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AdımODTÜ UNDERGRADUATE RESEARCH PROJECT

Examples of Undergraduate Research Projects supported by AdımODTÜ in 2021

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A joint project of the Corporate Communications Office and METU Development Foundation, AdımODTÜ is a communication-sharing-action platform where everyone can provide financial support to the scientific research and community service projects of our students and faculty members, contribute to the announcement of the projects and even take part in projects on a voluntary basis.

Research at METU starts in undergraduate years!

AdımODTÜ has created a fund to support the research efforts of undergraduate students through donations. In this booklet, examples of undergraduate projects that have applied to AdımODTÜ are presented. These projects are either fully or partially supported by AdımODTÜ.

To support AdımODTÜ Undergraduate Research Project please visit:
https://adimodtu.org.tr/proje/lisans-arastirmalari-projesi

Name of the Project: Investigation of Candidate Genomic Biomarkers with Pyrosequencing for COVID 19 Severity in Turkey

Field of Research: Biology

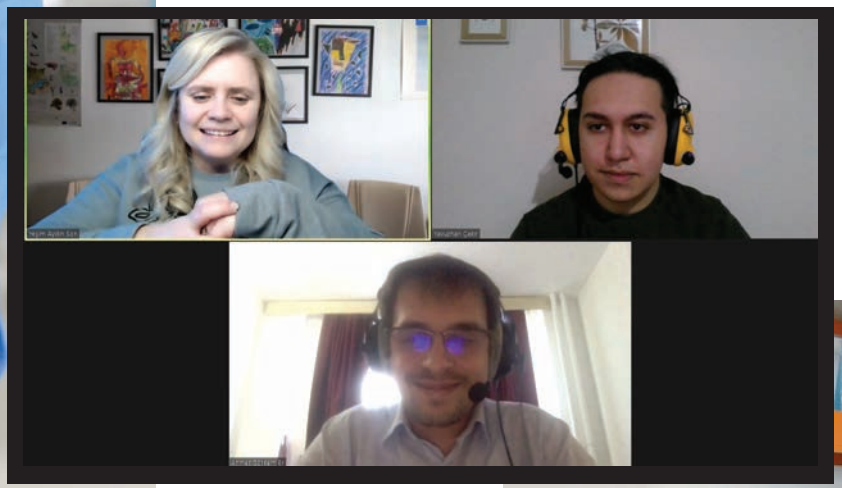
Project Team Members: Yavuzhan Çakır

Project Supervisor: Assoc. Prof. Yeşim Aydın Son M.D., PhD.

Abstract:

COVID-19 is a novel disease which is caused by SARS-CoV-2 and presents with different severity levels in the disease progress. Based on symptoms such as respiratory stress, hypotension, and kidney or lung injury, some patients may need to be treated in the intensive care units (ICU) while others may be treated in other services in hospitals, even in outpatient clinics.

In this study, we will try to observe the effects of four specific gene variants, which are selected through literature reviews, on severity of COVID-19. This study has the potential to identify possible variants as biomarkers for the severity of the disease in people with different genetic backgrounds. This information can be utilized in several different areas such as management and therapy of the infected patients, or administration of vaccines to higher risk groups.



Investigation of Candidate Genomic Biomarkers with Pyrosequencing for COVID 19 Severity in Turkey

Name of the Project: Detection of the Essential Phosphorylation Sites on β2 Adrenergic Receptor (β2AR) for β Arrestin 2 (Arrβ2) Binding

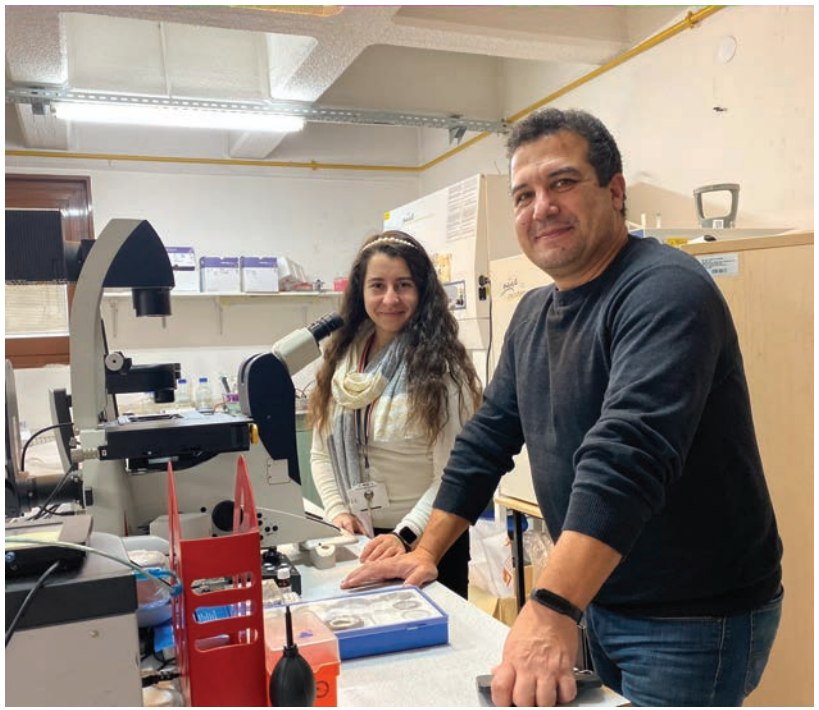
Field of Research: Structural Biology, G-Protein Coupled Receptor Activity

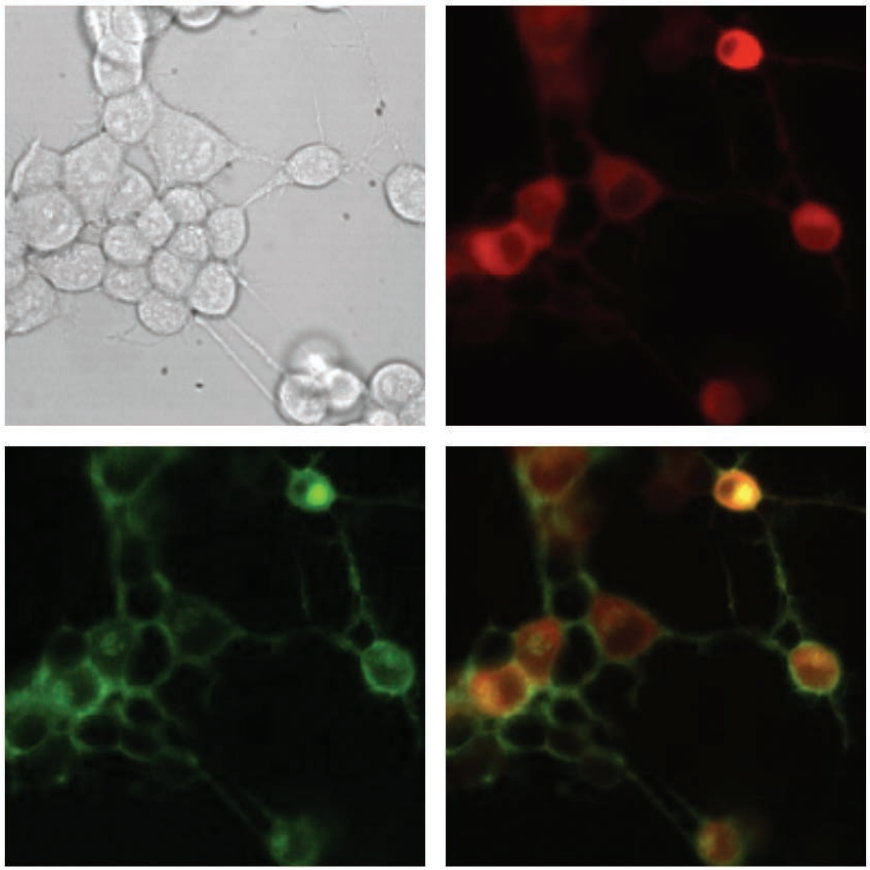
Project Team Members: Tolgahan Suat Sezen & İrem Aydın

Project Supervisor: Assoc. Prof. Çağdaş Devrim Son, PhD.

Abstract:

The receptors are the machineries of cells to communicate with their environments, relaying the signal through downstream pathways. After transmission of the signal, the receptors are desensitized to stop the signal transduction. β2AR phosphorylation leads to desentization, thereafter, β-Arrestin 2 binds to the receptor to facilitate desensitization with the help of other scaffold proteins. It is estimated that phosphorylation of four residues on C terminus of β2AR is fundamental for binding of Arrestin. This research reveals that the phosphorylation of 355th and 356th Serine residues are more significant than the other residues.





Detection of the Essential Phosphorylation Sites on β2 Adrenergic Receptor (β2AR) for β Arrestin 2 (Arrβ2) Binding

Name of the Project: The Establishment of Single Barcode Derived Colorectal Cancer Cell Lines

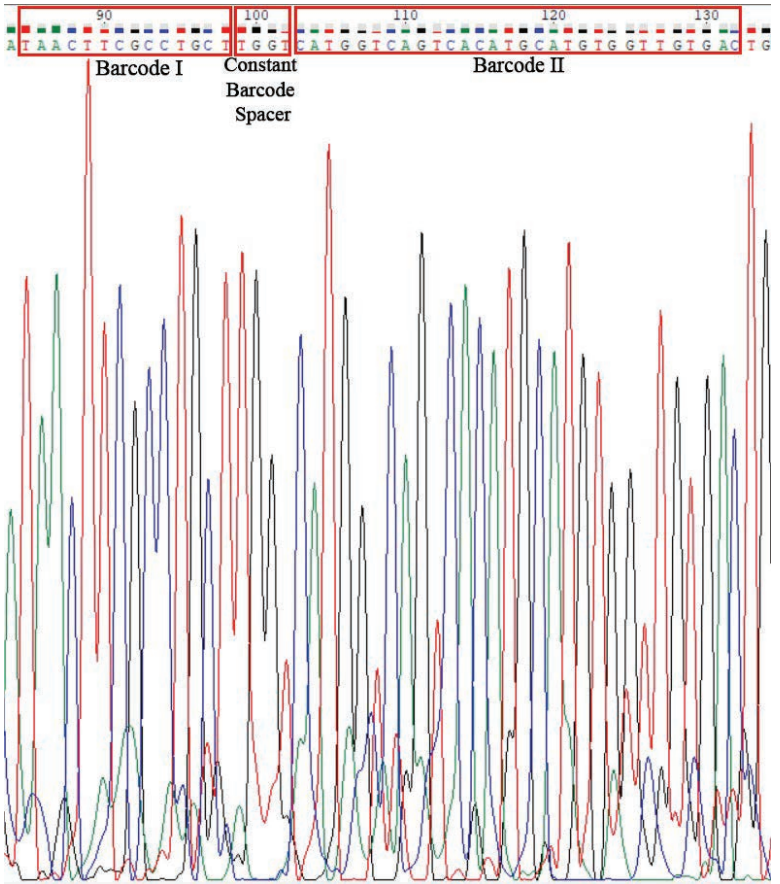
Field of Research: Biological Sciences-Cancer Research

Project Team Member: Ecesu Özdal, Sıla Karakuş & Gizem Damla Yalçın

Project Supervisor: Asst. Prof. Ahmet Acar, PhD.

Abstract:

Studies have demonstrated intratumoral heterogeneity as a cause of drug resistance and multiple subclones facilitate distinct resistance mechanisms and contribute to the failure of therapy. Lentiviral cellular barcoding is a method in which individual cells are tagged with unique nucleotide sequences to allow the tracking of cells, and thereby providing information about monitoring of clonal dynamics in response to drug treatment. This project aimed to establish the single-cell clones that we expect to have a single barcode. For this purpose, single-cell barcoded HCT-116, and Caco-2 colon cancer cell lines were used. The single-cell dilution method was used for the establishment of single-cell clones. The generated single-cell derived-cell lines that we expect to contain a single barcode were confirmed by the Sanger sequencing.



The Establishment of Single Barcode Derived Colorectal Cancer Cell Lines

Name of the Project: Identification of Novel Mixed Lineage Leukemia 1 (MLL1) Inhibitors for Cancer Therapy

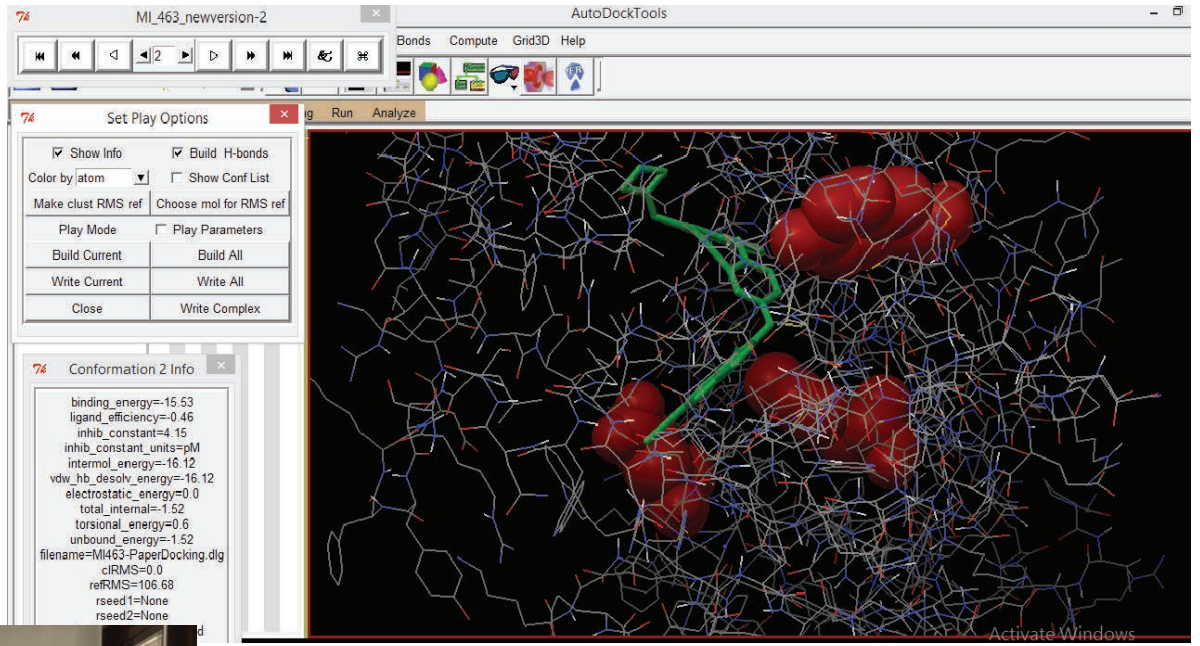
Field of Research: Cancer Biology

Project Team Members: Olka Missaghimamaghani, Fatimah Safieh & Ilir Sheraj

Project Supervisor: Prof. Sreeparna Banerjee, PhD.

Abstract:

MLL1 is a member of the evolutionary conserved SET1 family of histone H3 lysine 4 methyltransferases and functions as a transcriptional co-activator. MLL1 plays a critical role in the development of acute lymphoid leukemia (ALL) and acute myeloid leukemia (AML). Recently, a role of the MLL1 protein in the regulation stem cell gene expression in human colon cancer cells has been identified. We have hypothesized that therapeutic targeting of MLL1 may reduce the stem cell population in colorectal tumors by inhibiting their self-renewal. To address this hypothesis, we used bioinformatics tools to structurally model known MLL1 inhibitors and analyzed their binding efficiency. On the basis of these binding efficiencies, we have evaluated various other drugs that may inhibit MLL1. To identify the candidate drugs, we have classified cell lines from colon, breast, lung, prostate cancer and leukemia into MLL1 high expressing and MLL1 low expressing using the Cancer Cell Line Encyclopedia. Next, the drugs that the MLL1 high expressing cell lines were sensitive to were curated and evaluated for their binding efficiencies. We have identified two FDA approved drugs Gemcitabine and Crizotinib that showed good binding efficiencies to MLL1. As future studies, the effects of these drugs on MLL1 expressing and non-expressing colon cancer cell lines for proliferation, apoptosis and stem cell enrichment will be tested.



Identification of Novel Mixed Lineage Leukemia 1 (MLL1) Inhibitors for Cancer Therapy

Name of the Project: Cell Cycle Dependent Regulation of CXXC5 Gene Expression

Field of Research: Cancer Biology

Project Team Members: Hazal Ayten, Pelin Toker & Dr. Pelin Yaşar

Project Supervisor: Prof. Mesut Muyan, PhD.

Abstract:

Previous studies in the laboratory identified CXXC5 as a nucleation/scaffolding factor involved in cellular growth of experimental cell models derived from breast carcinomas. Moreover, CXXC5 was suggested to contribute to the initiation and progression of breast cancer. Cell cycle is a series of events in which cell grows and divides into two daughter cells and is tightly regulated. It consists of four stages; G1 (where cells increase in size), S (where cells replicate their DNA), G2 (where cells increase more in size and prepare to go into mitosis) and M (where mitosis and cytokinesis occur). Cell cycle regulation is predominantly dependent upon the synthesis and degradation of proteins critical for cellular proliferation. For example, the intracellular protein levels of RB1 (Retinoblastoma protein) and E2F family proteins and/or hematopoietic transcription factors such as ELF1 are critical protein components for driving the cell cycle initiation and progression.

Our studies in the laboratory suggest that the interactions of RB1 and ELF1 proteins with the promoter elements of the CXXC5 gene promoter are involved in the regulation of the CXXC5 gene expression. We therefore predict that the expression and synthesis of CXXC5 also occurs in a cell-cycle dependent manner. Therefore, here, we investigate the association and dissociation patterns of RB1 from the CXXC5 promoter throughout the cell cycle phases using synchronized breast cancer cells.

Cell Cycle Dependent Regulation of CXXC5 Gene Expression

Name of the Project: Systematic Investigation of Unknown Grasses of Festuca Genus from the Mountains of the Black Sea Region in Turkey

Field of Research: Biology, Botany

Project Team Members: Gencer Yaprak, Halime Karatoprak & Jelena Erdal

Project Supervisor: Prof. Musa Doğan, PhD.

Abstract:

Festuca is a plant genus that belongs to grasses (Poaceae) family. As a part of the ongoing Festuca genus revision in Turkey, plant samples that cannot be allocated within the known species had been collected from the mountains of the Black Sea region. We had performed morphological, anatomical, and scanning electron microscope (SEM) analyses of the samples and compare them with the known species from the same area to identify the group to which they can be included. Preliminary results of our study revealed existence of two species new to science. Thus, we are going to provide new species' descriptions with notes on taxonomy, ecology, habitat, conservation, distribution maps and to assign IUCN threat categories.

