanism. •To comply with safety and durability standards (e.g., DO-160, MIL-STD). •To validate system performance through simulation and prototype-level testing. **3. Method** •Conducting a literature review to analyze existing aircraft power distribution systems. •Using MATLAB/Simulink or similar software tools for power flow modeling and simulations. •Selecting appropriate cables, fuses, circuit breakers, and power electronic components for hardware design. •Determining the suitable power distribution topology (radial, ring, zonal, etc.). •Developing test scenarios to perform fault detection and reliability analyses. **4. Expected Outcomes** •A lighter, safer, and more efficient electrical power distribution system design. •A system concept capable of fault detection and isolation. •Simulation results and a prototype design report. •Technical documentation demonstrating the applicability of the system for aircraft.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	**Requirements** ● must ensure reliable and continuous power delivery to flight-critical subsystems. ● Must comply with aviation electrical standards and constraints (e.g., weight, redundancy, safety). ● Should address fault tolerance and reconfiguration in case of failures. ● Must define and justify the chosen voltage level and system architecture

	•Voltage levels: •AC systems: 115 V AC, 400 Hz (standard in aircraft). •DC systems: 28 V DC (commonly used for low-power circuits). •For modern aircraft and high-power loads: ±270 V DC can be utilized. •Frequency: 400 Hz, with variable frequency systems (360–800 Hz) for specific applications. •Power capacity: Scalable up to several hundred kW for high-power consumers (e.g., electric propulsion, environmental control systems, radar). •Weight requirement: Minimum cable weight and compact design. •Safety requirement: Compliance with international aviation standards such as DO-160 and MIL-STD-704. •Simulation and testing tools: MATLAB/Simulink, Altium Designer, Proteus, and similar software. **Constraints** ● Strict aviation safety and certification requirements. ● Weight and space limitations on board the aircraft. ● Environmental conditions (temperature, vibration, pressure). ● Complexity of integrating multiple subsystems. •Weight limitation: The power distribution system must contribute minimally to the overall aircraft weight (especially batteries and wiring harnesses). •Voltage tolerances: •For 28 V DC: within 22–29 V range. •For 115 V AC: ±5% tolerance. •Safety: Mandatory protection against short circuits, overcurrent, and insulation failures. •Cooling: Power electronic components must operate within thermal limits (e.g., below 85°C). •Testing constraints: Actual flight testing cannot be performed; only laboratory and prototype-level testing will be feasible. •Budget: Costs of high-voltage testing equipment, specialized cables, and connectors may be restrictive.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	**Multidisciplinary and Interdisciplinary Aspects** The following disciplines can be integrated into the project: •Mechanical Engineering (ME): Cabling, connectors, weight considerations, and structural integration. •Industrial Engineering (IE): System reliability, maintenance planning, and cost analysis. •Chemical Engineering (CHEM): Insulation materials, cable coatings, and fire safety. •Computer Engineering (COMPE): Fault detection, data processing, and control algorithms. **Justification of Collaboration** •Mechanical engineers ensure the mechanical integration of cable routing and connection points.

	•Computer engineers develop control algorithms and fault detection software for the system. •Industrial engineers optimize maintenance schedules and conduct reliability analysis. •Chemical engineers propose lighter, more durable, and flame-resistant material solutions. By working together, these disciplines enable the design of a safer, lighter, more durable, and cost-effective system.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	**Alignment with UN Sustainable Development Goals (SDGs)** •Goal 7: Affordable and Clean Energy → Designing a system that increases energy efficiency. •Goal 9: Industry, Innovation, and Infrastructure → Developing innovative power distribution systems. •Goal 12: Responsible Consumption and Production → Achieving sustainability through reduced material and energy usage. •Goal 13: Climate Action → Reducing fuel consumption and carbon emissions through lighter and more efficient systems.
Team size (number of students)	☒ 3 ☐ 4 ☐ 5

