Electrical-Electronics Engineering Department

Electrical Engineering Design Project Offerings

For 2024-25 Spring Term

The following are Electrical Engineering Design Projects offered for 2024-25 Spring term by the members of the department. Students are required to complete 150 ECTS and Design Processes course before the Spring term in order to register EE Design Project. Candidate students are expected to get in contact with the advisor for the offered project(s) in their interest and acquire information.

The workflow is;

1. Juniors (3rd grade) and Seniors who successfully completed 150 ECTS are expected to apply for the EE Design Project flow before the Fall semester. Inspect this document thoroughly and get in contact with the advisor offering the project you are interested in. You may also prefer to form your project group first before applying to the advisor.
2. Fill in the form on https://forms.gle/yRwp9wrBVrnp7u3E7 before June 5, 23:59.
3. Students are expected to register to Design Processes course in 2024-25 Fall semester if they have not already enrolled in and passed that course. You need to have completed 150 ECTS in order to register.
4. Enroll on EE Design Project course in 2024-25 Spring course registration duration. Students who fail Design Process course may register to Design Process and EE Design Project courses in 2024-25 Spring simultaneously.
5. Complete the requirements given by the project advisor. Prepare project report/thesis according to the guidelines.
6. Present and demonstrate your project and results to the jury members.

Electrical-Electronics Engineering Department

Design Processes (2024-2025 Fall)
Electrical Engineering Design (2024-2025 Spring)

Project Proposal Form

Advisor	Prof. Dr. Semih ERGİN
Co-advisor	Dr. Burak URAZEL
Title of the Project	The Early – Stage Diagnosis of Various Brain Diseases from EEG Signals using an EEG Measurement Equipment
Number of Teams (One or more)	1
Team Size	3 or 4 students

Project Details

The first aim of this project is to accurately measure the Electroencephalogram (EEG) signals from several locations on the scalp of a person. EEG is a monitoring method to record the electrical activity of brain. EEG measures the voltage fluctuations resulting from ionic current within the neurons of brain. In clinical contexts, EEG refers to the recording of the brain's spontaneous electrical activity over a period of time as recorded from multiple electrodes placed on the scalp.

The intended early - stage diagnosis of various brain diseases from EEG signals is implemented in mainly three separate stages:

- The accurately measurement Electroencephalogram (EEG) signals,
- Extraction some particular features from measured EEG signals,
- The early identification and diagnosis of various brain diseases employing several classification tasks.

Tools	• Layout Tools (ex: Proteus, ORCAD, etc.), • National Instruments LabVIEW Software, • Digital Signal Processing Software Tools (ex: Octave, MATLAB, etc.).
Success Criteria	• To design of a stable and durable EEG signal measurement circuit, • To extract some particular features from measured EEG signals, • To identify and diagnose of various brain diseases employing several classification tasks.
Cost	Approximately 700-800 TL
Duration	5+ months

Electrical-Electronics Engineering Department

Design Processes (2024-2025 Fall)
Electrical Engineering Design (2024-2025 Spring)

Project Proposal Form

Advisor	Prof. Dr. Semih ERGİN
Co-advisor	Gökhan Kaptan, Managing Director, Raitech Automation, Göztepe-Kadıköy, İstanbul/Türkiye.
Title of the Project	The Design of a Remote-Controlled Automation System using Mobile Devices
Number of Teams	1
Team Size	3 or 4 students
Project Details In this project, the remote control of an industrial automation system will be implemented. In the usual situations, a PLC programmer develops his/her own software onto a PLC device via either a computer or PLC touch panel. Generally, he tracks all of the changes risen by PLC devices. Carrying cellular devices such as mobile phones, tabs, etc. is becoming popular and an easier way for both tracking of and intervention to PLC devices on long-haul networks due to it is much easy and only needs a simple internet connection. Therefore, a remote control of an automation system will be established using cellular devices. This project consists of three basic stages: First of all, an automation application will be determined and started to program. Then, an application software will be developed for cellular devices to remotely control PLC. Finally, they are integrated with each other on long-haul (long-distance) networks.	
Tools	STEP 7 TIA Portal, Android Studio / Visual Studio with Xamarin / Xcode 11 with SwiftUI, Structured Query Language (SQL) Database Studio, Any web page design software
Success Criteria	• To design a stable, moderate and durable automation application, • To design a remote-controlled PLC software on cellular platforms, • To establish an interface between a PLC device and cellular devices.
Cost	Approximately 2000 TL
Duration	5+ months