Systematic Investigation of Unknown Grasses of Festuca Genus from the Mountains of the Black Sea Region in Turkey

Name of the Project: Determination of Pro Neurotrophin Receptor Sortilin Protein Expression in Mouse Embryonic Stem Cells

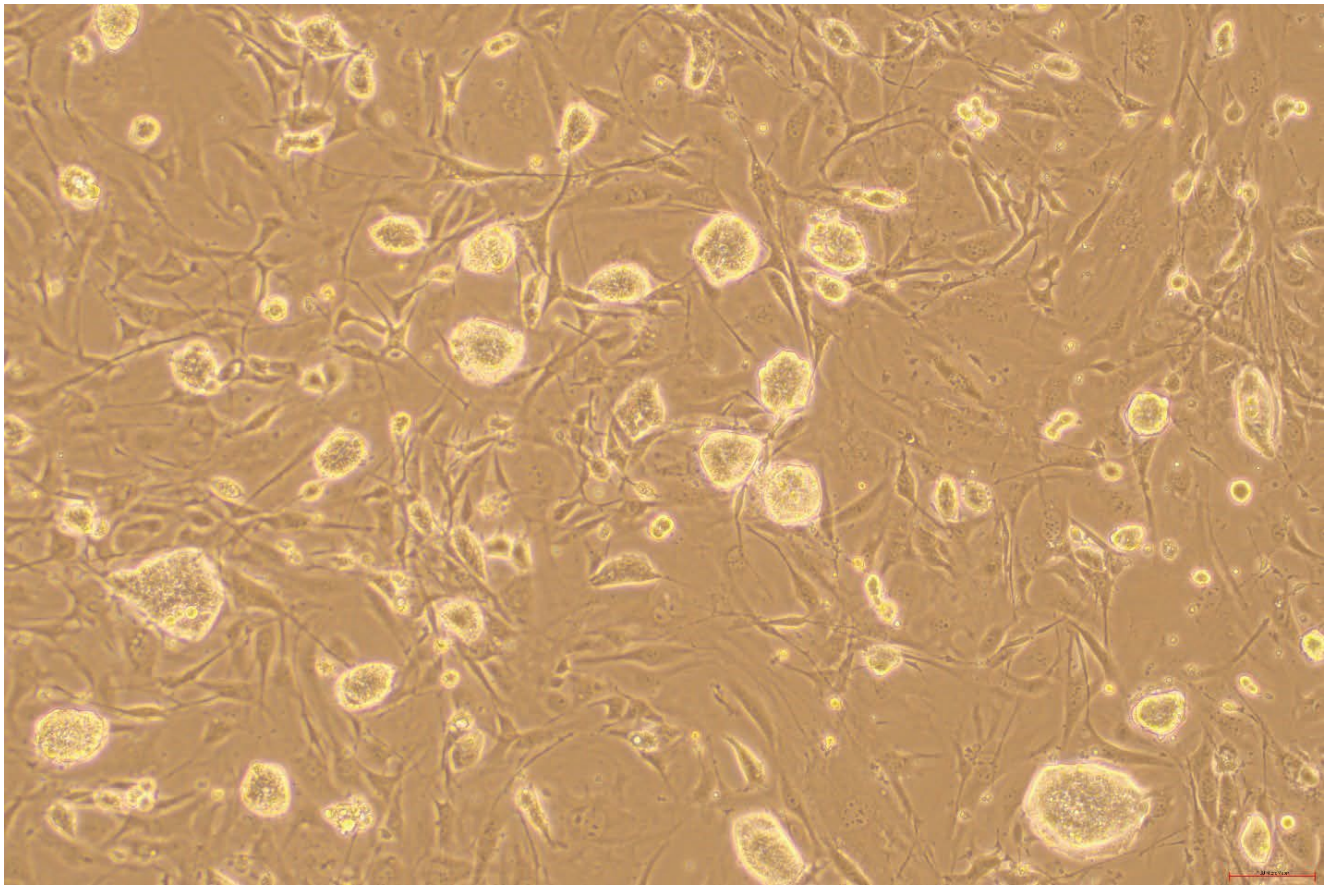
Field of Research: Neurobiology

Project Team Members: Fulya Kızıldağ & Peri Besarat

Project Supervisor: Asst. Prof. Erkan Kiris, PhD.

Abstract:

Neurotrophins (NTs) are a protein family associated with neuronal development and survival. These proteins interact with p75 neurotrophin receptor (p75NTR) or Tropomyosin-related kinase (Trk) receptors in order to function. On the other hand, precursors of neurotrophins called proneurotrophins interact with p75NTR to induce apoptosis. Sortilin is one of the vacuolar protein sorting 10 protein (VPS10P) domain receptors, which functions in this apoptosis process by its association with p75NTR. Sortilin is known to be related to a variety of diseases: Alzheimer's Disease, frontotemporal dementia, Parkinson's disease, and cancer. The role of sortilin in these diseases have been investigated using several types of cells. However, expression of sortilin in mouse embryonic stem cells, which are frequently used to research aforementioned diseases, is not clear yet. In this project, sortilin expression will be investigated in mESCs to provide preliminary information for studies on neurodegenerative diseases and cancer.



Determination of Pro Neurotrophin Receptor Sortilin Protein Expression in Mouse Embryonic Stem Cells

Name of the Project: Determination of the Potential Membrane Localization of Botulinum Neurotoxin A Cleaved SNAP-25 Fragment

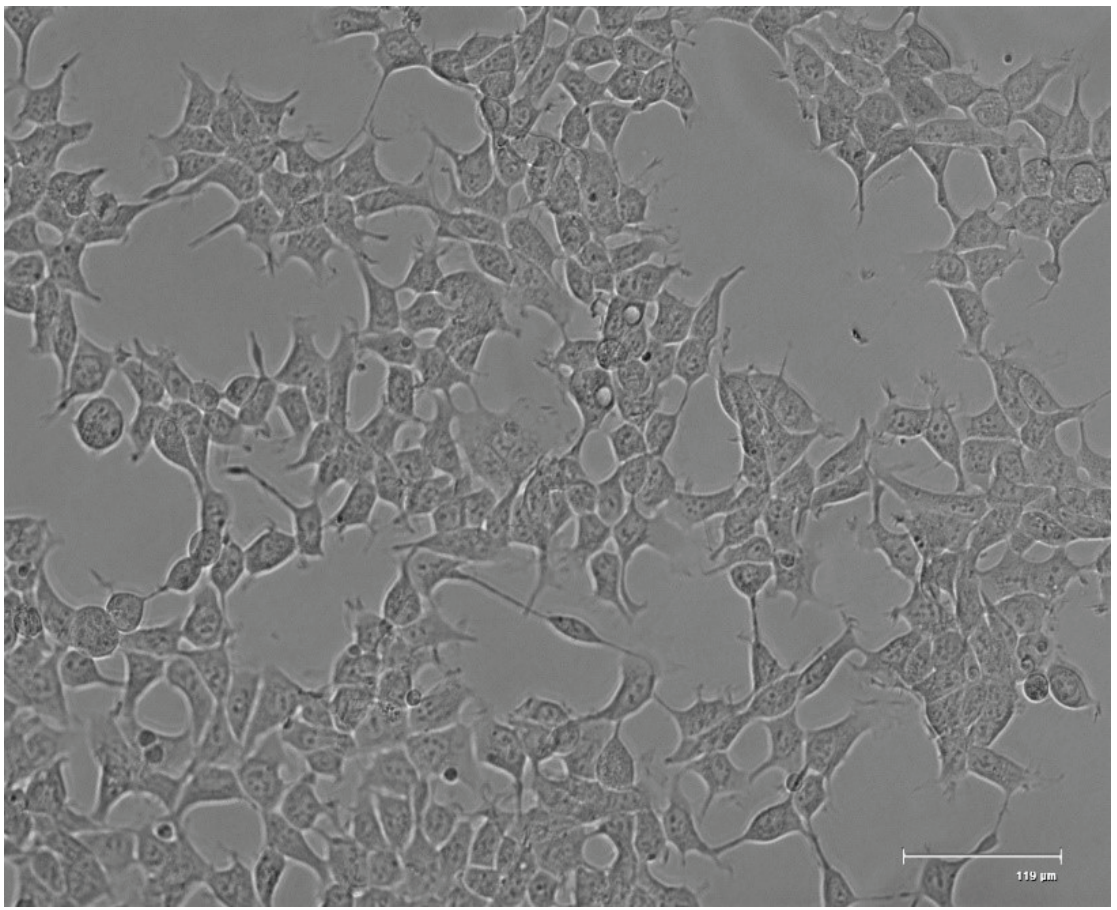
Field of Research: Neurobiology

Project Team Members: Ece Sönmez & Dilara Koç

Project Supervisor: Assoc. Prof. Erkan Kiriş, PhD.

Abstract:

SNAP-25 is one of the proteins that comprise the SNARE complex, which plays a fundamental role in neurotransmitter release cascade by enabling the fusion of synaptic vesicle to the plasma membrane, is known to be located on the plasma membrane. The phosphorylation of these proteins which enables regulation of the SNARE complexes occurs in either Serine-187 (Ser187) or Threonine-138 (T138) residues. The phosphorylated T138 sites contribute to the regulation of the size of vesicle pools and assembly of SNARE complex which are significant for continuous neurotransmission. Because of these features, deterioration in the structure, function, or phosphorylation mechanism of SNAP-25 has been determined to be associated with several neurological and neuromuscular disorders. Botulinum neurotoxin serotype A (BoNT/A), one of the most dangerous biological agents that shows high toxicity, disrupts the structure of SNAP-25 by cleaving the protein with its' light chain (LC). Moreover, this cleavage leads motor neurons to lose their function since acetylcholine release at nerve terminals is inhibited, and it can be eventually ended up with muscle paralysis. The localization of the SNAP25 Δ198, which is the cleaved form of SNAP-25, has been not studied yet, and therefore this project will try to identify the localization of the SNAP-25 fragment after cleaving by BoNT/A by using the HEK293 cell line. Hence, the principal goals of this project are to determine whether the SNAP25 Δ198 will be localized in plasma membrane or cytosol, and additionally, how the phosphorylation levels at T138 residues are linked with the localization.



Determination of the Potential Membrane Localization of Botulinum Neurotoxin A Cleaved SNAP-25 Fragment

Name of the Project: Investigating Effect of Excess Heat on Iron Nutrition of *Arabidopsis thaliana*

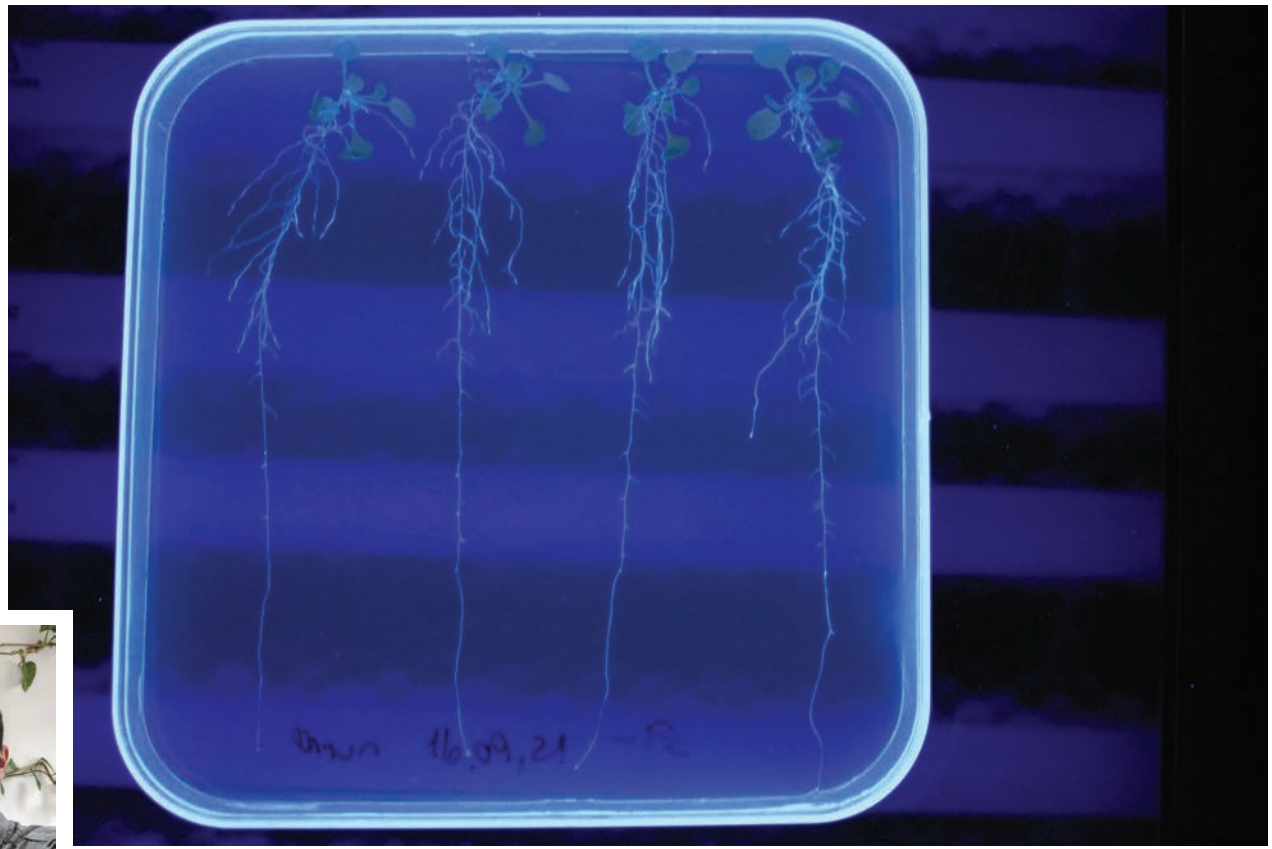
Field of Research: Molecular Plant Nutrition

Project Team Members: Mehmet Onur Barut

Project Supervisor: Asst. Prof. Seçkin Eroğlu, PhD.

Abstract:

Plants are usually exposed to more than one stress in nature: generating the need for studying them in combination. Iron (Fe) stands to be one of the most limiting nutrients in agriculture in countries that have basic soils such as Turkey. Another common stress for the plants, heat also impacts the agricultural productivity which is becoming even more relevant with the global warming. A recent report (Buckner et al,2019) indicated that upon heat a few key genes in the iron deficiency response are downregulated in model plant Arabidopsis thaliana, but whether this transcriptional effect translates into a physiological response remains unclear. We aim to explore how heat impacts plants' Fe homeostasis by using biochemical assays and gene expression analysis. In case a relation between the two stresses are observed, this will serve as a preliminary data for applying a new TUBITAK project.



Investigating Effect of Excess Heat on Iron Nutrition of *Arabidopsis thaliana*

Name of the Project: Determination of Transcript Variants for Gynecological Cancers

Field of Research: Cancer Genetics

Project Team Members: Elanur Almeriç & Didem Naz Döken

Project Supervisor: Prof. A. Elif Erson-Bensan, PhD.

Abstract:

Polyadenylation (pA) sites on newly transcribed pri-mRNAs are recognized by a group of proteins, that also add a polyA tail about 200-250 nucleotides long. The pA site recognized by the polyadenylation machinery proteins determines the location and length of the 3' Untranslated Region (3'UTR), which plays a crucial role in the stability, localization, and half-life of mRNA. This untranslated region contains sites for RNA binding proteins and microRNAs, adding another layer of complexity to gene regulation. In light of this information, identification and characterization of the isoform diversity due to alternative polyadenylation (APA) is important in cancer cells. In this project, the aim is identifying such isoforms in gynecological cancers.

Determination of Transcript Variants for Gynecological Cancers

Name of the Project: Synthesis of Bodipy Embedded Chitosan Nanoparticles for Enhancement of Antimicrobial Photodynamic Inhibition Activity

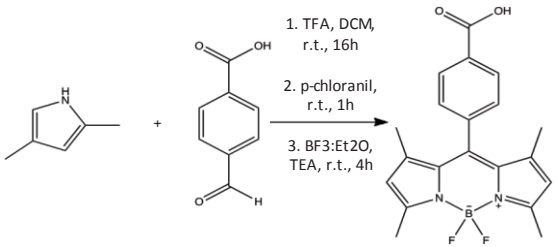
Field of Research: Biochemistry
Project Team Members: Alara Özdemir, Sena Tarım, Işıl Soysal & Naz Özoğul
Project Supervisor: Assoc. Prof. Görkem Günbaş, PhD.

Abstract:

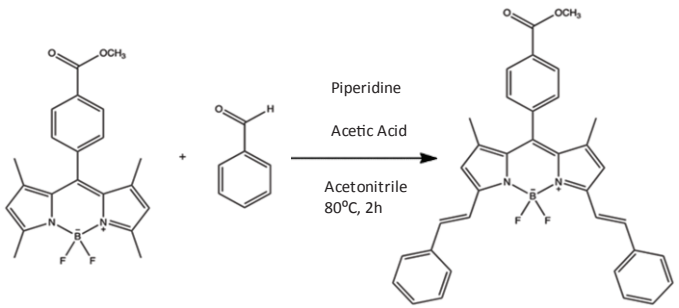
Antibacterial photodynamic therapy (PDT) is an effective light-based treatment to deal with multidrug resistance bacteria. Unlike antibiotics, bactericidal effects of PDT are independent of antibiotic resistance pattern, and no rapid resistance development occur upon multiple therapy sessions. The mechanism of PDT depends on the transition of energy to generate reactive oxygen species (ROS) and free radicals, which can damage bacterial macromolecules such as proteins, lipids, and nucleic acids and may result in bacterial killing. Photosensitizers are a group of dyes that are only activated with light to generate reactive oxygen species in the presence of oxygen molecules and are used as a PDT agent. One of the great scopes of these dyes is Boron dipyrromethene (BODIPY), giving a high yield of 1O2, having excellent photo-stability, and having properties that prevent self-oxidation, making them long-term usable.

Chitosan is the second most abundant biopolymer in nature and is used extensively because of its high antibacterial activity, biocompatibility, and low toxicity. However, it is nearly insoluble in physiological conditions so, the application field is limited. The modification of hydroxyl and amino groups on the polymer can strive this problem by improving the solubility of chitosan. O-carboxymethyl chitosan (O-CMC) is the amphiprotic ether derivative containing –COOH groups by carboxymethylation of the hydroxyl group. O-CMC has more oxygen group, so the solubility in water is higher than native chitosan. The antimicrobial activity, biocompatibility, biodegradability, hydrophobicity, targeted and controlled drug release ability of chitosan remains on O-CMC or is even enhanced after the carboxyalkylation process. In this study, the phototoxicity of the BODIPY dyes is intended to be improved by linking with cationic chitosan biopolymer, and self-assembling polymeric nanoparticles will be prepared. The hydroxyl group of the chitosan will be blocked, and the amine group is used to substitute BODIPY with O-CMC. In this context, the antimicrobial activity of the chitosan is desired to be used to augment the photodynamic inactivation effect of the BODIPY photosensitizer.