PROJECT PROPOSAL – 42

Advisor Name	Dr. Öğr. Üyesi Mehmet Karakaya
Project Title	Hybrid Energy Harvesting IoT Sensors for Sustainable Agriculture
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	**Problem Statement:** Smallholder farmers lack affordable precision agriculture instruments and frequently rely on manual irrigation, which wastes water and energy. Solar-powered IoT sensors are environmentally friendly, however they fail when there is not enough sunlight. This study creates a hybrid energy-harvesting IoT node that combines solar and a secondary source to provide continuous, off-grid, and dependable sensor operation in rural environments. **Objectives:** • Create a hybrid energy harvesting IoT node that can collect energy from solar, vibration, and radio frequency sources. • Create low-power circuits that can efficiently store and manage energy from many sources. • Install a sensor system (soil moisture, temperature, and humidity) for smart watering. • Determine system reliability under various weather and environmental situations. • Show increases in uptime and resilience when compared to solar-only systems. **Method:** • System Design: Choose a microcontroller (ESP32/STM32), environmental sensors, and power management ICs. • Hybrid Energy Harvesting Circuit: Solar panel plus vibration (piezoelectric harvester) or RF energy module or Wind Power. • Power management unit with MPPT (solar) and energy routing controller. • Firmware and IoT Communication: Use low-power firmware with MQTT/LoRaWAN data transmission. **Expected outcomes** • A functioning prototype for a hybrid-powered IoT sensor node. • Increased uptime and robustness during cloudy/rainy situations. • Reliable environmental data (soil moisture, temperature, humidity) for making informed irrigation decisions.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful.	**Requirements:** • Low-cost, commercially available harvesters • Robust power management circuit to handle multiple energy inputs. • Data logging and visualization dashboard for end users.

Constraints: Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• Operation in low-resource environments with minimal maintenance. **Constraints** • Limited energy from vibration/RF compared to solar (acts as a backup, not primary source). • Additional circuitry may increase system cost slightly. • Need to balance **low cost vs. improved reliability**.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	**Computer Engineering (COMPE):** IoT communication protocols, cloud dashboard, energy-aware firmware.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	SDG 2 (Zero Hunger): Increases agricultural yields through efficient irrigation. SDG 7 (Affordable and Clean Energy) promotes renewable and hybrid energy collection. SDG 12 (Responsible Consumption and Production) aims to reduce waste of water, fertilizer, and energy. SDG 13 (Climate Action): Increases the resilience of environmentally friendly technology in diverse climates.
Team size (number of students)	☒ 3 ☒ 4 ☐ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 43

Advisor Name	Özgür Ergül
Project Title	Follower Unmanned Aerial Vehicle (UAV)
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). **3.** Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). **4.** Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	In recent years the rate of forest fires has steadily been increasing. As such, early warning systems are crucial for timely response to these fires. One of the promising solutions is utilizing Unmanned Aerial Vehicles (UAVs) to detect starting fires. An UAV equipped with relevant hardware and software can fly over the forest area, detect fires and alert the authorities. Some of the goals will be • Building a UAV from the ground up by choosing proper parts (chassis, motor, propellers, Electric Speed Controller (ESC), Flight Controller (FC), battery, microcontroller/CPU, camera, wireless unit) that can stay airborne for a predefined amount of time. • Developing software (possibly utilizing machine learning) that can identify fire under various predetermined light intensities (depending on the time of day and cloud conditions), utilizing possibly images from different camera types (visual range, infrared range, etc.). • Ability to alert the authorities (E.g. via SMS messages). • Ability to keep a certain predefined distance within certain limits depending on the wind direction and strength • Ability to take photos with a predefined resolution and wirelessly transfer them along with wind direction and strength as well as humidity data at a predefined transmission rate to a computer and/or smart phone. An iterative design process is required, where the parts are chosen to meet some of the requirements (photo resolution, wireless transfer rate, processing power sufficient to run the fire identification algorithms). Then the total weight of the UAV is calculated. If the rest of the requirements (UAV speed, airtime of the UAV) cannot be met, then some of the components are replaced with proper ones and the design process iterates until all goals are met. Image processing techniques should be used for fire detection. Group members will decide on their own about software/hardware platforms to use. Anticipated results are • A display (plot) of wind direction & speed data along with average distance between UAV and target vs time as the UAV circles around the fire location