Electrical-Electronics Engineering Department

Design Processes (2024-2025 Fall)
Electrical Engineering Design (2024-2025 Spring)

Project Proposal Form

Advisor	Asst. Prof. Dr. Gökhan DINDIŞ
Co-advisor	May be assigned later
Title of the Project	A mobile robot with jumping function
Number of Teams (One or more)	2 or 3 teams
Team Size	3 or 4 members

Project Details

A wheeled or legged mobile robot will be built with added jumping function. Following features may be considered in designing and realization process:

- A simple mini sized mobile robot hardware (not exceeding 10x20x30 cm) with motorized wheels or legs, and an integrated jumping mechanism (partially purchased, partially designed),
- Should be able to jump as long as horizontally three times, and/or vertically twice of its longest dimension (partially purchased, partially designed),
- On board battery and DC-DC converters for powering all electronics, and actuators. (partially purchased, partially designed)
- An on-board controller, wireless camera, wireless communication unit(s), motor driving units, and some added modules like low cost IMU, LIDAR and/or ultrasonic based sensors for general purpose use (partially purchased, partially designed).
- A Robot side software, as a Remote Operations Firmware (will be designed)
- A PC or tablet side software, as a Base Station Operations Control Software (will be designed)

Tools	AVOmeter, Oscilloscope, Soldering Iron, Mechanical mounting tools, Personal computer. (AutoCAD, Blender3D, FreeCAD etc. to draw the mechanical parts. Proteus, EagleCAD-PCB or similar programs in Electronic design. Public licenced C/C++/C#/ Python tools for software development). 3D printer.
Success Criteria	The mobile robot with jumping feature should be demonstrated in remotely operable condition. Impress the jury members with the outputs.
Cost	Less than 8000TL (by May2024 prices). If required more, the exceeding portion will be financed by adviser or co-adviser.
Duration	3+ months

Electrical-Electronics Engineering Department

Design Processes (2024-2025 Fall)
Electrical Engineering Design (2024-2025 Spring)

Project Proposal Form

Advisor	Assoc. Prof. Dr. Atabak NAJAFİ
Co-advisor	
Title of the Project	Smart Solar Tracking System
Number of Teams (One or more)	2
Team Size	3-4
Project Details A **solar tracker** is a device that orients a payload toward the Sun. Payloads are usually solar panels, parabolic troughs, Fresnel reflectors, lenses, or the mirrors of a heliostat. The aim of this research article is to present a comprehensive study on the design and implementation of a dual-axis solar tracker system using Arduino and servo motors. The project utilizes four LDR sensors to detect the intensity of light, and through an algorithm implemented in Arduino, controls the servo motors to align the solar panel with the optimal position relative to the light source. Mechanical components can be designed using SolidWorks and manufactured using 3D printing technology. The research explores the effectiveness of the solar tracker system in maximizing the solar panel's energy output by maintaining its perpendicularity to the incoming sunlight.	
Tools	Solar Panel, Arduino, Battery Charger Chip, Servo motor
Success Criteria	
Cost	
Duration	4 months

Electrical-Electronics Engineering Department

Design Processes (2024-2025 Fall)
Electrical Engineering Design (2024-2025 Spring)