Synthesis of BODIPY core:

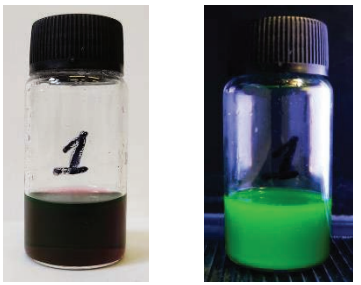


Knoevenagel condensation of BODPY:



Color of compounds

Under Daylight & UV(366nm)



Synthesis of Bodipy Embedded Chitosan Nanoparticles for Enhancement of Antimicrobial Photodynamic Inhibition Activity

Name of the Project: Developing a Universal Agar Medium for Plant Iron Deficiency Research

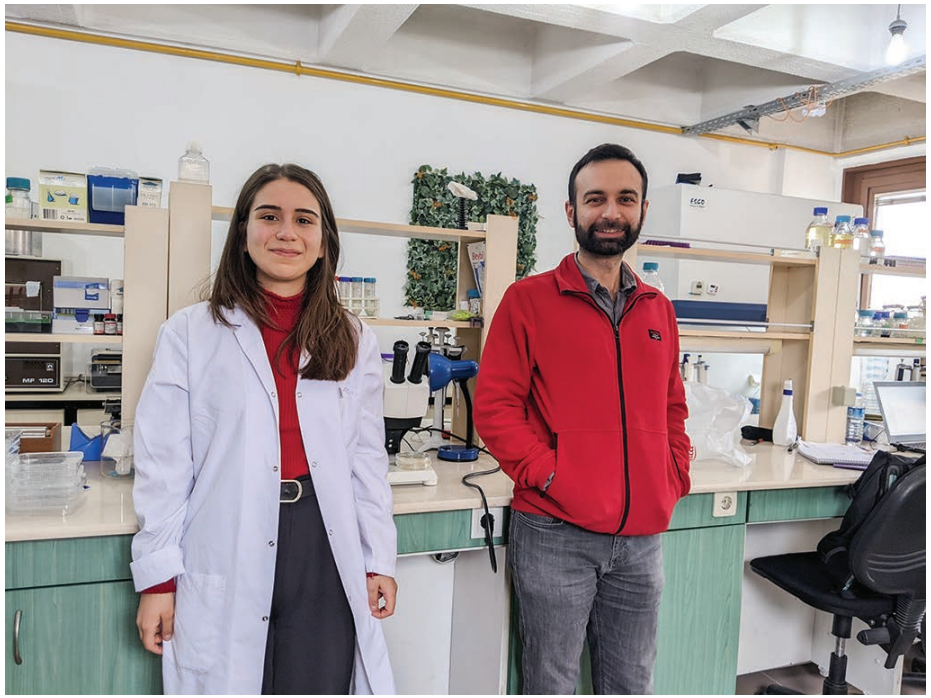
Field of Research: Molecular Plant Nutrition

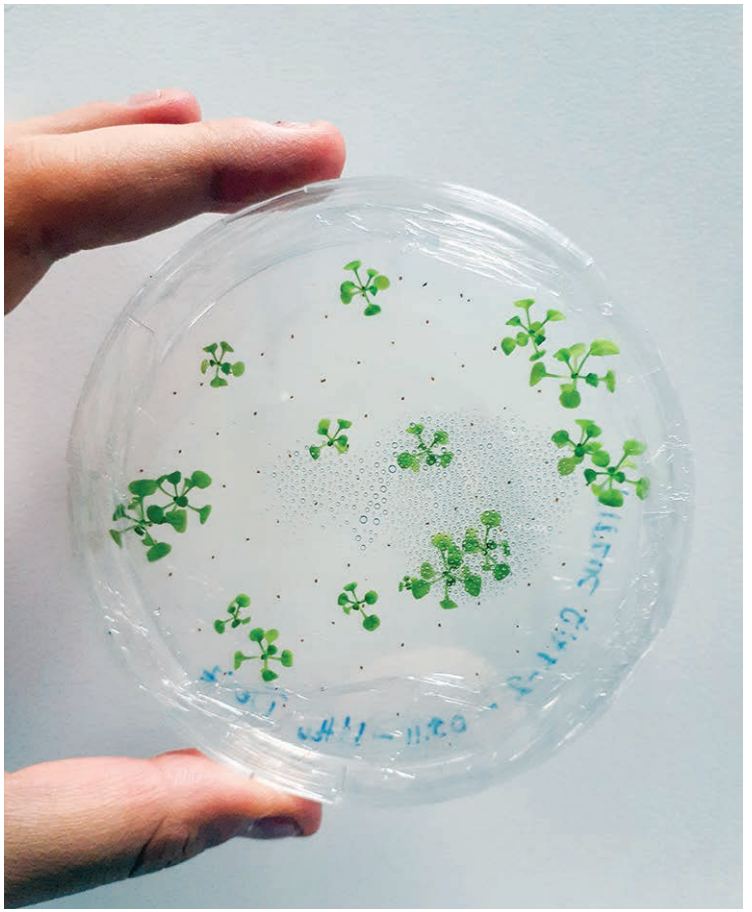
Project Team Members: Eylül Korkmaz

Project Supervisor: Asst. Prof. Seçkin Eroğlu, PhD.

Abstract:

The role of nutrients in the plants' life cycle can be understood by withdrawing the nutrient from the environment and examining the plants' response. The best approach is to mimic natural conditions as much as possible while assessing nutrient deficiency. However, scientists use traditional systems such as soil and hydroponics, and those systems can not mimic the natural soil with high accuracy. When applying plants Fe deficiency, the common practice is to use a chelator compound called ferrozine. This compound ultimately renders Fe in the medium unavailable to the plant, so tuning the stress is no longer possible. In this project, I aimed to optimize an agar medium that provides fine-tunning of Fe deficiency stress levels in the crop plants and become an alternative to traditional systems in basic Fe research.





Developing a Universal Agar Medium for Plant Iron Deficiency Research

Name of the Project: Aerodynamic Characterization of DU00-W- 212 Airfoil at Low to Moderate Reynolds Numbers

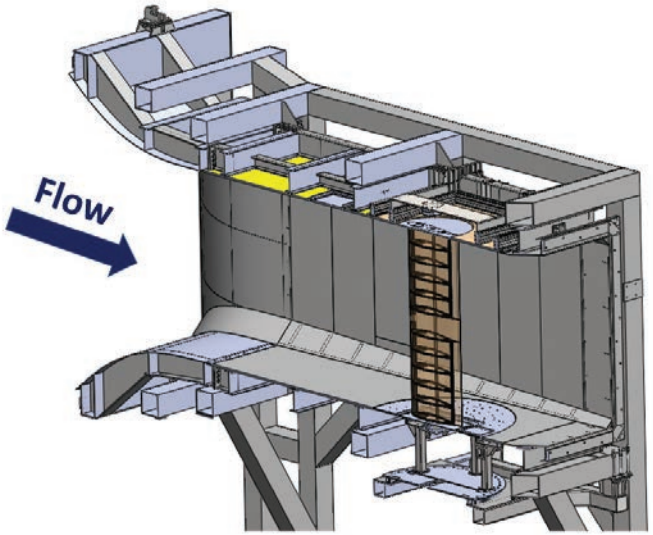
Field of Research: Aerodynamics

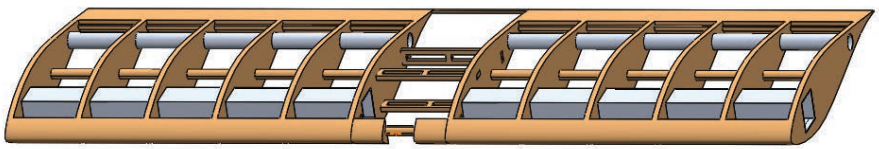
Project Team Members: Yankı Aloğlu

Project Supervisor: Prof. Oğuz Uzol, PhD.

Abstract:

In this study, we will perform wind tunnel measurements of DU00-W-210 wind turbine airfoil in the new RÜZGEM Large Scale Wind Tunnel to obtain its aerodynamic characteristics. This airfoil was previously tested in the High-Pressure Wind Tunnel in Göttingen (HDG) of DNW (German-Dutch Wind Tunnels) as a part of the AVATAR FP7 project for Reynolds numbers from 3 million to 15 million and at very low Mach numbers (in the range of 0.03 to 0.08). In the current study, we will obtain complimentary data on lower Reynolds number characteristics from 500K to 3 million with a step of 500K. Also, we will collect data from 3 million to 6 million at Mach numbers 0.2 to 0.3. We will compare the data to the existing AVATAR data to observe the Mach number effects on these measurements.





Aerodynamic Characterization of DU00-W- 212 Airfoil at Low to Moderate Reynolds Numbers

Name of the Project: FENER

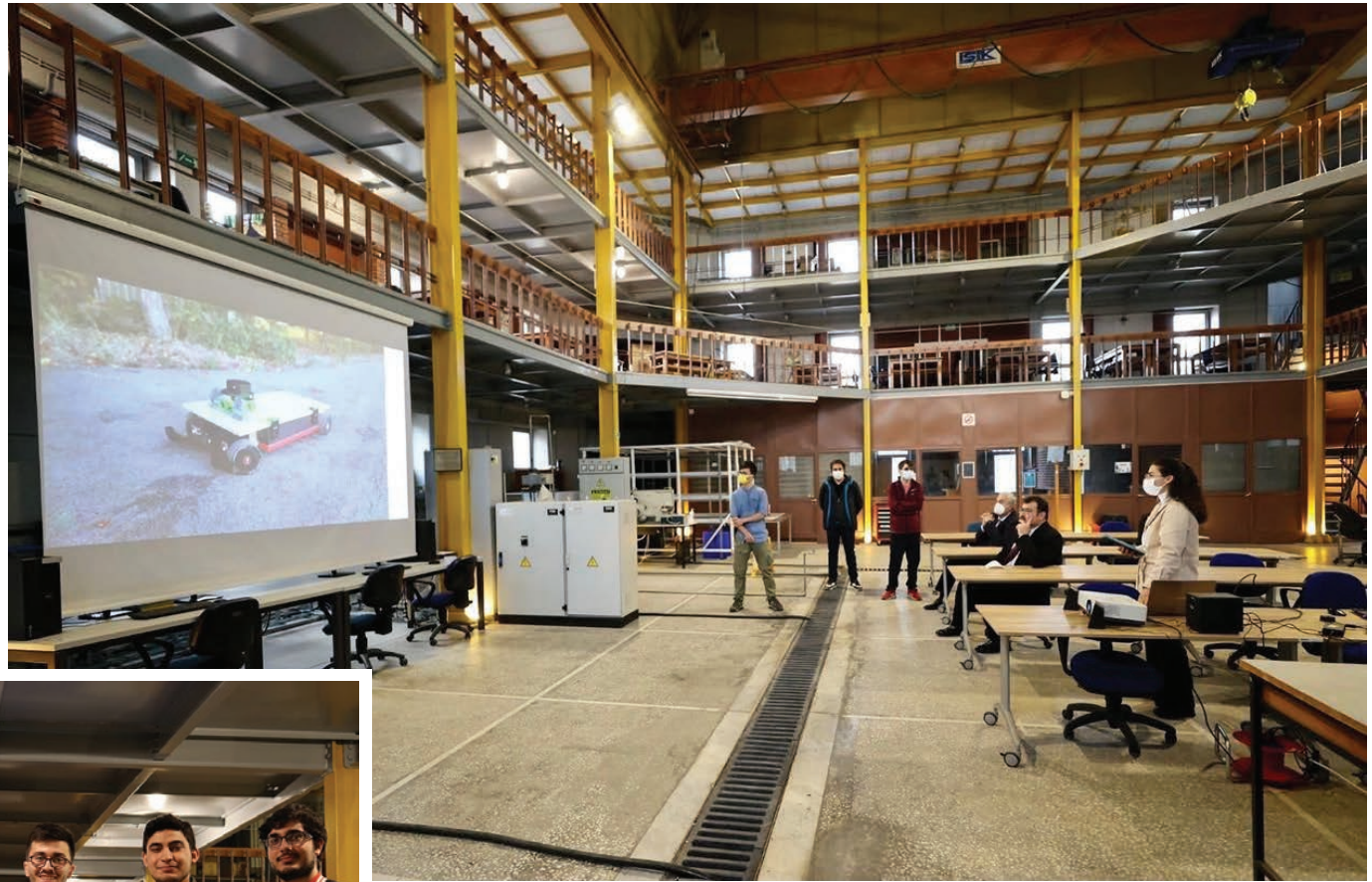
Field of Research: Robotics

Project Team Members: Şevval Belkıs Dikkaya, Muhammed Sezer, Evren Uçar, Metehan İçöz, Zahid Kalaycı & Yusuf Onat Yılmaz

Project Supervisor: Prof. Klaus Werner Schmidt, PhD.

Abstract:

In this project, our purpose was to design a self driving vehicle which can follow a target object. A custom stereo camera was designed and an object detection model was used in conjunction with template matching to determine object position. This data was later used to follow the object. The vehicle platform for the testing was designed with adaptability, expandability and repeatability in mind and will enable us and other researchers to test and develop wide variety of systems.



FENER

Name of the Project: METU ROVER

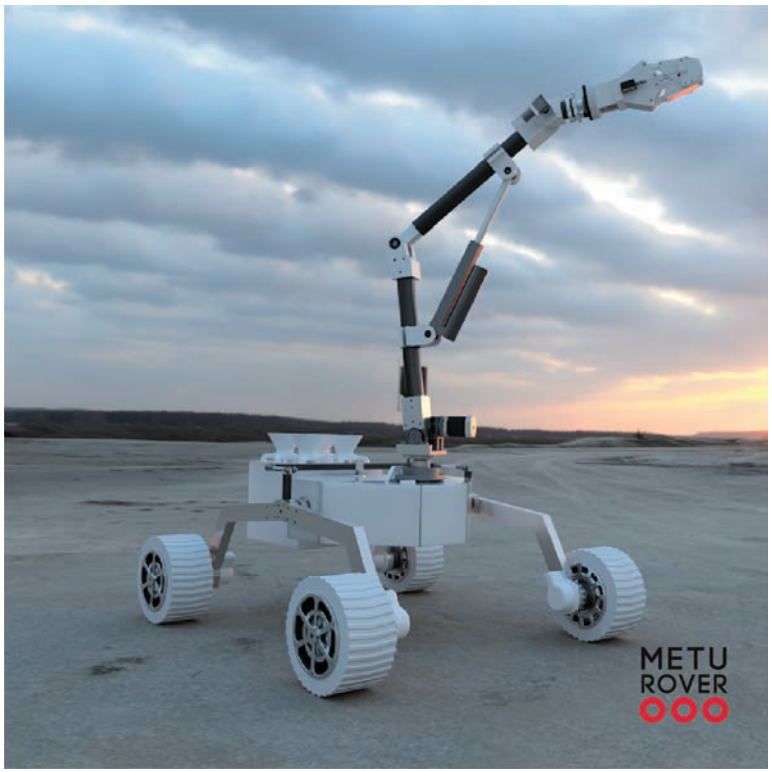
Field of Research: Robotics, Space Exploration

Project Team Members: Barış Özcan, Zeynep Neslişah Yılmaz, Yusuf Onat Yılmaz, Abdülkadir Sarıtepe, Berk Ünlü, Kaan Dere, Mahmut Bahadır Özbek, Taha Tolga Saadet, Evren Uçar, Alper Karasuer, Parnian Rastkar Abbasalizadeh, Onur Karakoç, Özgür Şanlı, Umut Akkaya, Alev Ayaz, Aysima Beril Baydar, İlayda Ayyıldız, Bartu Yaman, Aysima Beril Baydar, Zehra Nur Erol & Eren Aktaş

Project Supervisor: Assoc. Prof. A. Buğra Koku, PhD.

Abstract:

In the METU ROVER project, a planetary exploration vehicle that has the capability of taking soil samples and analyzing samples onboard, performing maintenance operations on an electric panel, geo-locating and navigating autonomously, collecting, and delivering predefined objects from the ground is to be designed and manufactured. The workload is divided into five sub-teams regarding the field of study of the competition tasks and interdisciplinary work is achieved through cooperative work of sub-teams. The project team aims to compete in international rover challenges held in various countries to create opportunities to work on robotics and space exploration in our country and university.



METU ROVER

Name of the Project: Parametric Aerodynamic Analyses and Design of a Jet Aircraft by using Panel Method

Field of Research: Computational Aerodynamics

Project Team Members: Fatma Zülal Kumser, Pamir Kıldiş & Ümran Öztürk

Project Supervisor: Assoc. Prof. Nilay Sezer Uzol, PhD.

Abstract:

Fast and parametrical aerodynamic analyses for design of high-speed jet aircraft is important especially during the initial design phases. In this study, different wing/body configurations designed with specific geometrical parameters for a jet aircraft are analyzed by using the panel method solver PANAIR. The analysis and design process are automated for the geometry and panel mesh generation and by using the Design of Experiment methodology. The aerodynamic analysis and design study are performed for different flow conditions, i.e., ranges of Mach number and angle of attack, for given design requirements, starting from a representative fighter aircraft geometry similar to F-16. Various geometrical design parameters are selected and their effects on the aerodynamic performance are investigated through Response Surface Methodology.