	• Photos taken and wirelessly transferred at certain time intervals • A warning mechanism to alert the authorities.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	Following are the requirements for the UAV: 1. Ability to identify the fire within 5 seconds for any sunlight intensity between 10.000 and 100.000 lux (there are mobile apps to measure light intensity) 2. Ability to keep relevant safe distance between the target and the UAV based on wind direction and fire and wind strength between 10m to 150m. 3. Ability to take photos of at least 1080p (1920 x 1080) and wirelessly send one such photo every 5 seconds. 4. An airtime of at least 5 minutes. 5. Ability to send an SMS message successfully to a predetermined number when fire is detected.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• The team needs expertise in mechanical construction of the UAV (*Mechanical Engineering*) • The team needs expertise in machine learning methods to be used in real-time detection and tracking (*Software or Computer Engineering*)
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	**13.1** Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
Team size (number of students)	3☐ 4 ☐ 5☒

PROJECT PROPOSAL – 44

Advisor Name	Özgür Ergül
Project Title	Spectrum Assessment Methods for Cognitive Radio
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). **3.** Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). **4.** Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	The prevalent method for spectrum access is static allocation, where certain portions of the radio spectrum are allocated for specific purposes and/or applications. On one hand, due to the static allocation approach, almost all spectrum is already allocated. On the other hand, if we check spectrum utilization at certain geological locations, we see that most of the statically allocated bands are not utilized. This leads to the spectrum scarcity problem, where even though there is ample number of "holes" in the spectrum that are not utilized, those available bands cannot be used due to the static allocation approach. Considering that there is an ever-increasing demand for the radio spectrum as the number of wireless communication services/applications increases, it is crucial that this problem is addressed. The most promising solution is Cognitive Radio, where a secondary network of users coexists on the same channel as the licensed users, also called primary users. One of the approaches for realizing a Cognitive Radio Network is transmitting on a channel only when the primary users are not using the channel. To this end, spectrum sensing will be performed by utilizing machine learning methods to determine whether there are active primary users on the channel or not. Anticipated results for each utilized detection methods are • Decision duration for various SNR (signal to noise ratio) values • False alarm probability (P_F) (deciding that the channel is busy, where in fact it is available) for various SNR (signal to noise ratio) values • Detection probability (P_D) (deciding that the channel is bust and in fact it actually is busy) for various SNR values • Receiver operating characteristic curves (P_D vs. P_F curves)
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	Following are the requirements for the developed detector: 6. Ability to make a decision on the channel condition (available or busy) within 200 ms. 7. A false alarm probability of less than 0.1 for an SNR of 10 dB. 8. A detection probability above 0.8 for an SNR of 10 dB.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your	• The team needs expertise in machine learning methods as well as a user-friendly application for real-time signal visualization and detection (*Software or Computer Engineering*)

project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	9.C Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020
Team size (number of students)	☒ 3 ☐ 4 ☐ 5

PROJECT PROPOSAL – 45

Advisor Name	Dr. Öğr. Üy. Bülent Dağ
Project Title	A Grid-Connected Small-Scale Wind Turbine Design
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	Climate change endangers future generations and the use of renewable energy sources becomes more important every day. In this project a small scale wind turbine system to be installed on the roofs of houses will be designed and produced. The system will convert wind energy into electricity in line with the grid electricity. In this context, aerodynamic/mechanical design of wind blades, electric generator selection and power converter selection and design are main objectives of the project. The methodology will be as follows; - Literature search to determine a suitable small scale wind turbine system - Aerodynamic and mechanical design - Selection of electrical generator - Design of power converters and simulation of overall system - Prototype design and tests
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• The output of the wind turbine system will be in line with the utility grid, i.e. 220 V(rms), 50 Hz. • The max power of the system will be in the range of 1-5 kW. • The acoustic noise level of the wind turbine must be below 80 dB.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• The team requires expertise in mechanical engineering for aerodynamic, mechanical and acoustic design.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	The project outcome aligns with the SDGs Goal 7 Affordable and clean energy
Team size (number of students)	☐ 3 ☒ 4 ☐ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 46

Advisor Name	Dr. Öğr. Üy. Bülent Dağ
Project Title	Automatic Hot Liquid Mixer
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	Hot liquids especially the soups that require continuous stirring can take a significant amount of time for cooks. This project aims to design a hot liquid mixer that will make the life of cooks easier. The mixer should be mounted on the pot lids and its energy should be generated from a suitable energy source. The methodology will be as follows; - Literature search for a suitable energy source, especially heat-to-electricity converters - Mechanical design of the mixer - Selection of the electric motor - Design of power converters if required - Prototype design and tests
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• The energy of the mixer is to be preferably from heat. But in case that it is not possible batteries can also be used. • The mixer should be portable and interchangeable with pot handlers.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• The team requires expertise in mechanical engineering for mechanical design of the mixer. • The team may require expertise in mechanical engineering also for possible heat to electricity or motion conversion technologies.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	The project outcome aligns with the SDGs Goal 9 Industry, innovation and infrastructure.
Team size (number of students)	☒ 3 ☒ 4 ☐ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 47