Project Proposal Form

Advisor	Prof. Dr. Salih FADIL
Co-advisor	Dr. Burak Urazel
Title of the Project	Speaking digital clock that can be used by a blind person
Number of Teams (One or more)	3
Team Size	4
Project Details The aim of the project is to design and realize a speaking digital clock by using mid-range microcontroller such as PIC16F877 and some other ICs like clock IC and voice record and play ICi etc. It is expected that the students have taken Introduction to Microcomputers class.	
Tools	Microcontroller programmer
Success Criteria	The student should show that the designed hardware accomplishes the intended functions.
Cost	1000-2000 TL
Duration	2 semester

Electrical-Electronics Engineering Department

Design Processes (2024-2025 Fall)
Electrical Engineering Design (2024-2025 Spring)

Project Proposal Form

Advisor	Assoc. Prof. Dr. Hasan Serhan Yavuz
Co-advisor	---
Title of the Project	Authentication based on head and hand gestures
Number of Teams (One or more)	1
Team Size	4

Project Details

A gesture is a short body motion that contains static anatomical information and changing behavioral (dynamic) information. For access control, a specific gesture can be selected as a "password" and used for identification and authentication of a user. If this particular motion were somehow compromised, a user could readily select a new motion as a "password" effectively changing and renewing the behavioral aspect of the biometric.

In this project, students will design a computer vision system that uses a camera and automatically detects and identifies face and hand gestures. Then, a gesture password would be created by using some combination of these gestures. The "gesture passwords" can be used to an access control system for authentication. Preliminary studies can be conducted on a personal computer but the final design must be run on an embedded platform such as raspberry pi, jetson nano or etc.
In this project, students will experience the following electrical engineering fields: electronics, computer vision and software programming.

Tools	Hardware tools: - A personal computer (for simulation) - A singleboard computer and its peripherals - A visual camera (RGB or IR) Software tolls: - Python or C/C++ with OpenCV library.
Success Criteria	The system should have a success ratio which is higher than 80% correct authorization.
Cost	Depends on the platform: min. 350-400 USD
Duration	4 months

Electrical-Electronics Engineering Department

Design Processes (2024-2025 Fall)
Electrical Engineering Design (2024-2025 Spring)

Project Proposal Form

Advisor	Prof. Dr. Gökhan ÇINAR
Co-advisor	
Title of the Project	Intelligent Traffic Management System
Number of Teams (One or more)	1
Team Size	3 or 4
Project Details Create a system that uses cameras and sensors at intersections to monitor traffic flow and dynamically control traffic signals to reduce congestion. Use deep learning to predict traffic patterns and optimize signal timings.	
Tools	Cameras, microcontrollers, traffic signal control units.
Success Criteria	Accurate analysis of traffic flow Dynamic control of traffic lights accordingly Design of the required hardware Prediction of traffic patterns
Cost	5000 TL
Duration	Two terms

Electrical-Electronics Engineering Department

Design Processes (2024-2025 Fall)
Electrical Engineering Design (2024-2025 Spring)

Project Proposal Form

Advisor	Prof. Dr. Gökhan ÇINAR
Co-advisor	
Title of the Project	Age and Gender Prediction Based Product Display
Number of Teams (One or more)	1
Team Size	3 or 4
Project Details Develop an automated product display which selects the products based on the age and gender prediction of viewers. Age and gender prediction algorithm will be used to develop a target group which will allow a more efficient product set to be selected for display.	
Tools	Camera, microcontroller, Display.
Success Criteria	Age and gender prediction with deep learning Hardware design Dynamic programming for product selection from database and display
Cost	5000 TL
Duration	Two terms

Electrical-Electronics Engineering Department

Design Processes (2024-2025 Fall)
Electrical Engineering Design (2024-2025 Spring)

Project Proposal Form

Advisor	Prof. Dr. Gökhan ÇINAR
Co-advisor	
Title of the Project	Face Recognition Based Attendance System
Number of Teams (One or more)	1
Team Size	3 or 4
Project Details Create a system that uses facial recognition to automatically take attendance in a classroom setting. Implement deep learning to accurately identify students and mark their presence.	
Tools	Camera, microcontroller, Display.
Success Criteria	Design of the required hardware Apply face recognition procedure and prepare a database Implement deep learning to accurately identify students
Cost	5000 TL
Duration	Two terms