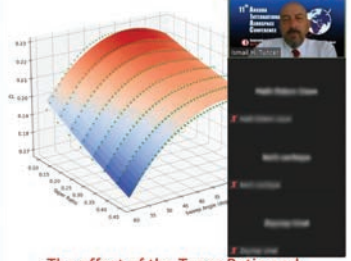
FAST AERODYNAMIC ANALYSIS AND DESIGN OF A JET AIRCRAFT BY USING PANEL METHOD

Results

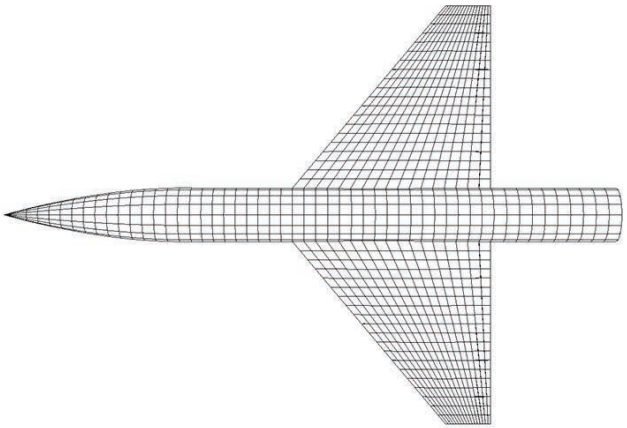
- Design of Experiment (DoE) & Design Space & Response Surface

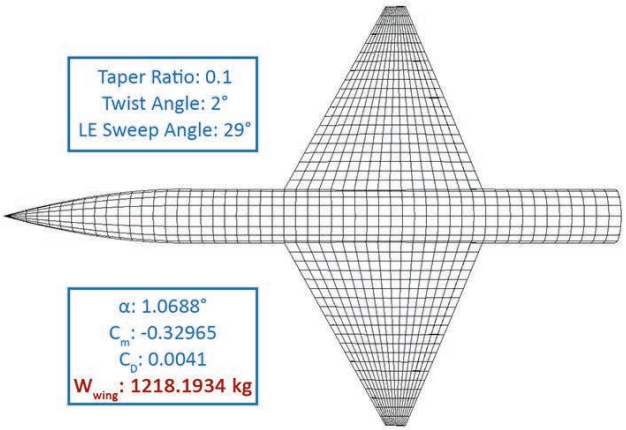
Example Results from PanAUTO

Test	Mach	Alpha	LE Sweep	Twist	Taper	Weight	C_L	C_{La}	C_M	C_{Ma}	Cdi	CL_{err} (%)
1	0.6	3.7185	20	-5	0.1	1241.771	0.20002	3.593	-0.30325	-5.0718	0.00373	0.01
2	0.6	3.7215	21	-5	0.1	1236.899	0.20002	3.5833	-0.30485	-5.0913	0.00369	0.01
3	0.6	3.7112	22	-5	0.1	1232.527	0.20002	3.5844	-0.30684	-5.1326	0.00367	0.01
4	0.6	3.7013	23	-5	0.1	1228.678	0.20002	3.585	-0.30885	-5.1744	0.00364	0.01
5	0.6	3.6921	24	-5	0.1	1225.378	0.20002	3.5856	-0.3109	-5.2156	0.00362	0.01
...	...	...	...	...	...	...	...	...	...	...	...	...
381	0.6	3.1361	31	-4	0.2	1335.221	0.20002	3.7053	-0.33248	-5.7462	0.00301	0.01
382	0.6	3.1358	32	-4	0.2	1341.461	0.20002	3.6973	-0.33489	-5.7834	0.00301	0.01
383	0.6	3.1367	33	-4	0.2	1348.733	0.20001	3.6881	-0.33735	-5.8201	0.003	0.005
384	0.6	3.1385	34	-4	0.2	1357.097	0.20001	3.6778	-0.33987	-5.8556	0.003	0.005
385	0.6	3.1414	35	-4	0.2	1366.617	0.20001	3.6664	-0.34245	-5.8911	0.003	0.005
...	...	...	...	...	...	...	...	...	...	...	...	...
718	0.6	3.0999	40	-4	0.3	1598.414	0.20002	3.6772	-0.36103	-6.224	0.00279	0.01
719	0.6	3.1149	41	-4	0.3	1621.332	0.20001	3.6549	-0.36401	-6.2504	0.0028	0.005
720	0.6	3.1316	42	-4	0.3	1646.167	0.20002	3.632	-0.3671	-6.275	0.00282	0.01
721	0.6	3.1516	43	-4	0.3	1673.044	0.20002	3.6056	-0.37024	-6.2957	0.00283	0.01
722	0.6	3.1706	44	-4	0.3	1702.101	0.20003	3.581	-0.37356	-6.3197	0.00285	0.015



The effect of the Taper Ratio and Sweep Angle on Lift Coefficient





Taper Ratio: 0.1
Twist Angle: 2°
LE Sweep Angle: 29°

α: 1.0688°
C_m: -0.32965
C_D: 0.0041
W_{wing}: 1218.1934 kg

Parametric Aerodynamic Analyses and Design of a Jet Aircraft by using Panel Method

Name of the Project: Aerodynamic Analysis of Flow over Aircraft Geometries by using PANAIR Supersonic Panel Method Solver

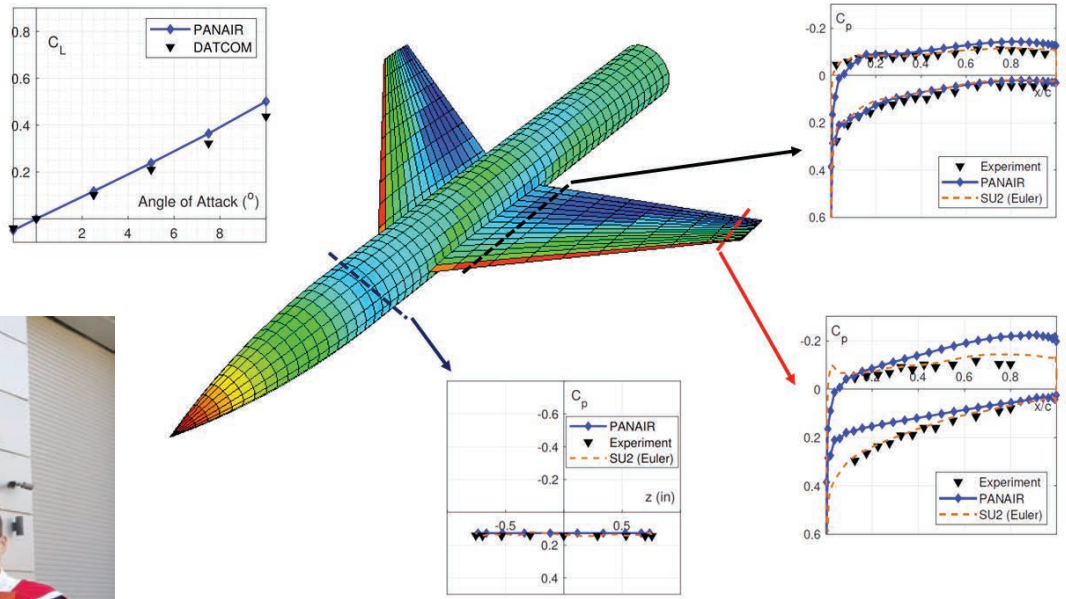
Field of Research: Computational Aerodynamics

Project Team Members: Levent Uğur, Sena Turan & Ramazan Kürşat Gedik

Project Supervisor: Assoc. Prof. Nilay Sezer Uzol, PhD.

Abstract:

In this study, the aerodynamic properties of a selected aircraft geometry are calculated in supersonic flow condition using PANAIR. PANAIR is an open-source high-order panel method solver for irrotational and inviscid flows and it is more efficient than higher fidelity CFD analyses for the preliminary design process since it is faster and easier to use. A batch of supersonic analyses is completed for a sweptback wing, a cylindrical body and a wing/body geometry is considered, and the analyses are performed using PANAIR for compressible flow solutions at supersonic condition of M = 2.01 and with various panel grids, and the results are compared with the experimental data. Different nose configurations are also considered separately to observe the effect of geometry to the prediction accuracy of PANAIR. Moreover, a Class-Shape Transformation (CST) code is also developed to create wing and nose geometries together with the surface panel mesh with parametrization. In addition, SU2 and DATCOM software are used to compare the computational results.



Aerodynamic Analysis of Flow over Aircraft Geometries by using PANAIR Supersonic Panel Method Solver

Name of the Project: Model Satellite "Simulation of a Space Mission"

Field of Research: Space Technologies

Project Team Members: Emine Nur Yakın, Ataberk Öklü, Ezgi Sena Karabacak,

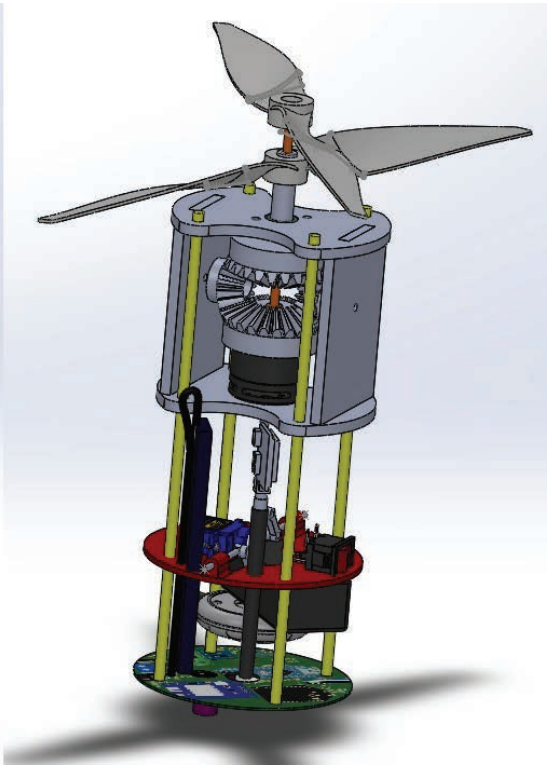
Tan Çağatay Acar, Ayşe İrem Akyıldız, Egemen İlikmen, Deniz Cenk Temel,

Oğuz Kaan Gürbüz, Yağız Güzelcan, Alper Sosyal, Elif Ünel, Serhat Çelik & Elif Topaloğlu

Project Supervisor: Prof. Erhan İlhan Konukseven, PhD.

Abstract:

In this project we designed a small sized model of a satellite. Our goal was modelling a landing mission, with both active and passive landing methods. The project has three subsystems which are electronics, mechanics and ground station control. In mechanics part, we worked on the most efficient design that can resist to external obstacles. In electronics and software, we produced a circuit board. The electronics system provided us to gather scientific data from the environment. We also developed a communication system, to send the scientific data to ground station for further analyze. By the communication system, we also had a chance to send commands to mission payload from ground station. In ground station control team, we developed a software to have a continuous communication with the model satellite. Through our ground station software; we gathered data from the mission payload and visualize them to analyze and make inferences.



Model Satellite “Simulation of a Space Mission”

Name of the Project: The Effects of Mutually Opposing Forces on Propulsion of Underwater Vehicles

Field of Research: Bioinspired Robotics

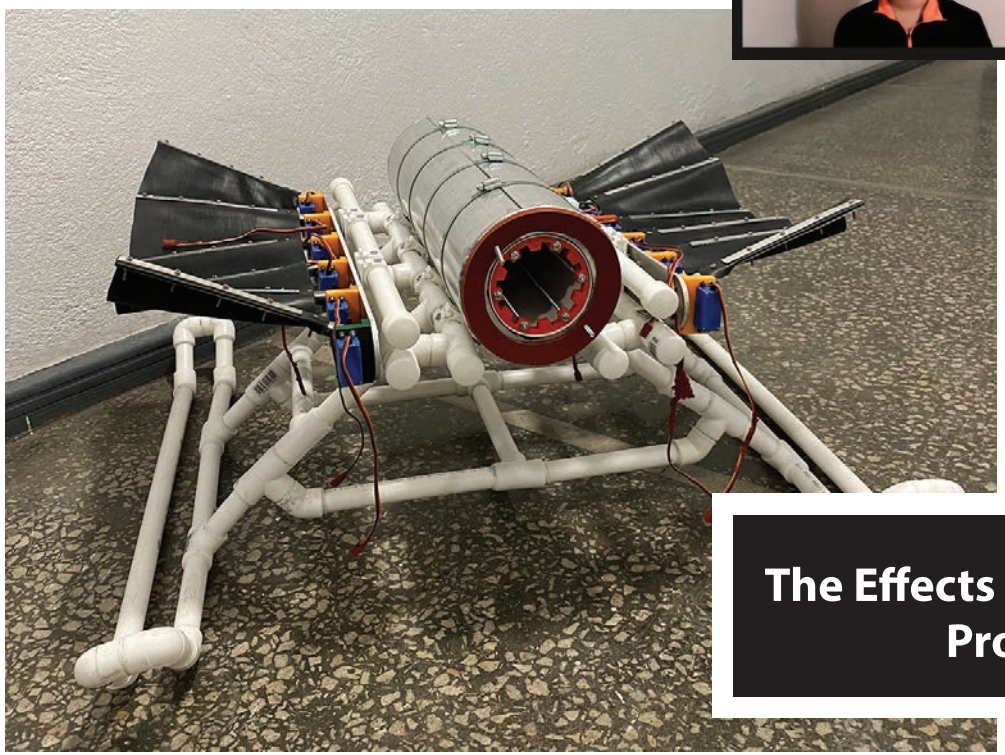
Project Team Members: Atakan Durmaz, Merve Nur Zembil, Berkay Kılıç, Bengisu Deniz,

Enes Ata Ünsal & Demet Tangolar

Project Supervisor: Asst. Prof. Mustafa Mert Ankaralı, PhD.

Abstract:

In this project, it is aimed to examine the effect of mutually opposing forces on propulsion of underwater vehicles. Moreover, a robot, which can perform simple but time-consuming tasks hard to perform by divers, will set an example for academic resources in our country. This robot will also be a security system for solo divers, which will protect the distance with the diver and give alarm to surface in an emergency case. Nautilius, whose mechanical structure is found out, is expected to become more autonomous with mapping and object avoidance techniques soon.



The Effects of Mutually Opposing Forces on Propulsion of Underwater Vehicles

Name of the Project: Alternative Energy Vehicle "Steel-Core Radial Flux Electric Motor"

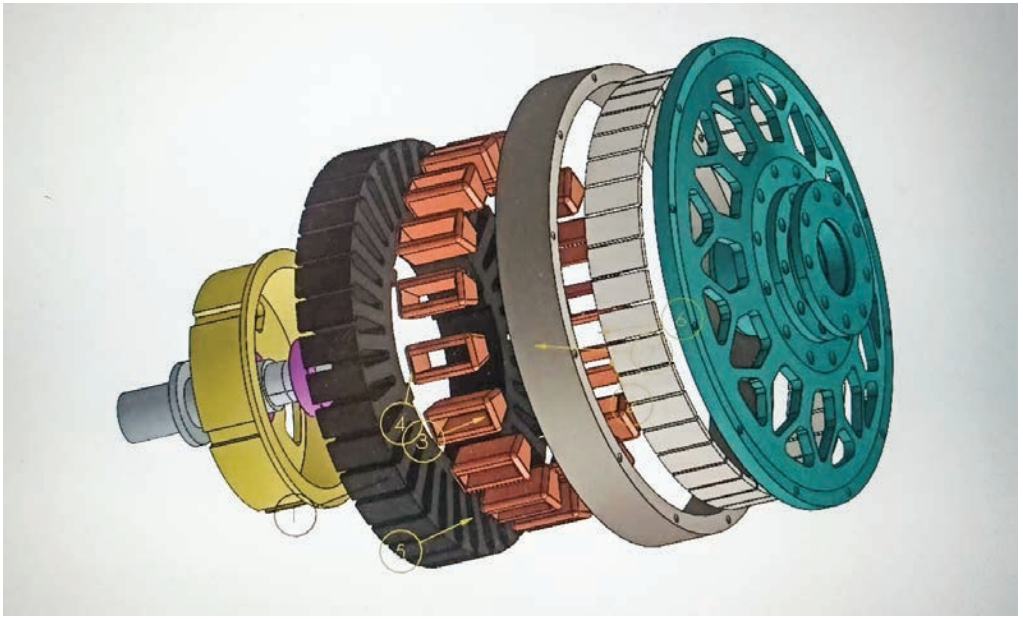
Field of Research: Motor Design for Electric Cars

Project Team Members: Serkan Can, Ufuk Can Karataş, Emre Dağ, Yalın Şahin, Faruk Öztürk, Mert Canbolat, Ege Dağıstan, Aleyna Yıldırır, Altuğ Aktepe, Mustafa Emir Şimşek, Abay Tekkol, Derya Yılmaz, Mustafa Mert Özgel, Elif Topaloğlu & Tomris İlkim Doğan

Project Supervisor: Prof. Erhan İlhan Konukseven, PhD.

Abstract:

METU-CET has been designing and producing Alternative Energy Cars and systems for their cars since 2005. Electric cars are becoming popular, and they need more efficient systems to sustain more range with less energy consumption. Electric motors have been used for higher efficiency. Steel-Core radial flux hub motor type is one of them. It consists of a case that works like a cover, a rotor which rotates and produces torque, a stator with electric coils at the ends, bearings which reduce friction and increase efficiency, and a shaft that makes it possible to hold the motor stable. We designed and produced this motor and took part in TÜBİTAK Efficiency Challenge'21.



Alternative Energy Vehicle "Steel-Core Radial Flux Electric Motor"

Name of the Project: Photovoltaic Industry Waste as a Sustainable Source of High Capacity Li- ion Battery Anodes

Field of Research: Energy Storage

Project Team Members: Mehmet Nevzat Duman

Project Supervisor: Prof. Mehmet Kadri Aydınol, PhD.

Abstract:

Lithium-ion batteries have come a long way since they were invented, and thanks to this technology, portable electronic devices, and electric vehicles have become widespread. Nonetheless, currently used electrode materials have approached their limits and active materials with higher energy density are needed, especially for the future of electric vehicles. On the anode side, silicon is considered as a most promising alternative, since it has ten times higher theoretical capacity compared to graphite, the existing anode material. However, the commercialization of Si is hampered by the high cost of battery-grade Si and pulverization of the electrode due to substantial volume fluctuations (300 %), resulting in poor cycle stability during discharge and charge. In this work, the adoption of photovoltaic industry waste-derived silicon is investigated as a low-cost and high-quality anode active material for Li-ion batteries.