Advisor Name	Dr. Öğr. Üy. Bülent Dağ
Project Title	Solar Inverter System
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	With the increasing interest to renewable energy sources, the interest to the power supply solutions integrating renewable energy sources, such as Photovoltaics, have been increasing. In this Project a solar energy based inverter system will be developed. Main source of the system will be solar energy. During the day-time solar energy should charge a system battery. After the battery there will be the inverter sub-system. The required converter sub-systems before and after the battery should also exist in the system. During the night times, a fully charged battery should supply max power for at least one hour. The first step in the project should cover system development including solar panel, battery, converters and inverter with respective controllers and drivers. After the initial design, the system should be simulated and verified using PLECS or Simulink. The prototype design and relevant tests are the next steps after the verification of the initial design with simulations. At this stage battery sizing calculations will be critical to determine the battery size that meets the requirements. At the end of the project, a solar inverter system that can also be used with vehicle batteries will be the final deliverable of the project.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• The output voltage is 220 V, 50 Hz AC with a rated power of 500 W • The solar panel max power is 500 W • The battery voltage is 12 V
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• The team requires expertise in computer engineering for software design for the controllers of the converters.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	The project outcome aligns with the SDGs Goal 7 Affordable and clean energy.
Team size (number of students)	☒ 3 ☒ 4 ☐ 5 (submit a justification for approval of any other team size)

PROJECT PROPOSAL – 48

Advisor Name	Emrah Demir
Project Title	BMS with ADALM Pluto SDR
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	The project aims to develop a low-cost, modular Battery Management System (BMS) that provides real-time monitoring and protection to address challenges in multi-cell Li-ion battery packs regarding safety, accuracy, and lifetime. The method includes per-cell voltage and pack current sensing (shunt/Hall) with multi-point temperature measurements; SOC estimation via Coulomb counting combined with OCV fusion and Kalman-filter–based modeling, trend-based SOH tracking; protections for over/under-voltage, charge/discharge over-current, short circuit, and over/under-temperature; passive balancing with an architecture prepared for future active balancing; and communication via CAN (with optional BLE/USB) supported by a PC/Mobile interface for real-time visualization, event logging, and calibration. Expected outcomes include a working BMS hardware prototype covering a typical multi-series pack range with complete manufacturing files (schematic, PCB, BOM), embedded firmware (SOC/SOH library) and a PC/Mobile monitoring application, test reports on accuracy, response time, balancing performance, and thermal behavior, along with a user and calibration guide plus risk/safety analysis; subsequent work will focus on active balancing hardware and a certification roadmap.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	Ensure safe operation for multi-cell Li-ion packs with monitoring/protection (cell voltage, pack current, temperature), SOC/SOH estimation, and cell balancing (passive; architecture prepared for active balancing). Modular hardware (supports different series cell counts), reliable isolation and accurate sensing; maintainable, updatable embedded firmware with event logging and fault detection. Communication interface for diagnostics/telemetry (e.g., CAN, optional BLE/USB) and a PC/Mobile interface for visualization, calibration, and data export. Component selection and test scope constrained by budget, lead times, and project timeline; only partial environmental/lifecycle testing may be feasible. Limited access to test equipment (cell simulator, electronic load, thermal conditions) and chemistry/aging variability complicate SOC/SOH calibration; thermal/PCB constraints in compact layouts and high energy currents impose strict lab safety requirements.

Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	COMPE develops software and algorithms (SOC/SOH, data logging, CAN/BLE communication, PC/Mobile interface); ME handles thermal–mechanical design and vibration/shock robustness; CHEM provides cell chemistry, OCV, and aging data; IE drives manufacturability (DFM/DFA), cost, and process optimization. In the collaboration flow, OCV/aging data from CHEM is integrated into COMPE's SOC/SOH models, these models are validated against ME's thermal–mechanical constraints, and IE refines team decisions with test/production feedback to meet project targets on time and within budget.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	Our project strengthens renewable integration by improving battery safety and efficiency via the BMS. By extending lifetime, enabling balancing, and using smart telemetry, it reduces waste and emissions, supporting sustainable and resilient electrification.
Team size (number of students)	☐ 3 ☐4 X5 (submit a justification for approval of any other team size)

(*) https://turkiye.un.org/tr/sdgs

PROJECT PROPOSAL – 49

Advisor Name	Dr. Öğr. Üyesi Funda Ergün YARDIM
Project Title	Autonomous Navigation and Deep Learning-Based Obstacle Detection in Unmanned Ground Vehicles (UGVs)
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	The project works on the limitations of traditional navigation and obstacle detection in unmanned ground vehicles, which can lead to poor awareness, unsafe routes, and collisions. By combining deep learning-based obstacle detection with autonomous navigation, it enables reliable operation in dynamic environments. The goal is to build a prototype that fuses data from LiDAR, cameras and IMU for real-time mapping, localization, and path planning. The system will run on an embedded GPU for perception tasks with a microcontroller handling low-level control. The expected outcome is a functional autonomous vehicle capable of detecting and classifying obstacles, planning safe paths, and demonstrating real-world performance. Deliverables include trained AI models, an integrated hardware-software system, and validated field results.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	• The vehicle must detect and classify obstacles in real time using deep learning. • LiDAR, camera, and IMU data must be fused for reliable localization and mapping. • The navigation system must autonomously generate and follow safe routes. • Models must be optimized for embedded hardware with limited power and processing. • Environmental variability (lighting, terrain, noise) and budget constraints may affect performance.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• Computer Engineering for AI model development and system integration • Mechanical Engineering for chassis and mobility design • Electrical-Electronics Engineering for sensor interfacing, embedded systems, and motor control.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	The project supports SDG 9 (Industry, Innovation, and Infrastructure) by advancing autonomous mobility systems and SDG 11 (Sustainable Cities and Communities) through safer urban transport and disaster response applications.
Team size (number of students)	☐ 3 ☐ 4 ☒ 5 (submit a justification for approval of any other team size)

(*) https://turkiye.un.org/tr/sdgs

PROJECT PROPOSAL – 50

Advisor Name	Ass. Prof. Ihsan Kanbaz
Project Title	Smart Near-Field Beamforming for Joint Localisation and Electronic Warfare Applications
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	Modern 6G communication and electronic warfare systems require not only efficient data transmission but also precise localisation and targeted energy delivery. Conventional far-field beamforming is insufficient in the near-field region, where both distance and angle strongly affect performance. This project aims to design and simulate near-field antenna array techniques for joint localisation and beam focusing. Localisation accuracy will be evaluated in terms of range and angle estimation, and adaptive beamforming algorithms will be applied to focus energy on identified targets while suppressing interference. Simulations will be conducted in MATLAB/Python using Fresnel-region models, classical methods such as MVDR, and AI-assisted techniques. The expected outcomes include a simulation framework, quantitative analysis of localisation and focusing performance, and insights into selective near-field energy focusing for 6G and electronic warfare applications.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	**Requirements:** • Accurate implementation of near-field propagation models. • Robust simulation of antenna array configurations with adjustable element spacing and geometry. • Integration of optimisation or AI algorithms for improved localisation and focusing accuracy. • Computational efficiency to ensure real-time applicability of developed algorithms. • Clear documentation and visualisation of results (heatmaps, beam patterns, localisation errors).

(*) https://turkiye.un.org/tr/sdgs

	Constraints: • High computational load due to near-field modeling and large-scale array simulations. • Limited availability of real-world measurement data to validate purely theoretical simulations. • Trade-off between localisation accuracy and computational complexity in algorithm design. • Potential simplifications in propagation environment (ideal channel assumptions vs. realistic multipath).
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• Computer Engineering (COMPE): Development of AI-assisted localisation algorithms, adaptive beamforming, and signal processing simulations. • Industrial Engineering (IE): Optimisation of simulation workflow, performance evaluation metrics, and system-level design integration for practical scenarios.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	SDG 9: Industry, Innovation, and Infrastructure – Supports the development of innovative near-field communication and defence technologies, contributing to resilient and advanced infrastructure for next-generation wireless systems. SDG 11: Sustainable Cities and Communities – Enhances communication reliability and high-precision localisation, which can be applied to smart city services, autonomous transportation, and critical infrastructure safety. SDG 17: Partnerships for the Goals – Encourages collaboration between academia, industry, and defence sectors in advancing emerging technologies for global communication and security needs.
Team size (number of students)	☐ 3 ☒4 ☐5 (submit a justification for approval of any other team size)