Electrical-Electronics Engineering Department

Design Processes (2024-2025 Fall)
Electrical Engineering Design (2024-2025 Spring)

Project Proposal Form

Advisor	Dr. Faruk Dirisağlık
Co-advisor	Gamze Kara Mağden (Bugamed Biyoteknoloji)
Title of the Project	Electronic Health Platform
Number of Teams (One or more)	1-2
Team Size	Max 3
Project Details Real time/long term monitoring is important for home cared patients, elderly, disabled people and patients suffering from chronic diseases such as cardiovascular diseases, chronic lung diseases, hypertension, diabetes and cancers. Electronic health monitoring systems enable medical doctors to closely monitor patients' vital health parameters (blood pressure, blood glucose level, body temperature, Electrocardiography (ECG), hearth rate, respiratory rate, galvanic skin response, body mass index (BMI), oxygen saturation level, ...) in real time, without having to be present at hospital. Utilizing the technology to build an electronic health monitoring system can improve and enhance the comfort of patients, reduce risks and cost of hospitalizations. In this project, a user-friendly electronic health monitoring system will be designed with hardware and software implementation. Raspberry platforms with compatible sensors to be used to measure the abovementioned health parameters. Data will be wirelessly sent, stored and displayed in list/graph forms. Data can also be entered manually via web, or a mobile app. Respiratory rate and ECG data will be analyzed to evaluate respiratory disorders, hearth rate and determining arrhythmia. Patients will be warned in any emergency condition. If the patient does not respond to the warning, the authorized person will be informed by SMS.	
Tools	Raspberry platforms with compatible sensors, Personal computer, C/C++/C#/ Python programming, Firebase platform, Android studio/Java programming
Success Criteria	Hardware and software design to acquire, analyze, store and display the data. (Candidates must have an intention to submit their proposal to TUBITAK 2209 Industry Oriented Undergraduate Thesis Support Program)
Cost	<5000 TL
Duration	3+ months

Electrical-Electronics Engineering Department

Design Processes (2024-2025 Fall)
Electrical Engineering Design (2024-2025 Spring)

Project Proposal Form

Advisor	Dr. Faruk Dirisağlık
Co-advisor	Dr. İlknur Tatar (İlksem Mühendislik)
Title of the Project	Hall Measurement Setup
Number of Teams (One or more)	1-2
Team Size	Max 3
Project Details Hall Voltage is the potential difference generated across an electrical conductor, transverse to an electric current under a magnetic field perpendicular to the current. Measurements of the Hall voltage and electrical resistivity can be used to determine type of a semiconductor, carrier concentration and carrier mobility that provides important information on electrical transport characteristics of a semiconductor material. Hall measurements using the van der Pauw technique is a common approach to measure the electrical resistivity and the hall coefficient of arbitrarily shaped thin film materials. In this project, a low-cost Hall measurement setup will be realized, and various semiconductor thin film and bulk materials will be characterized.	
Tools	Raspberry platforms and compatible sensors, Personal computer, C/C++/C#/ Python/Labview programing.
Success Criteria	Measurement setup design for electrical characterization. Software for data acquisition and analysis. Materials characterization. (Candidates must have an intention to submit their proposal to TUBITAK 2209 Industry Oriented Undergraduate Thesis Support Program)
Cost	<5000 TL
Duration	3+ months

Electrical-Electronics Engineering Department

Design Processes (2024-2025 Fall)
Electrical Engineering Design (2024-2025 Spring)