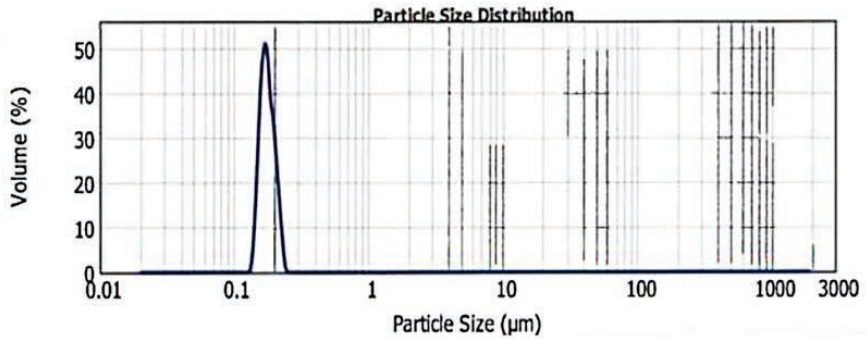


Figure 1 - Particle Size Distribution of Recycled Si

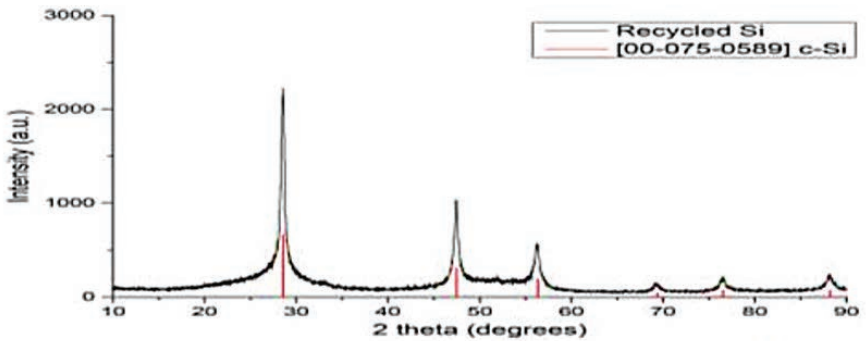


Figure 2 - XRD spectrums of the waste derived and c-Si.

Photovoltaic Industry Waste as a Sustainable Source of High Capacity Li- ion Battery Anodes

Name of the Project: The Upcycling of Waste Fried Oils

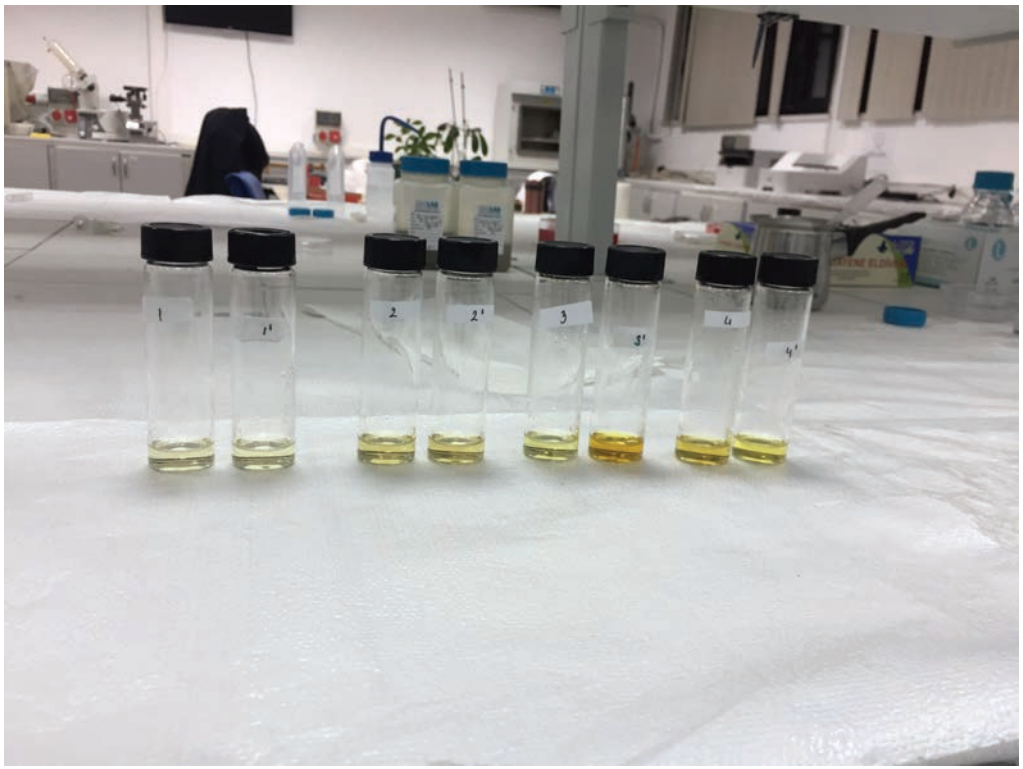
Field of Research: Sustainability, Organic Chemistry

Project Team Members: Duygu İnce, Ecem Baskın, Melda Öcalan & Anıl Yılmazkan

Project Supervisor: Asst. Prof. Simge Çınar Aygün, PhD.

Abstract:

Waste frying oils pollute the soil, cause the sewage to clog, cover the water's surface in which living things live, and 1 liter of waste oil pollute thousands of liters of drinking water. With the motivation to live in an ecologically sustainable METU campus we aim to upcycle of the waste oils collected from campus kitchens to the environmentally friendly, non-toxic soaps that can be used for campus cleaning. To this end, waste frying oil samples were collected from different cafes/restaurants on the METU campus and domestic oils used for cooking different foods. The oil samples were analyzed to detect carcinogenic substances using the TBARS technique. Then, saponification procedure was carried out. Completion of this reaction were determined based on pH measurements and FTIR Spectroscopy analysis. As a result, all waste oil samples collected from variety of resources can be successfully upcycled to soap that can be used for cleaning purposes.



The Upcycling of Waste Fried Oils

Name of the Project: Investigation and Optimization of Parameters Affecting the Coating on Mg for Aircraft Structures to Protect Corrosion

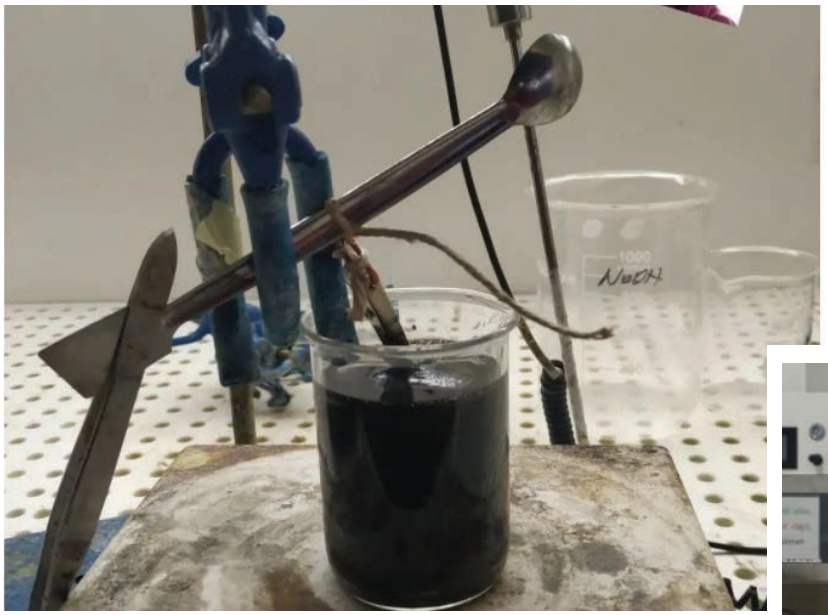
Field of Research: Electrochemistry, Electrodeposition, Corrosion

Project Team Members: Ezgi Demir & Seda Kartal

Project Supervisor: Prof. İshak Karakaya, PhD.

Abstract:

Magnesium is the lightest metal with 1.7 g/cm3 density, and it is suitable for producing aircraft structure with its other material properties. However, it has very low oxidation resistance. In this project, blocking all oxidation reaction on the magnesium surface is targeted with coating the other light material with 0.44 g/cm3, graphene oxide. In this study, Mg coated with Graphene Oxide by electrodeposition method. Then, corrosion tests will be done. If we manage to succeed to block corrosion, average weight of an airplane will decrease with amount of 1 ton. So, the lightest aircraft structure will be obtained.



Investigation and Optimization of Parameters Affecting the Coating on Mg for Aircraft Structures to Protect Against Corrosion

Name of the Project: Project Leviathan

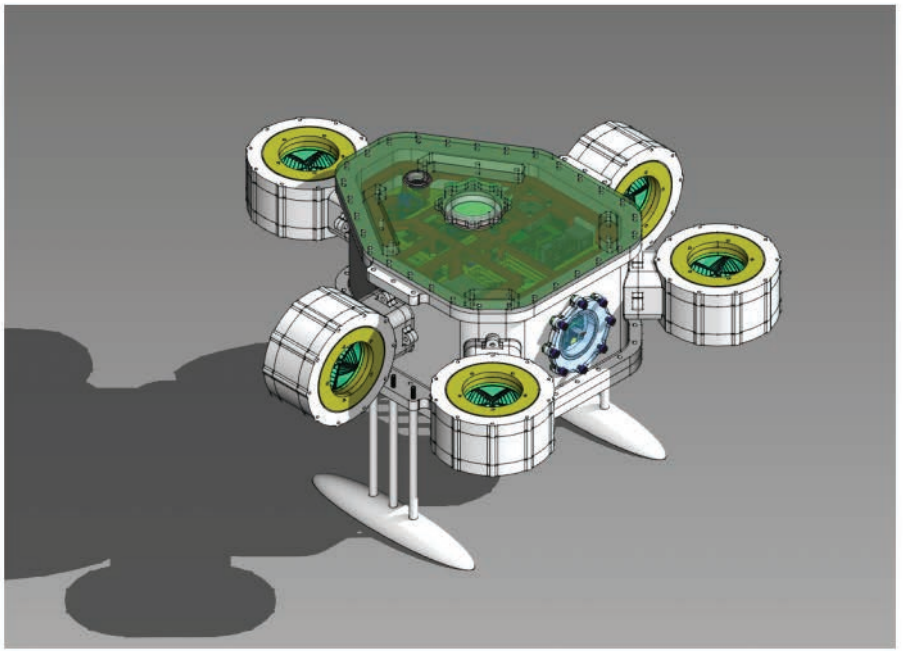
Field of Research: Mekatronik

Project Team Members: Aysu Balamutcu, Berkay Çağlı, Ege Hacışahinoğlu, Bora Hekimoğlu, Emir Taylan Karakaş & Pelin Turan

Project Supervisor: Assoc. Prof. Batur Ercan, PhD.

Abstract:

The aim of "Project Leviathan" was to create an easy to manufacture autonomous underwater vehicle that has a goal of achieving underwater tasks that are relatively difficult to accomplish with pure manpower such as underwater server inspection, oil rig and bridge pillar control. In order to achieve this manufacturing ease, highly available home production methods like 3D printing, single sided PCB manufacturing, highly sustainable surface treatment methods and easy assembly techniques were used. Besides these, open source softwares like OpenCV library, Python and C++ programming languages and open source hardware like Arduino Nano are used for the controlling and processing systems. At the end, we expect to maximise occupational safety and minimise expenses.



Project Leviathan

Name of the Project: Fabrication of Ag/AgCl Reference Electrodes for Suspensions

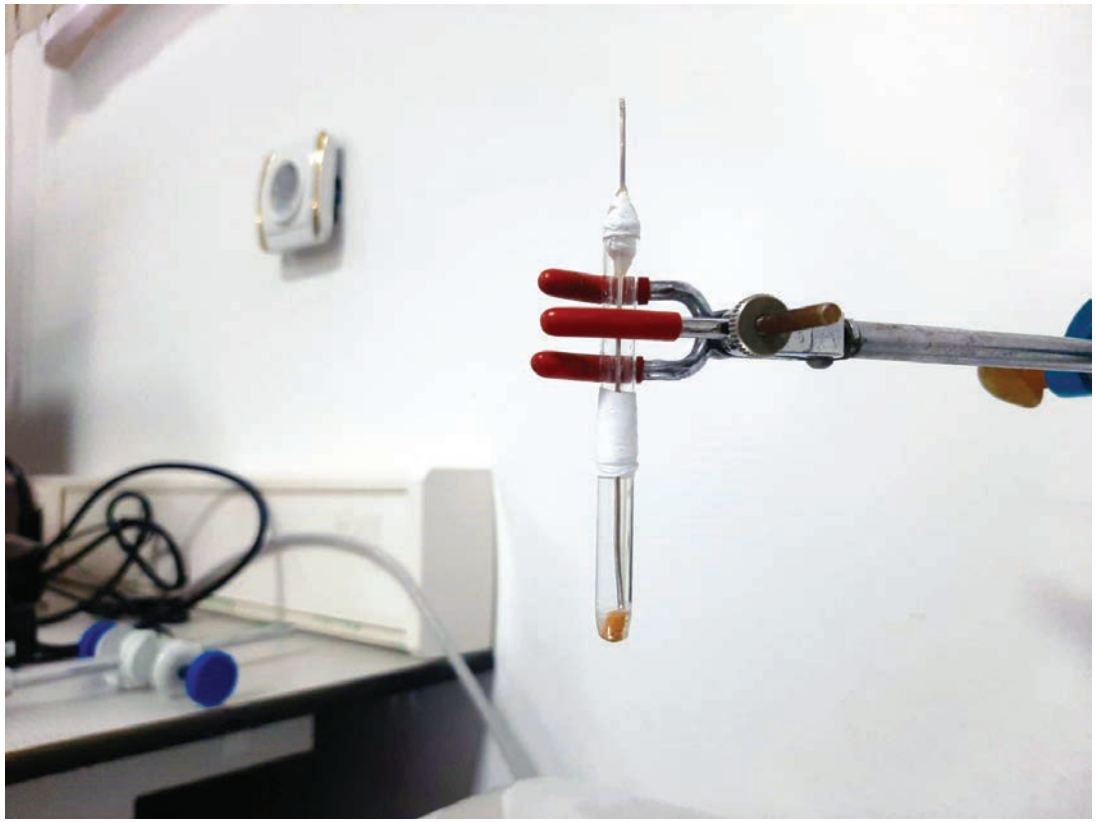
Field of Research: Electrochemistry (Reference Electrodes)

Project Team Members: Müge Damla Numanoğlu & Ekin Kurşun

Project Supervisor: Asst. Prof. Simge Çınar Aygün, PhD.

Abstract:

In this project, we aim to fabricate Ag/AgCl reference electrode that is convenient to be used in electrochemical characterization of suspension electrodes in three electrode cell configuration. Stability and maintenance of reference electrode is a big concern while using in suspension electrode characterization since the particles in the electrolyte may plug the pores in the frit or even penetrate through it into the reference electrolyte. The commercial reference electrodes are very expensive and not suggested to be used in suspension electrode set-up. Using a molecular sieve instead of a glass frit that allows controlled ion exchange and fabricating a cost-effective reference electrode relatively with ease are achieved. The performance of the fabricate electrode tested and the results were found comparable with the commercial ones.



Fabrication of Ag/AgCl Reference Electrodes for Suspensions

Name of the Project: Synthesis of Hydroxyapatite/Sericin/Calcium Carbonate Nanoparticles for Drug Detoxification Purposes

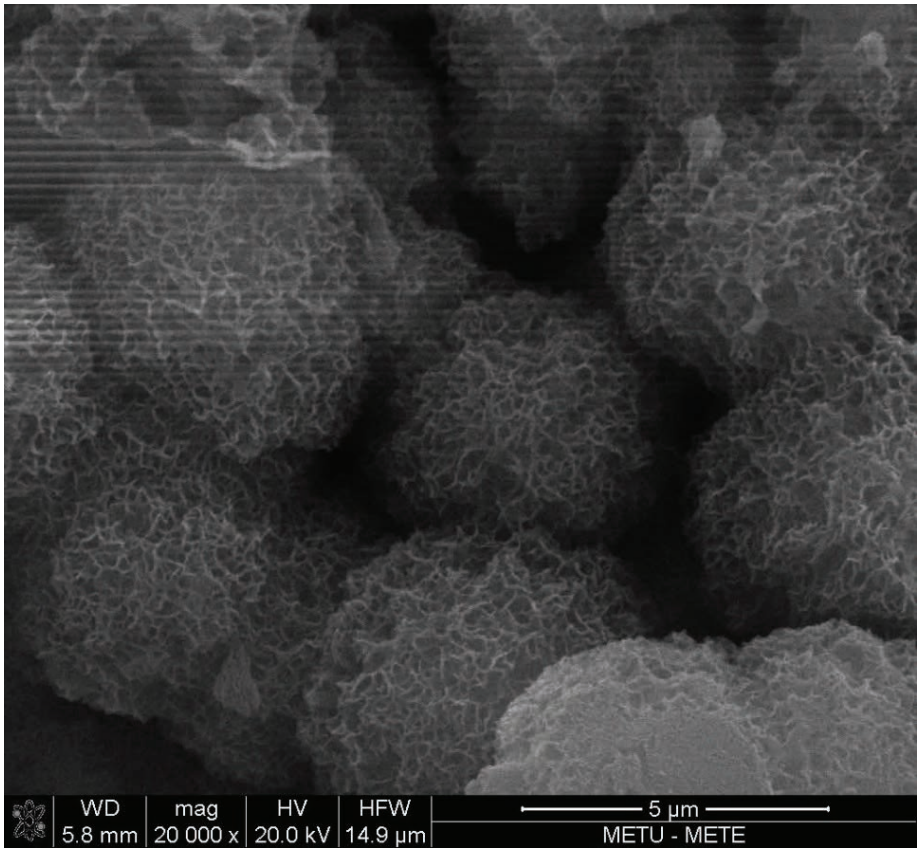
Field of Research: Nanotechnology

Project Team Members: Arda Çalışkan

Project Supervisor: Assoc. Prof. Batur Ercan, PhD.

Abstract:

Drug overdoses are one of the most common forms of deliberate self-harm or accidental death. Treatment of drug overdoses mainly relies on decreasing the body load of the toxic material, yet, current treatment methods are not efficient enough to cleanse molecules with high volume distribution and high protein binding affinity. In this study, Hydroxyapatite-Sericin micro/nanoparticles are synthesized and planned to use for eliminating the drugs in the bloodstream by adsorbing them to their surfaces. Sericin is a protein that makes up 20% of the cocoons of bombyx mori. It contains many polar groups that are strongly charged, which lets it form very strong connections with other molecules; consequently, it is highly adsorbent. However, it is not very stable in biological environments. Hydroxyapatite particles provide a stable medium to sericin molecules and a highly porous surface. Initially, $CaCO_3$ particles are synthesized in the presence of Sericin at different concentrations and utilized as solid templates to synthesize and control the morphology of Hydroxyapatite particles. Later, the adsorbing capacity and biosafety of these particles will be tested.