(*) https://turkiye.un.org/tr/sdgs

PROJECT PROPOSAL – 51

Advisor Name	Ass. Prof. Ihsan Kanbaz
Project Title	Real-Time Health Monitoring and Early Warning System Using Multi-Sensor Fusion
Project Description 1. Describe specific issue(s) or challenge(s) that the project addresses (Problem Statement) 2. Define the measurable goals the project aims to achieve through project lifetime (Objectives). 3. Describe the approach, techniques, and tools that will be employed to address the problem and meet the project objectives (Method). 4. Outline the anticipated results, findings, or deliverables that will be produced by your project (Expected Outcomes).	Infants are highly vulnerable to sudden fever spikes, unsafe sleeping positions, and prolonged crying episodes, which may go unnoticed by parents and result in serious health risks. This project aims to address these challenges by developing a real-time health monitoring and early warning system based on multi-sensor fusion. The system will integrate an RGB camera, a thermal sensor, and a microphone, combined with AI algorithms, to measure body temperature, detect movement and sleep position, and classify crying sounds. By fusing these data sources, the device will provide reliable alerts through alarms and mobile notifications, ensuring timely parental intervention. Beyond routine monitoring, its early warning capability may support the detection of severe conditions such as meningitis, where delayed diagnosis can lead to brain damage. The expected outcome is a functional prototype capable of contactless monitoring, accurate risk detection, and effective early warnings that contribute both to parental reassurance and to improved child health outcomes.
Requirements: Specify the essential conditions, features, or characteristics that must be met for the project to be successful. **Constraints:** Identify limitations, restrictions, or challenges that may impact the project's scope, timeline, resources, or outcomes.	**Requirements:** • Accurate calibration and continuous operation of the thermal sensor to ensure reliable temperature measurements. • AI algorithms optimized for real-time processing on edge devices such as Raspberry Pi or Jetson Nano. • Robust sensor fusion of visual, thermal, and audio data to minimize false alarms. • A user-friendly notification system, including audible alarms and mobile alerts, accessible to parents at all times. • On-device data processing to preserve privacy and prevent the need for cloud-based storage. • Stable power supply to guarantee uninterrupted monitoring during long infant sleep periods. **Constraints:**

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	The limited resolution and sensitivity of cost-effective thermal sensors may restrict measurement accuracy. • Environmental conditions such as blankets covering the infant, variations in lighting, and background noise may interfere with detection. • Hardware procurement and integration may be constrained by cost and availability within the project timeline. • Real-time processing requires careful algorithm design to balance accuracy and computational efficiency. • Validation and testing of the system must be conducted in controlled environments, as ethical and safety considerations limit direct trials on infants.
Multidisciplinary and Interdisciplinary Aspects: Integrate at least one other engineering discipline (COMPE, ME, IE, CHEM) into your project activities. Clearly justify how this/these different disciplines will collaborate and contribute to the project activities.	• Computer Engineering (COMPE): Development of AI algorithms for image and audio processing, multi-sensor fusion, and real-time decision-making; implementation of mobile notification systems. • Mechanical Engineering (ME): Design of the prototype enclosure, proper sensor placement, and thermal distribution analysis to ensure accuracy and safety. • Industrial Engineering (IE): User-centered design, system integration, and workflow optimization to improve usability and reliability for parents.
Alignment with UN Sustainable Development Goals: indicate the specific goal/goals from the SDGs list (*)	SDG 3: Good Health and Well-Being – Promotes infant health and safety by enabling early detection of critical conditions through real-time monitoring. SDG 9: Industry, Innovation, and Infrastructure – Develops an innovative healthcare technology that integrates AI and multi-sensor fusion into a practical prototype. SDG 10: Reduced Inequalities – Provides an accessible and affordable health monitoring solution, supporting families by reducing inequalities in access to early healthcare interventions.
Team size (number of students)	☐ 3 ☒ 4 ☐ 5 (submit a justification for approval of any other team size)

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