Project Proposal Form

Advisor	Dr. Faruk Dirisağlık
Co-advisor	Dr. İlknur Tatar (İlksem Mühendislik)
Title of the Project	High Temperature Electrical Characterization Tool for Thin Films
Number of Teams (One or more)	1-2
Team Size	Max 3
Project Details Insulator, conductor, and semiconductor materials are commonly used in electronic industry. Understanding of the material properties is crucial and play a significant role in development of electronic devices. Characterizing thin film forms of these materials is a common approach. In this project, the temperature dependent electrical resistivity values of thin films (nanometers to several micrometers in thickness) coated on various substrates in 25-500 C temperature range will be studied.	
Tools	Raspberry platforms and compatible sensors Personal computer C/C++/C#/ Python/Labview programing
Success Criteria	Measurement setup design for electrical characterization. Software for data acquisition and analysis. Materials characterization. (Candidates must have an intention to submit their proposal to TUBITAK 2209 Industry Oriented Undergraduate Thesis Support Program)
Cost	<5000 TL
Duration	3+ months

Electrical-Electronics Engineering Department

Design Processes (2024-2025 Fall)
Electrical Engineering Design (2024-2025 Spring)

Project Proposal Form

Advisor	Dr. Faruk Dirisağlık
Co-advisor	Gamze Kara Mağden (Bugamed Biyoteknoloji)
Title of the Project	Postural Assessment Tool
Number of Teams (One or more)	1-2
Team Size	Max 3

Project Details

Abnormal posture is a serious health disorder, often leads to musculoskeletal problems, organ disorders and mental disorders, and impacts the quality of life. There are three common posture disorders: 1) Scoliosis, is the lateral curvature of the spine, visible in the chest or lumbar region, 2) Kyphosis, also known as humpback, caused by leaning the spine forward, 3) Lordosis is a condition where the spine has an excessive inward curvature. It is very important to treat/minimize these disorders in the early stages, otherwise surgical operation becomes inevitable. In this project, a user-friendly posture assessment tool will be designed via hardware and software implementation. The mobile application will utilize photos taken from various perspectives to detect postural disorders, employing contemporary image processing techniques for analysis. A wearable device will be developed to prevent disease progression in users with early or moderate postural disorders. This device collects real-time data on the user's posture and provides audible and vibrating alerts if prolonged poor posture is detected, encouraging the user to adjust their positioning.

Tools	Raspberry/Arduino platforms with compatible sensors, Personal computer, C/C++/C#/ Python programming, Android studio/Java programming
Success Criteria	Hardware and software design to acquire, analyze, store, and display the data. (Candidates must have an intention to submit their proposal to TUBITAK 2209 Industry Oriented Undergraduate Thesis Support Program)
Cost	<5000 TL
Duration	3+ months

Electrical-Electronics Engineering Department

Design Processes (2024-2025 Autumn Term)
Electrical Engineering Design (2024-2025 Spring Term)

Project Proposal Form

Advisor	Prof. Dr. Rifat EDİZKAN
Co-advisor	Associate Prof.Dr. Uğur YAYAN
Title of the Project	AI-based Agricultural Robot for Crop Monitoring in Greenhouse
Number of Teams (One or more)	1
Team Size	3-4
Project Details: The aim of the project is to implement an autonomous agricultural robot that monitors the health status of tomato and pepper crops in greenhouses. The robot will be equipped with distance sensors and cameras. The robot will use the map obtained from SLAM to navigate between plants. RGB cameras will be used to detect diseases in plants. The apparatus will be designed to provide pan and tilt functionality for the cameras. The images captured by these cameras will be analyzed by a DNN model. When a disease is detected, the system will promptly generate an alert and transmit a message to the server through a wireless network. Evarobot will serve as the base model for the agricultural robot. https://www.inovasyonmuhendislik.com/tr/products/evarobot The project encompasses various areas of study, including robotic systems, embedded systems, programming, machine learning, and wired/wireless communication.	
Tools	C/C++, Pyhton, Matlab, ROS, Gazebo
Success Criteria	• Detection of a disease: >80% accuracy. • Send a notification and the captured image through wireless network in the event of disease detected.
Cost	12.000 TL
Duration	Two semesters