Synthesis of Hydroxyapatite/Sericin/Calcium Carbonate Nanoparticles for Drug Detoxification Purposes

Name of the Project: Molecular Modeling Studies on the Conducting Polymer-Graphene Nanocomposites

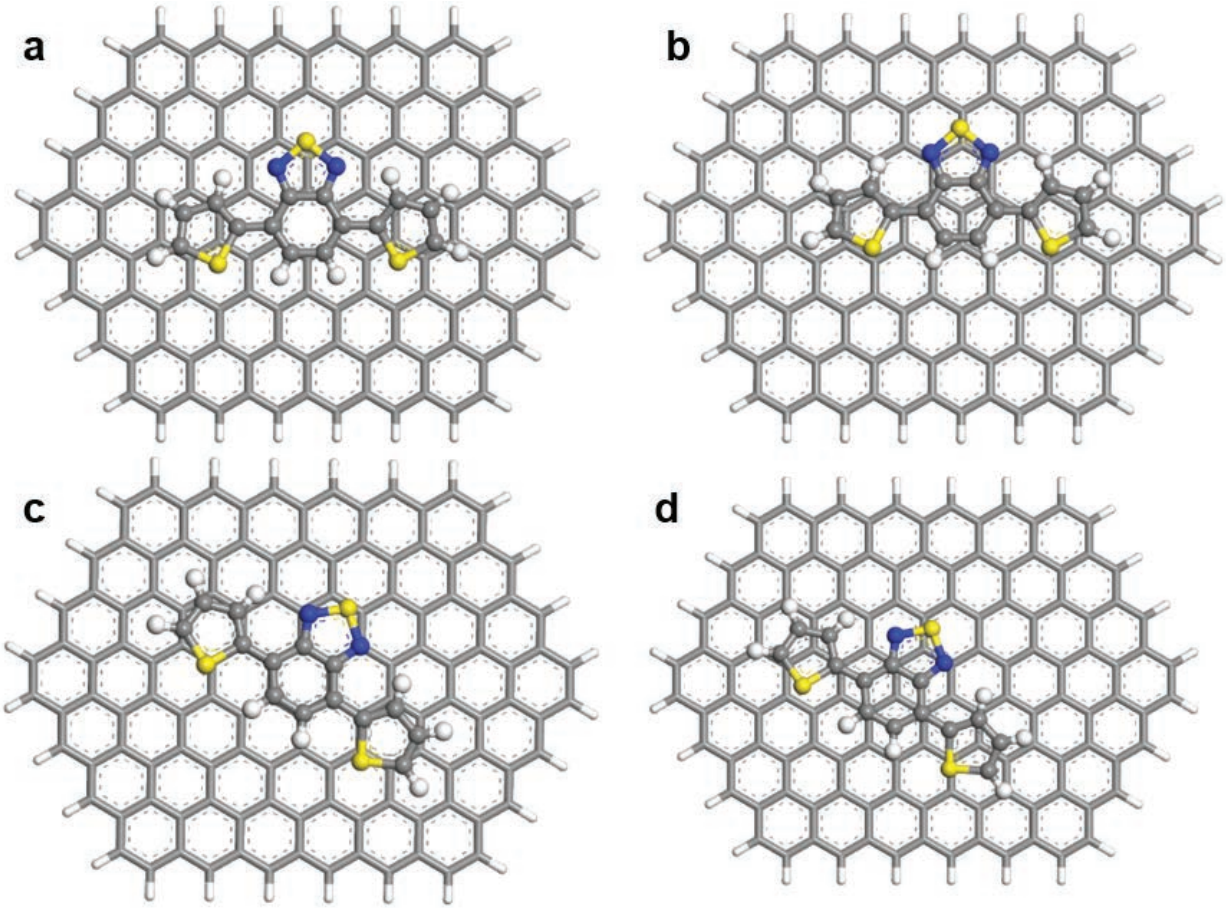
Field of Research: Materials for Energy Applications

Project Team Members: Servin Çağıl Ulusay

Project Supervisor: Asst. Prof. Erol Yıldırım, PhD

Abstract:

Different acceptor units with thiophene end group were positioned onto the graphene surface with four different initial configurations given in the Figure. These copolymers were selected mainly from novel benzothiadiazole (BT) and quinoxaline (QA) derivatives. Interaction energies and configurational preferences between graphene-conductive polymer interfaces were determined by using DFT methods. Our results showed that interaction at the interface is increased with the aromaticity and electron delocalization of the acceptor unit. Larger planar units with more aromatic rings result in the stronger interaction with graphene surface. These interactions are still weaker than graphene-graphene self-interaction and we can expect phase separations in the nanocomposites. We demonstrated that donor-acceptor type structures mostly prefer to align on the armchair direction on the graphene surface.



Molecular Modeling Studies on the Conducting Polymer-Graphene Nanocomposites

Name of the Project: Designing Low-power, Low-cost and Robust LoRa Based Wireless Communication Unit to Enhance Smart Agriculture

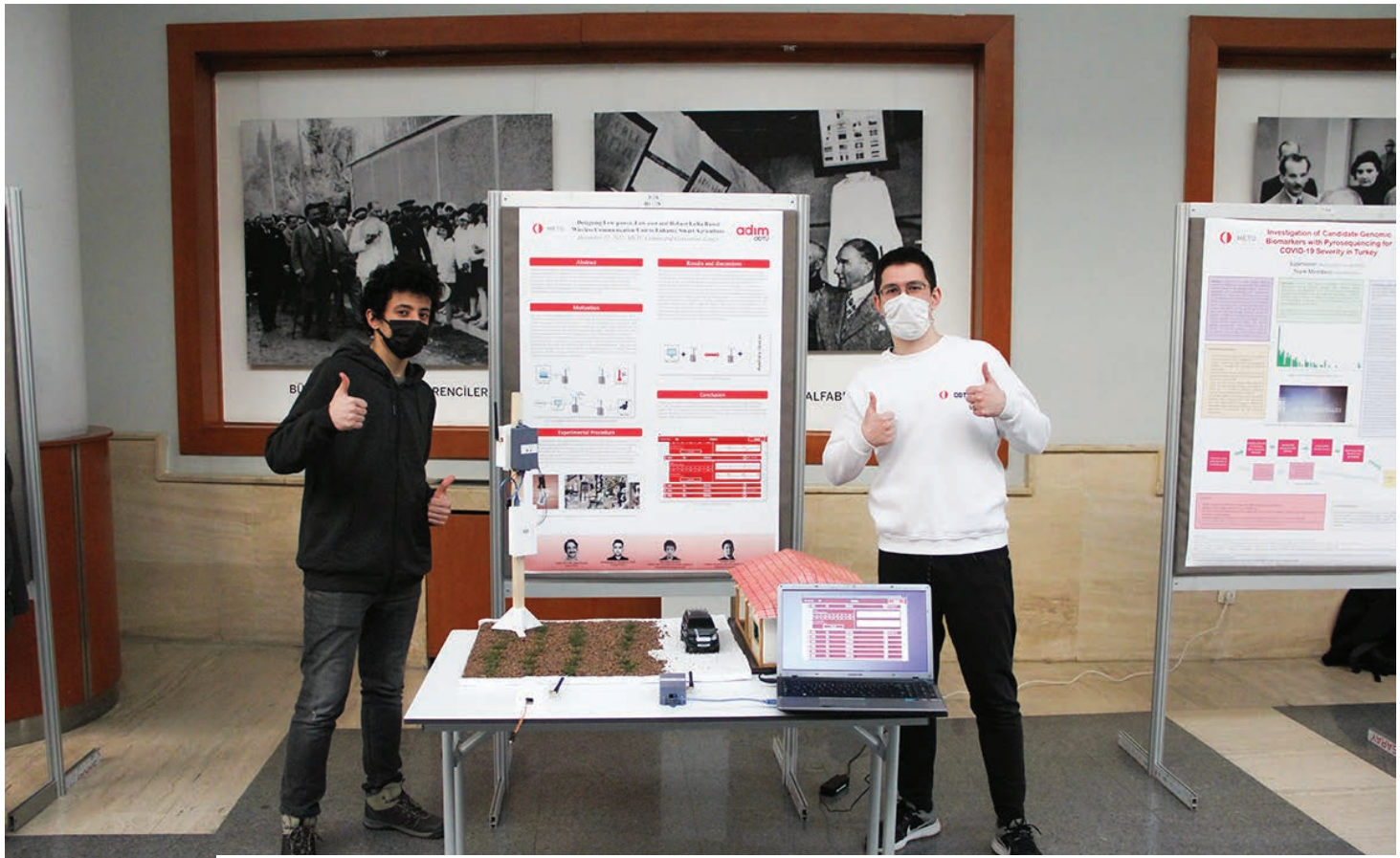
Field of Research: : IoT, Smart Agriculture, Microgrid

Project Team Members: Erdem Canaz, Işık Emir Altunkol & Mohammad Hossein Mokhtare

Project Supervisor: Asst. Prof. Ozan Keysan, PhD

Abstract:

Farmers may manually collect data and merge it with the available information to achieve higher profitability and efficient use of resources of an agricultural production. However, a relatively complex and expensive infrastructure is needed to automate this process. This complexity and cost are likely to cause small scale farmers to not perform precision agriculture. Hence, In this project, we demonstrated a scaleable, off-the-shelf and affordable prototype empowered by LoRa technology that enables farmers to continuously monitor the environmental data and take actions if needed.



Designing Low-power, Low-cost and Robust LoRa Based Wireless Communication Unit to Enhance Smart Agriculture

Name of the Project: CS-Trust2vec: Context-Sensitive Trust Network Embedding Model

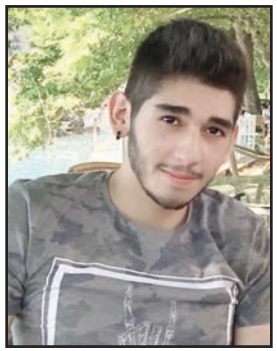
Field of Research: Social Network Analysis, Computational Trust

Project Team Members: Onat Özdemir

Project Supervisors: Prof. Pınar Karagöz, PhD. & Prof. İsmail Hakkı Toroslu, PhD.

Abstract:

Trust network embedding is a network modeling task aiming to map nodes in social trust networks to low dimensional vector space. Although there are trust network embedding models proposed in the literature, these models focus on the structural properties of the trust networks and disregard additional supportive information such as the context of trust. Context-specificity is an often-mentioned property of trust, and it has been studied well in sociological and psychological terms. However, it has not been elaborated on within computational trust modeling. In this paper, we propose a novel trust network embedding model (CS-Trust2Vec) that integrates the context information into the embedding process. Due to the lack of a dataset containing contextual information, we created a context-labeled trust network dataset by crawling a social media platform. We validate the efficiency and accuracy of our model on the link prediction task using the dataset.



CS-Trust2vec: Context-Sensitive Trust Network Embedding Model

Name of the Project: Field Teams Coordination for Earthquake Damaged Distribution System Restoration

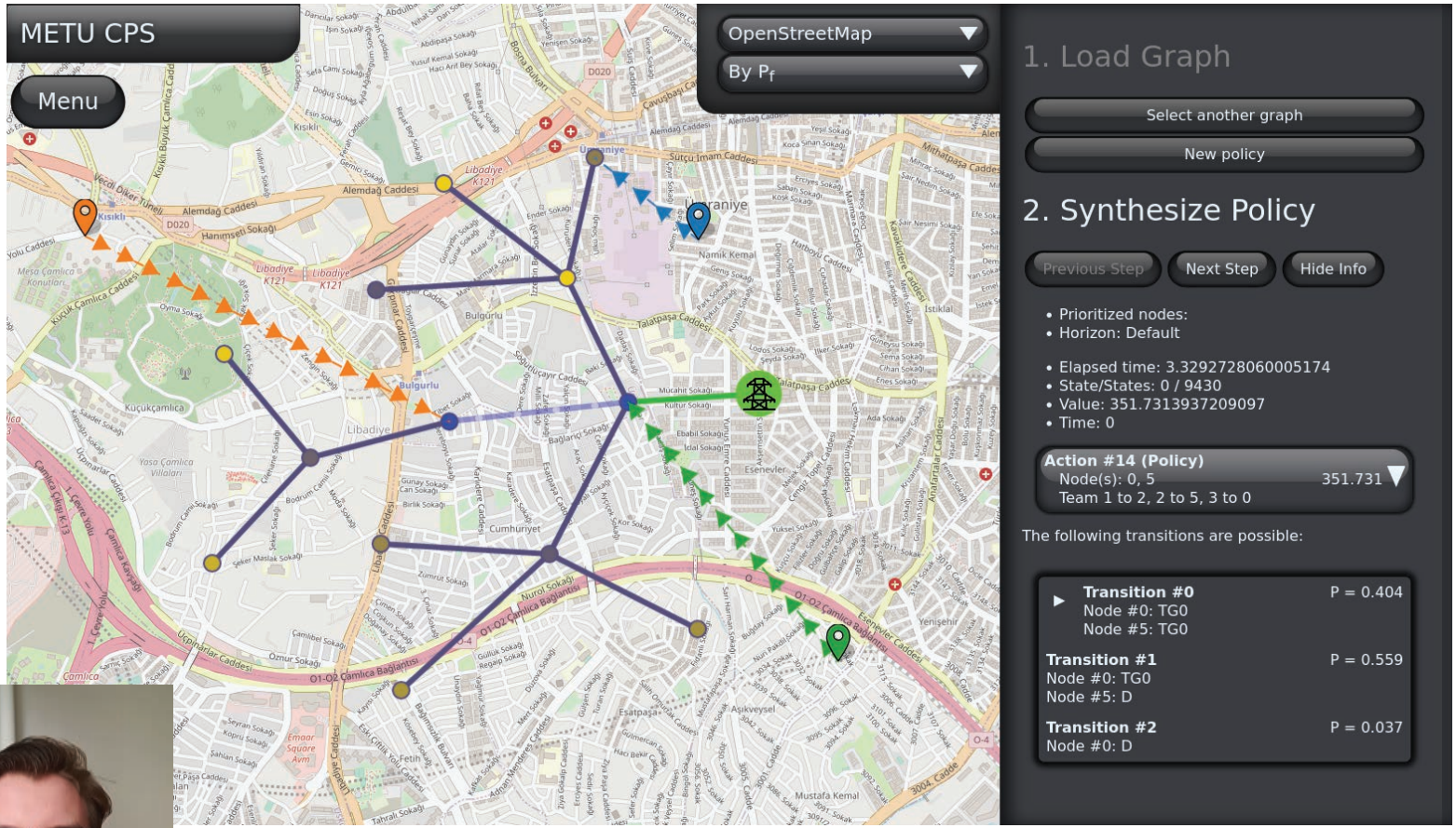
Field of Research: Cyber-Physical Systems

Project Team Members: İlker Işık

Project Supervisor: Asst.Prof. Ebru Aydın Göl, PhD.

Abstract:

Since most modern infrastructure systems rely heavily on the presence of electricity, the restoration of electrical distribution systems in a post-disaster scenario is of grave importance. Hence, we introduce a method to coordinate the field teams for the optimal restoration of an electrical distribution system. The proposed method utilizes a Markov Decision Process (MDP) to create an optimal restoration strategy, which aims to minimize the expected time to restore each distribution system component. The travel duration of each team and the possible outcomes of the distribution system are considered in all state transitions. The failure probabilities of the system components are computed using the fragility curves of structures and the Peak Ground Acceleration (PGA) values. Furthermore, the proposed solution offers several methods to determine the non-optimal actions during the construction of the MDP and eliminate them, in order to improve the run-time performance without sacrificing the optimality of the solution.



Field Teams Coordination for Earthquake Damaged Distribution System Restoration

Name of the Project: QRegister

Field of Research: Sustainability

Project Team Members: Humeyra Bodur, Alkım Dömeke & Deniz Karakay

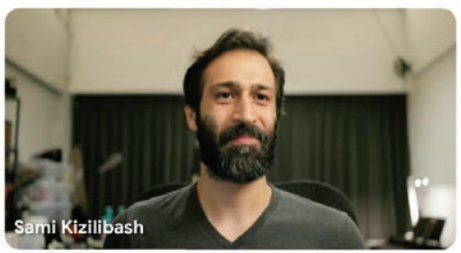
Project Supervisor: Asst. Prof. Pelin Angın, PhD.

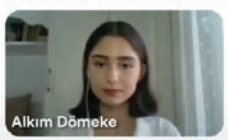
Abstract:

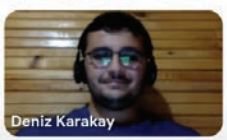
It is well-established that traditional paper receipts cause profound damage to the planet. They are hard to store, keep track of and usually end up as trash. This study aims to develop an environmentally friendly smart register that eliminates paper receipts and stores purchase data. It investigates the fastest and safest ways to send the virtual receipt through QR-codes. Moreover, QRegister is used both by customers and merchants. To test our hypothesis, an online survey was distributed to volunteers across Turkey. Respondents were asked to anonymously answer several questions regarding paper receipt use and its challenges as storage, access, and increased risk of COVID-19. The results verified the hypotheses and showed dissatisfaction with the unnecessary paper use in daily life. These results suggest that a replacement for inconvenient paper receipts that are damaging our planet and health is long overdue. Accordingly, a mobile application paired with a digital screen was developed.

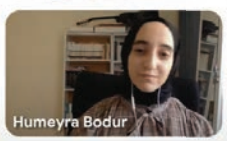

Register
Scan QR
Info
Profile
Register
My Receipts
Today
A101
Yesterday
METRO Lok
2515.26
93.83
Info
Home
Register
ODTÜ
Date: 21.2.2021
Time: 18:7
Cashier: Deniz
Havuç
(2 x 1.50)
Dardanel Ton 2x150g
(3 x 30.00)
%8.0 3.18
Portakal Finike
(2 x 9.99)
%8.0 90.00
Roka
(3 x 4.95)
%8.0 19.98
Total Tax:
%8.0 13.12
Total:
10.10
126.28

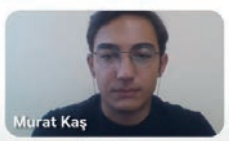

Erica Hanson


Sami Kizilibash


Alkım Dömeke


Deniz Karakay


Humeyra Bodur


Murat Kaş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Solution Challenge
Demo Day
Google Developer Student Clubs

QRegister

Name of the Project: An Ensembled Deep Learning Approach for Flow Field Prediction

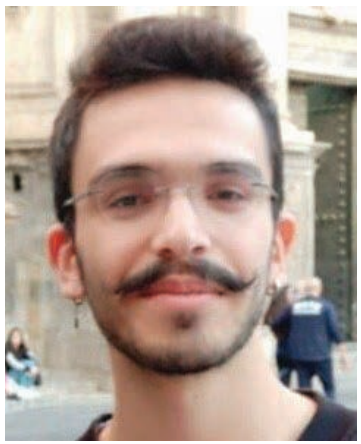
Field of Research: Machine Learning - Physics-Informed Learning - Fluid Mechanics - Aerodynamics - Deep Learning

Project Team Members: Adnan Harun Doğan & Ali Doğan

Project Supervisors: Asst. Prof. Hande Alemdar, PhD. & Asst. Prof. Özgür Uğraş Baran, PhD.

Abstract:

In this paper, a machine-learning-driven method for predicting steady flow fields over the airfoil is presented based on Convolutional Neural Networks (CNN) and Multilayer Perceptron (MLP). The flow field around an airfoil plays a crucial step in aircraft design. In the classical approaches, the Navier-Stokes (NS) equations yield the flow field over an airfoil on a computational mesh with appropriate boundary conditions, known as computational fluid dynamics (CFD) techniques. However, they are computationally sluggish and expensive. Even though several machine-learning-driven models predict flow fields over an airfoil, they suffer from inconsistencies around the surface and high gradient regions. An ensembled CNN-MLP model predicting a flow field of an airfoil is presented. CNN model with physical loss function focuses on solving the prediction errors of the high gradient areas, and MLP model is employed to obtain the flow field of the airfoil around its surface.



An Ensembled Deep Learning Approach for Flow Field Prediction

Name of the Project: A Study on the Job Perception of Angel Investors

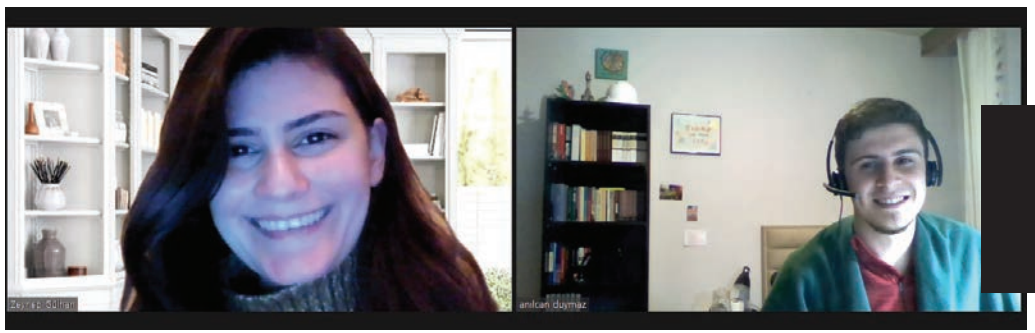
Field of Research: Sociology

Project Team Members: Zeynep Dicle Gülhan & Anılcan Duymaz

Project Supervisor: Prof. H. Sibel Kalaycıoğlu, PhD.

Abstract:

With artificial intelligence and Industry 4.0, job descriptions are also transforming very quickly. Increasing data storage capacity, the data processing power of computers, and wireless digital communication; we are at the starting point of a rapid transformation where robotics and artificial intelligence can be used for very different purposes, as the opportunity to combine with technological innovations increases. Being digitally literate for individuals is an indispensable part of this transformation, and the number of young people who combine their technological skills with a business idea and establish their own start-ups is increasing rapidly. In the later stages of start-ups, various supports can be obtained from our country. One of these sources of support is “angel investors.” In this regard, our aim is to illuminate this significant notion of "angel investment" in Turkey.



A Study on the Job Perception of Angel Investors

Name of the Project: Effect of Auditory Cues on Material Perception of Objects

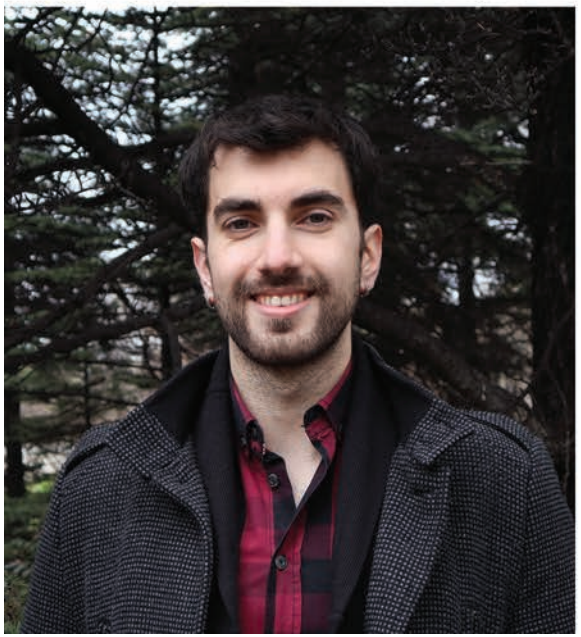
Field of Research: Cognitive Psychology, Material Perception

Project Team Members: Ömer Faruk Yıldıran

Project Supervisor: Asst. Prof. Dicle Nahide Dövencioğlu, PhD.

Abstract:

Material perception is a multisensory process, in which every sensory modality provides diverse information about the material. Parchment Skin Illusion shows that while rubbing our hands and hearing a soft sound would make us feel our skin is soft, but hearing a harsh sound during the same action would make us feel our skin as rough. Present study aims to investigate this illusion on 3D material perception by auditory and haptic cues. Two experiments reported here: Results of first experiment show that perceived material properties from only sound is very similar to perceived properties of haptic material perception with an exception of differences in hard-soft ratings of materials. In the second experiment, the tactile stimuli were given together with congruent and incongruent auditory cues MANOVA results of our findings on the effect of auditory cues on haptic material perception demonstrate that the Parchment Skin Illusion transfers to real-life 3D-objects for some material dimensions.



Effect of Auditory Cues on Material Perception of Objects

Name of the Project: Development of Social Media Trust Scale

Field of Research: Social Psychology

Project Team Members: Hande Hanım Büyüktaş, Beyza Gülzehra Ekinci, Enes Kor & Rümeysa Tosun

Project Supervisor: Prof. Bengi Öner-Özkan, PhD.

Abstract:

Social Media Trust Scale (SMTS) aims to measure the trust in social media, whose usage is rapidly increasing in today's world, and to fill the gap in the literature in this way. To develop reliable and valid SMTS, we reached 274 college students between the ages of 18-58. We found our scale as internally consistent with high Cronbach's Alpha. Convergent validity was not found high and significant which threatened the validity of this scale. On the other hand, discriminant validity and criterion validity results were found to be expected and showed significant validity for our scale. Overall, the newly developed Social Media Trust Scale was found to be a reliable and partially valid tool for assessing trust in social media.

Development of Social Media Trust Scale

Name of the Project: Effect of Haptic Exploratory Procedures on Online Shopping Experience

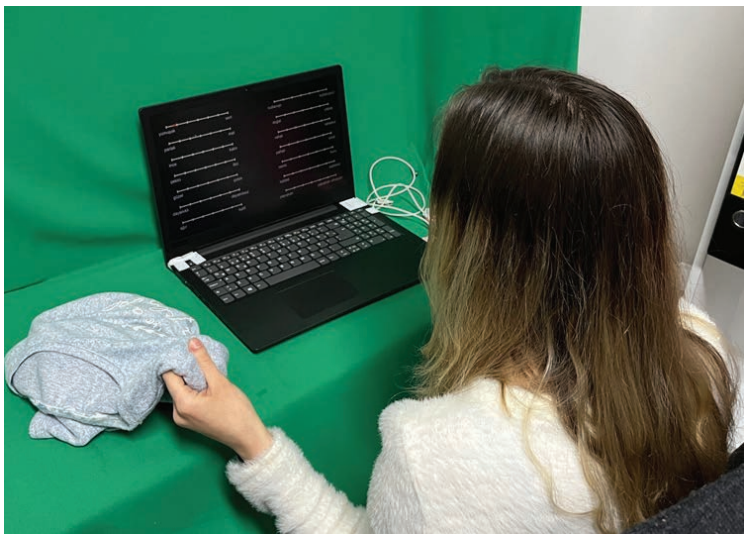
Field of Research: Cognitive Psychology, Haptic Perception

Project Team Members: Fatma Çelebi, Hümeyra Aybüke Bilir & İzel Deniz Vardar

Project Supervisor: Asst. Prof. Dicle Nahide Dövencioğlu, PhD.

Abstract:

Many of us have at least one disappointing online shopping experience, such as, buying a t-shirt online and realizing that it is not as high quality as it. Research shows that perception of material qualities differ for photographs and videos in shiny objects (Dövencioğlu et al., 2013). Similar studies investigated the issue with different materials such as jeans (Cavdan, Drewing, & Doerschner, 2021), or with multiple materials by focusing on the softness dimensions particularly (Kılıç, in publish). These studies found that videos are informative than the photos. But are they as informative as actually touching the object? We wanted to expand the literature by using materials from different categories, to compare two visual stimulation types with haptic stimulation.



Effect of Haptic Exploratory Procedures on Online Shopping Experience

Name of the Project: Student Satisfaction in Online Education

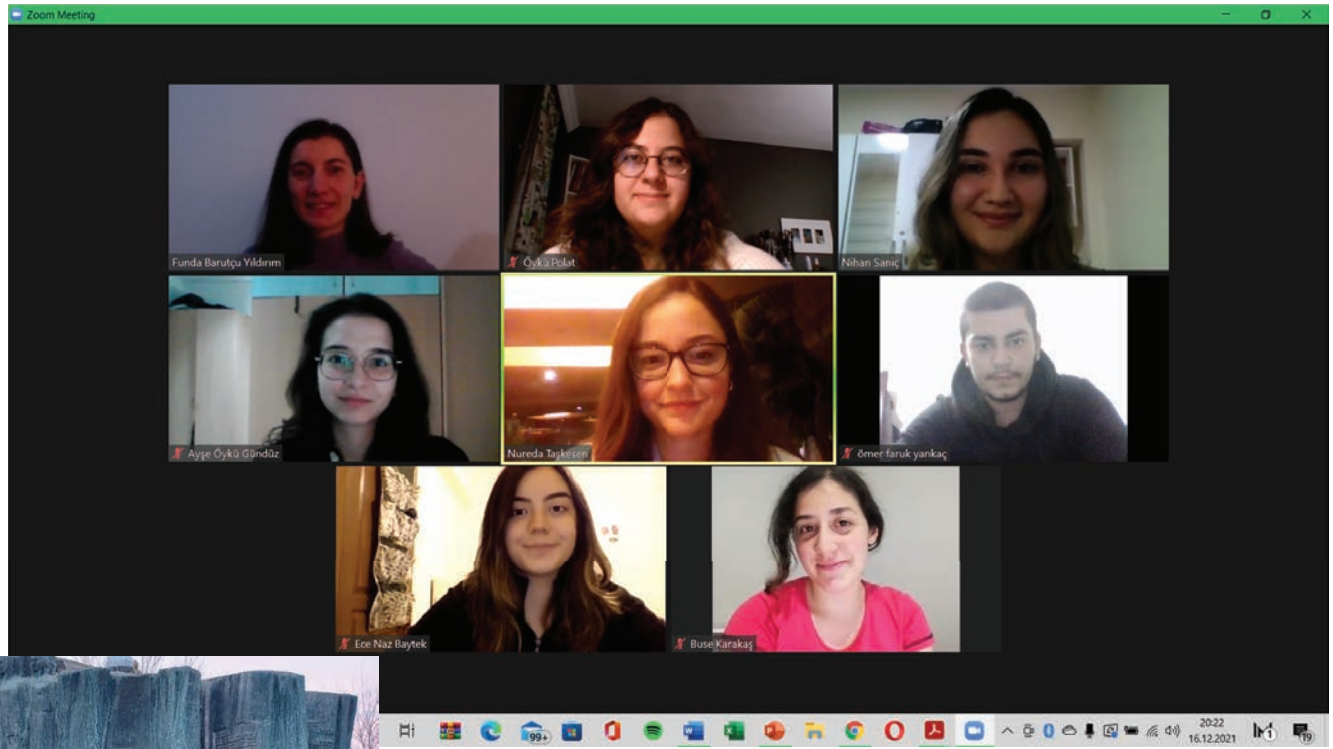
Field of Research: Education

Project Team Members: Öykü Polat, Ayşe Öykü Gündüz, Buse Karakaş, Ece Naz Baytek, Nihan Saniç, Batuhan Cem Sarraf, Ömer Faruk Yankaç, Burak Göç, Beril Sarı, Berkan Demir (Res.Asst.) & Nureda Taşkesen (Res.Asst.)

Project Supervisor: Asst. Prof. Funda Barutçu Yıldırım, PhD.

Abstract:

This project includes two studies. The aim of the first study is to develop and validate a scale to measure university students' satisfaction level in the online education process. The aim of the second study is to measure students' satisfaction levels through the measure that was developed. Furthermore, the relationship among certain demographic variables of the participants (grade, gender, study major), technical opportunities (having adequate data plan, computer, online platforms, etc.), and the online satisfaction level of the students will be investigated during 2021-2022 fall and spring semesters in Middle East Technical University. Convenient sampling methods will be utilized to reach out to 1000 (Study 1: 300, Study 2: 700) METU students. In study 1, exploratory factor analysis (EFA), confirmatory factor analysis (CFA) and reliability analysis will be used to analyze data. In study 2, descriptive analysis and regression analysis will be used.



Student Satisfaction in Online Education

Name of the Project: Effects of Online Education on Language Learning Anxiety and the Place of "Universal Design for Learning" Model in Online Education

Field of Research: Education, Foreign Language Learning, Online Education, Foreign Language Anxiety

Project Team Members: Ali Yıldız, Sema Betül Demirezen & Şevin Kaya

Project Supervisor: Assoc. Prof. Pervin Oya Taneri, PhD

Abstract:

Online education has become the most common way of education during the pandemic. However, both students and teachers have experienced some difficulties while adapting to this unexpected situation. In the literature review, it was seen that learning through online platforms caused language learning anxiety among undergraduate university students. The sources of anxiety that influence the acquisition of certain specific language skills such as reading, writing, listening, speaking, and language knowledge. With this project we plan to reveal whether online education has an effect on the anxiety levels of undergraduate university students in the foreign language preparatory class. If it has, we plan to detect the most common causes of language learning anxiety among students in online preparatory class at METU and suggest solutions to reduce this anxiety's negative effects by using the data that we will collect from students and instructors.

Effects of Online Education on Language Learning Anxiety and the Place of "Universal Design for Learning" Model in Online Education

Name of the Project: Attitudes and Behaviors of METU Students Regarding the Disposable Products

Field of Research: Disposable products consumption on METU Campus

Project Team Members: Merve Ekiz, Selin Erol, Deniz Güvenç Tek & Zehra Deniz Taş

Project Supervisor: Assoc. Prof. Zeynep Işıl Kalaylıoğlu, PhD

Abstract:

Although issues such as sustainability, zero waste or saving the planet have gained popularity in recent years, the use of disposable products has increased. Among the main problems brought by this situation are animal deaths, clogging of sewers, and the emergence of nature pollution. Low prices and easy availability were the main reasons for the widespread utilization of these products. Especially in METU Campus, other attitudes and behaviors that cause this consumption have been wondered. The ultimate aim of this project is to analyze the attitudes and behaviors of METU students towards disposable products by using sampling methods and survey techniques, and as a result of these statistical analyzes, to produce solutions to reduce disposable products consumption in the METU Campus. At the end of the project, it was aimed to publish the statistically significant results in a brochure as a road map that all METU components can benefit from.

SCAN ME

Attitudes and Behaviors of METU Students Regarding the Disposable Products

Name of the Project: Comparison of Anomaly Detection Techniques in Univariate Time Series Analysis

Field of Research: Statistics

Project Team Members: Barış Kaan Alagöz, Berk Niyazi Aydın & İpek Aydın

Project Supervisor: Assoc. Prof. Ceylan Talu Yozgatlıgil, PhD

Abstract:

Anomaly detection is one of the most crucial steps in data analysis. It can be used in time series data analysis, as a quality control tool or for forecasting performance refinement. It is used in various applications such as realization of abnormal situations at entry, fraud detection, healthcare, homogeneity of climate variables, private account intrusion detection and surveillance systems. We want to reveal the best anomaly detection method(s) by comparing the performances of the methods on the labeled real data. In this way, the quality of the time series will increase, and we will be able to determine the predictions for the data correctly.

Comparison of Anomaly Detection Techniques in Univariate Time Series Analysis

Name of the Project: The Effects of COVID-19 Pandemic in Turkey

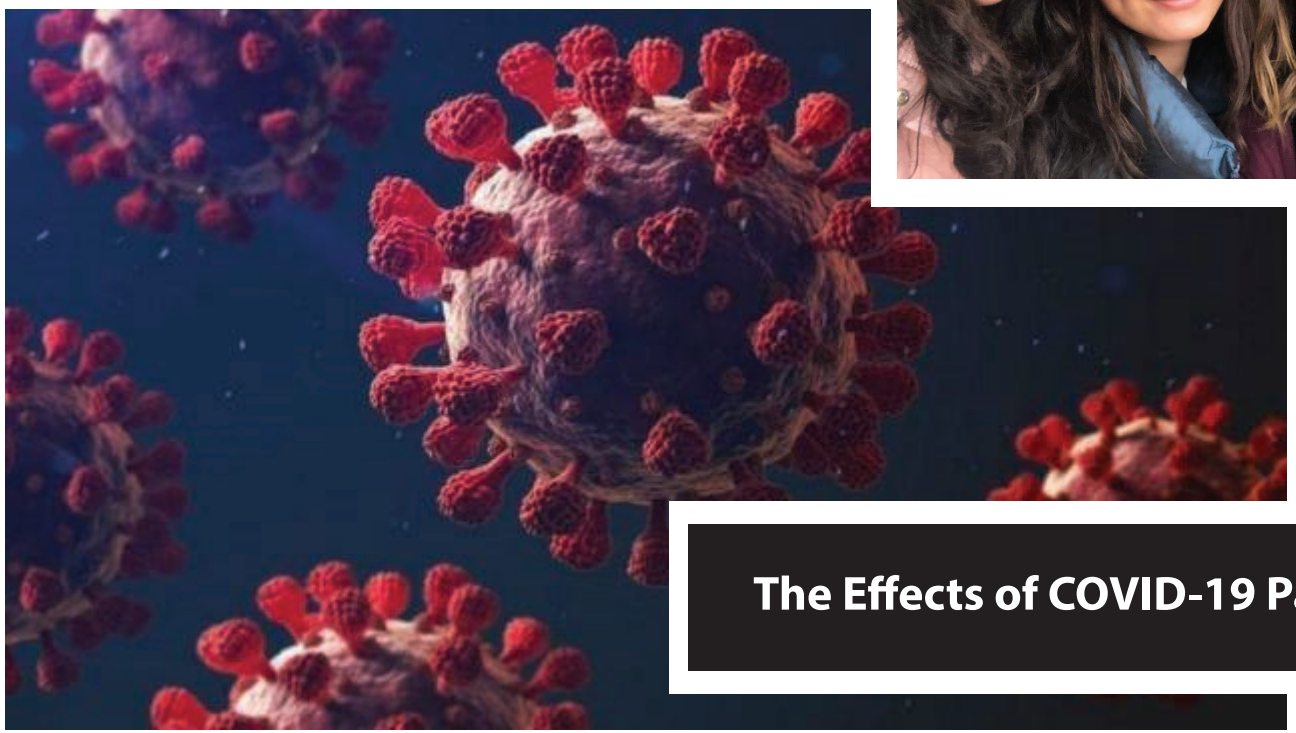
Field of Research: Statistics

Project Team Members: Ayça Yaren Arslan, Elif Beyza Akyıldız, Fatoş Aydın & Pelin Topaz

Project Supervisor: Prof. Özlem İlk Dağ, PhD.