Electrical-Electronics Engineering Department

Design Processes (2024-2025 Autumn Term)
Electrical Engineering Design (2024-2025 Spring Term)

Project Proposal Form

Advisor	Prof. Dr. Rifat EDİZKAN
Co-advisor	Associate Prof.Dr. Hasan Serhan YAVUZ
Title of the Project	AI-based Robot for Plant Detection and Localization
Number of Teams (One ormore)	1
Team Size	3-4
Project Details: An AI-based robot will be developed in the project. The movement of the robot will be controlled manually. The system will capture images from a stereo camera. The crops will be detected by a DNN model. The system will also calculate the distances of the crops by analysing stereo images. It will be assumed that the crops are planted in an NxN matrix form and the distance between plants is 30 cm. An encoder will be assembled to the robot wheel. The encoder will provide the relative position of the robot. The plants will be marked on the image and their distances will be displayed. The relative position of the robot will also be displayed on the monitor. The project encompasses various areas of study, including robotics, embedded systems, signal processing, and deep learning.	
Tools	C/C++, MATLAB, Phyton, OpenCV, ROS, Gazebo
Success Criteria	• Plant detection accuracy >80%. • Error in the distance measurement < 20% • Put a rectangle around the plants detected on the image and also show the calculated distances on the monitor.
Cost	12.000 TL
Duration	Two semesters

Electrical-Electronics Engineering Department

Design Processes (2024-2025 Fall)
Electrical Engineering Design (2024-2025 Spring)

Project Proposal Form

Advisor	Assist. Prof. Dr. Burak Kaleci
Co-advisor	Research Assistant Gülin Elibol Seçil
Title of the Project	Indoor SLAM with Point Cloud Data
Number of Teams (One or more)	2
Team Size	3

Project Details:

In this project, the task is simultaneously localization and mapping (SLAM) via point cloud data captured by RGB-D camera or LiDAR.

The following tasks should be accomplished for a successful project.

a) First, analyzing publicly available and well-known dataset for indoor SLAM methods
b) Separating the datasets into point clouds and robot poses.
c) Using point clouds and poses with well-known feature extraction methods for scan registration.
d) Using the features for odometry estimation using matching algorithms such as Iterative Closest Points (ICP) or optimization tools (Ceres).
e) Updating the map according to the estimated robot pose.
f) Using the Point Cloud Library (PCL) to implement given steps.
g) Building an appropriate interface for the task.

Testing the methods with captured point cloud datasets captured from Gazebo and the Laboratory environment

Tools	Gazebo, ROS, C++, RGB-D Camera, LiDAR, PCL.
Success Criteria	• Design and implement a point cloud based SLAM method. • Designing a user friendly interface to show the map, captured point cloud, and robot pose. • Testing the methods.
Cost	-
Duration	9 months

Electrical-Electronics Engineering Department

Design Processes (2024-2025 Fall)
Electrical Engineering Design (2024-2025 Spring)

Project Proposal Form

Advisor	Assoc. Prof. Dr. Erol Seke
Co-advisor	-
Title of the Project	Digital Oscilloscope Design
Number of Teams (One or more)	1
Team Size	3

Project Details:

A digital oscilloscope with FFT, constellation diagram and signal generator capabilities will be designed using the following;

- An FPGA
- A microcontroller/microprocessor (see below)
- Dual ADC
- Dual DAC
- LCD module and panel
- Various controls (knobs/buttons) and power units.

Microprocessor might be embedded in FPGA board depending on the design. Candidates are required to enroll on technical elective VHDL course in Fall semester.

Team members must learn FPGA, microprocessor, programming and digital design basics. No PCB design is required unless the team decides so (can use ready to use modules). However, some soldering and cabling will be necessary.

Tools	Xilinx ISE for VHDL, a Programming Language Environment for graphics.
Success Criteria	A working oscilloscope (cased)
Cost	6000 TL
Duration	2 semesters including learning cycle