Abstract:

One of the most critical issues of today is coronavirus that has been seen in more than two hundred countries worldwide. In this study, we try to develop a method that can detect and predict the emergence of new cases of COVID-19 at an early stage by using the popularity of Google searches related to smell loss and taste loss. Additionally, we aim to investigate the relationship between the number of weekly confirmed COVID-19 cases and weekly Google Searches including the dates between 2020-03-15 and 2021-12-05. This project comprises several stages starting from the data manipulation to analyze and predict the number of coronavirus cases by considering the number of Google Searches. The findings obtained in Turkey have demonstrated that the trend followed by Google trends is not similar to the trend followed by weekly coronavirus cases. We observed correlations between weekly Google searches related to loss of smell and taste, increases of weekly COVID-19 cases.



The Effects of COVID-19 Pandemic in Turkey

Name of the Project: Synthesis, Neutron Sensitivities and Drug Delivery Capacities of Calcium Tetraborate

Field of Research: Inorganic Chemistry

Project Team Members: Özde Ceren Abacı, İpek Yıldırım & Mine Kocatuş

Project Supervisor: Prof. Ayşen Yılmaz, PhD

Abstract:

In addition to known methods during the treatment of cancer cells, secondary treatment methods such as Boron Neutron Capture Therapy (BNCT) are sought. Therapeutic agents used in these areas and drug delivery systems must be targeted to carry drugs to tumor cells without releasing them into healthy cells to prevent their side effects. In our project, multifunctional systems with a high accumulation ratio in the target cell, capable of neutron capturing, bioimaging, and carrying high amounts of drugs will be designed and synthesized. The project aims to synthesize and characterize CaB_4O_7 nanoparticles containing a high amount of ^{10}B isotope that is capable of upconversion emission. In the synthesis of the material, different amounts and combinations of lanthanide ions, Ln^{3+} ($Ln = Tb^{3+}, Yb^{3+}$) will be doped. At the end of our project, inorganic nanoparticles which can be used for medical purposes will be produced.

Synthesis, Neutron Sensitivities and Drug Delivery Capacities of Calcium Tetraborate

Name of the Project: The Effect of Voting on Tax Compliance in Groups with Income Inequality

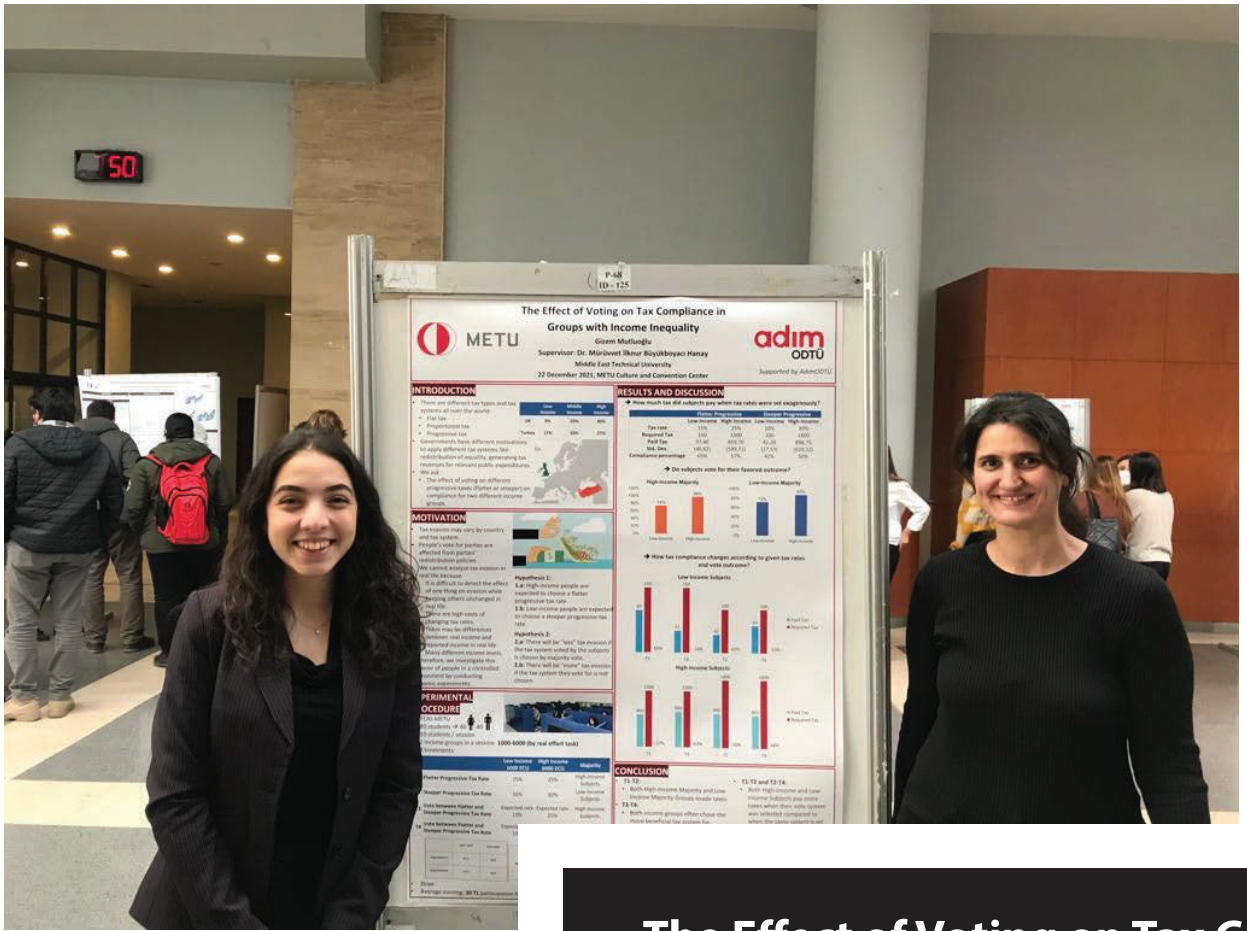
Field of Research: Experimental Economics, Applied Microeconomics

Project Team Members: Gizem Mutluoğlu

Project Supervisor: Asst. Prof. Mürüvvet Büyükboyacı Hanay, PhD.

Abstract:

There are different tax types and tax systems all over the world such as flat tax, proportional tax, and progressive tax. In progressive tax system, while some countries increase tax rates slowly as income rises, others increase faster. In this study, by using two different progressive tax systems (flatter or steeper) and two income groups (high and low), we first analyze subjects' evasion behavior through an experiment. Second, we allow subjects to vote on flatter and steeper progressive taxes and check how subjects' evasion behavior differs depending on their votes and the resulting outcome. We find that both high income and low-income groups evade taxes under both tax systems. Although both high income and low-income groups vote for a more beneficial tax system for themselves most of the time, high incomes vote more optimally than low incomes. Both high-income and low-income subjects pay more (less) taxes when their vote system was (not) selected compared to when the same system is set exogenously.



The Effect of Voting on Tax Compliance in Groups with Income Inequality

Name of the Project: Health Risk Analysis of Syrians under Temporary Protection in Turkey during the COVID-19 Pandemic

Field of Research: Immigration, Economics, Sociology

Project Team Members: Ecem Yargıcı

Project Supervisors: Asst.Prof. İlhan Can Özen, PhD., Assoc. Prof. Pınar Derin-Güre, PhD., & Asst. Prof. Besim Can Zırh, PhD.

Abstract:

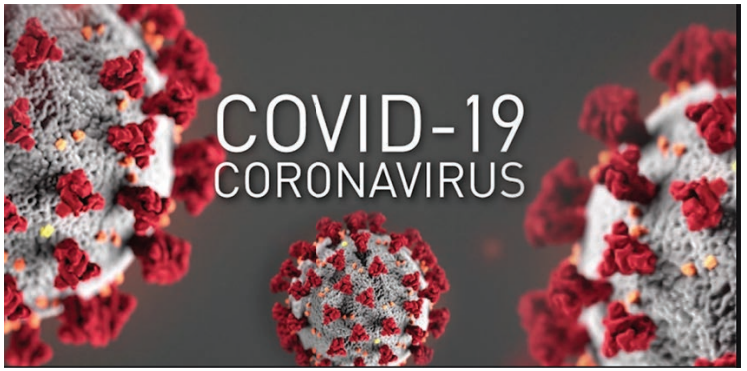
Immigrants have a higher risk of COVID-19 infection due to disadvantages such as higher poverty rates, overcrowded housing conditions, and high concentration in occupations where physical separation is difficult. (OECD, 2020) After the Syrian Civil war started in 2011, many refugees have immigrated to Turkey, and especially in the Southeastern Anatolia Region, refugee camps were established for shelter. In Turkey, there are over 3.5 million Syrian refugees under temporary protection, according to Ministry of Interior of Turkey statistics. The research project aims to determine whether COVID-19 infection is more prevalent among immigrants using Syrian Immigrants in Turkey as a case study.

In the study, data are collected under different dimensions at the city/region level to analyze the effects of COVID-19 on Syrian refugees. By the use of the restriction index first calculated for Turkey in a similar manner to Blavatnik School of Government and the University of Oxford COVID-19 Government Response Tracker (OxCGRT), we aim to find whether the COVID-19 infection is more prevalent in the areas that Syrian Refugees densely live in, the regression analysis, difference in difference and synthetic control methods. Results from cross-section estimations at the city level show a positive and significant impact of the number of Syrian immigrants on COVID-19.

Ecem Yargıcı will present the paper in Pre-ASSA Meeting by the Middle East Economic Association in Boston on the 5th of June 2022.







Health Risk Analysis of Syrians under Temporary Protection in Turkey during the COVID-19 Pandemic

Name of the Project: Economic Obstacles to Women's Political Freedom: A Portrait of the Politically Active Women in Turkey

Field of Research: Gender Politics

Project Team Members: Öykü Kurun & Deniz Hızlı

Project Supervisor: Assoc. Prof. Aylin Topal, PhD

Abstract:

The political freedom of women in Turkey is an increasingly important subject, particularly with its link to the level of poverty and living conditions of women. Although there are many factors at play, a key obstacle is most likely economic factors that prevent women from freely exercising their political rights and freedoms. The literature review further strengthened the idea that key role of economic factors in the women's political freedom but there was still a lack of research specifically focusing on this correlation. Thus, we aim to find whether there is a correlation between the economic factors and political freedom by examining the profiles and creating the portrait of women active in politics in Turkey, as well as observing if there are disparities in different regions and across different political parties.

Economic Obstacles to Women's Political Freedom: A Portrait of the Politically Active Women in Turkey

Name of the Project: Outlier Removal and Denoising of Permanent Downhole Gauge Data Using Nonlinear and Nonparametric Methods

Field of Research: Reservoir Engineering, Pressure Transient Analysis, Well Test Analysis,

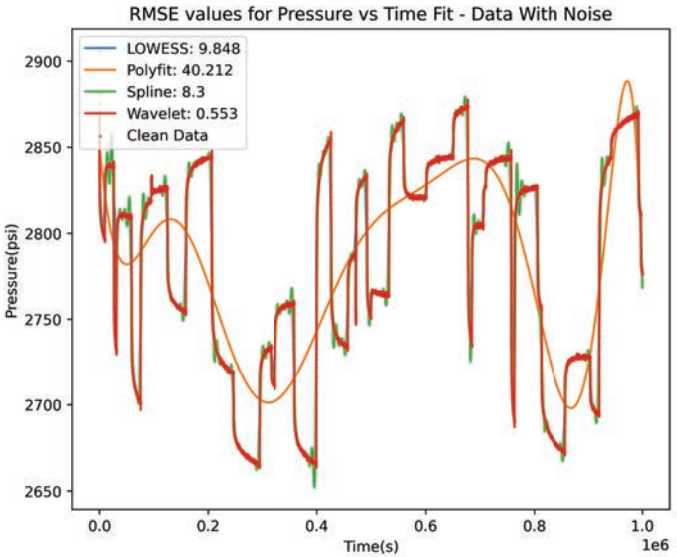
Big Data Applications in Petroleum Engineering

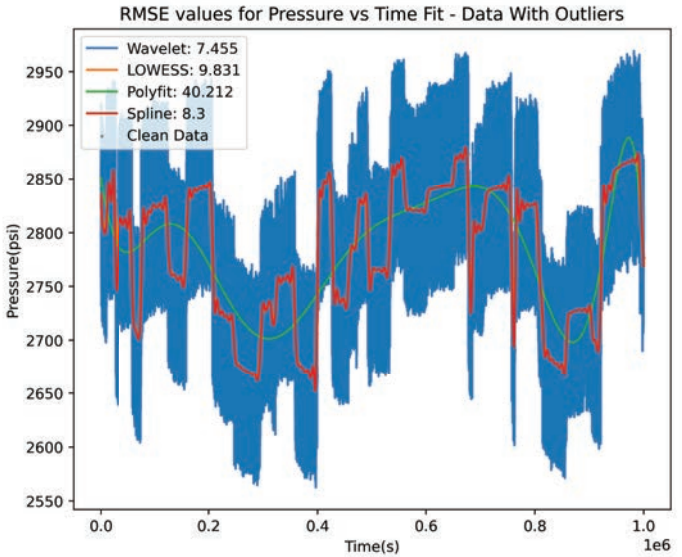
Project Team Members: Fehmi Özbayrak

Project Supervisor: Asst. Prof. Fulya Gökalp Yavuz, PhD.

Abstract:

Since permanent downhole gauge datasets are usually noisy and they contain outliers, the studies in this field are required to remove the outliers and to denoise the data, mainly with the help of wavelet transform. However, wavelet transform requires several sets of procedures and it is time consuming. This study suggests using a nonlinear and a nonparametric regression method, which are spline regression and LOWESS method, besides polynomial regression for the same purpose. A one flow rate synthetic dataset and a varying flow rate synthetic dataset are generated to investigate the performance of the proposed regression methods and to compare their performance over wavelet transform.





Outlier Removal and Denoising of Permanent Downhole Gauge Data Using Nonlinear and Nonparametric Methods

Name of the Project: Investigation of Potential for Nuclear Waste Storage in Underground Hard Rock Caverns Considering the Thermal Damage Effect on Elastoplastic Geomechanical Properties

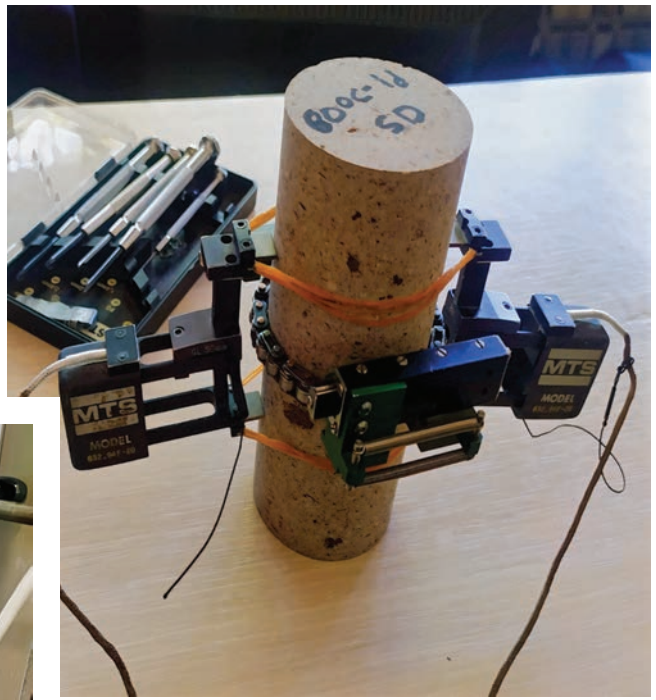
Field of Research: Rock Mechanics

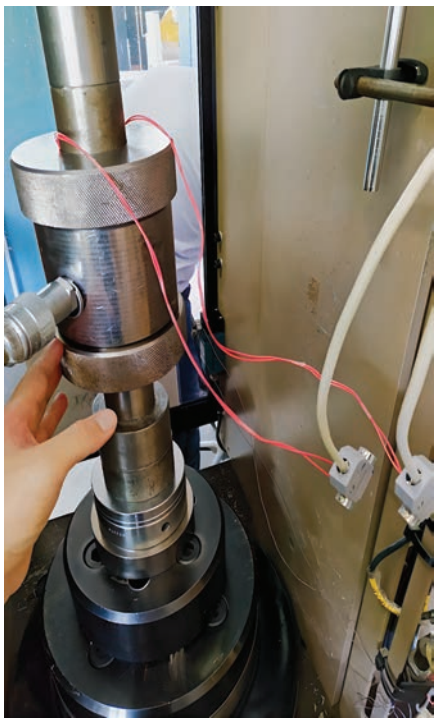
Project Team Members: Taci Emre Altıntaş & Alak A.A. Abduljabar

Project Supervisor: Asst.Prof. Ahmet Güneş Yardımcı, PhD.

Abstract:

Besides being a great source of carbon-free electricity, nuclear power creates hazardous radioactive waste products. Burial into deep geological voids is currently the most reliable waste management policy. As heat emission from high-level wastes may continue for long periods, underground opening stability is threatened by the thermal damage effect on rock mass. This research aims to investigate the potential of using old mine openings for high-level radioactive waste storage. Rock Mechanics tests were carried out on heat treated andesite core samples to investigate the thermal effect on geomechanical properties. A representative hard rock mine layout was simulated using a Finite element code to check the thermally induced stresses and deformations.





Investigation of Potential for Nuclear Waste Storage in Underground Hard Rock Caverns Considering the Thermal Damage Effect on Elastoplastic Geomechanical Properties

Name of the Project: Coal Gas Characterization by Gas Chromatography

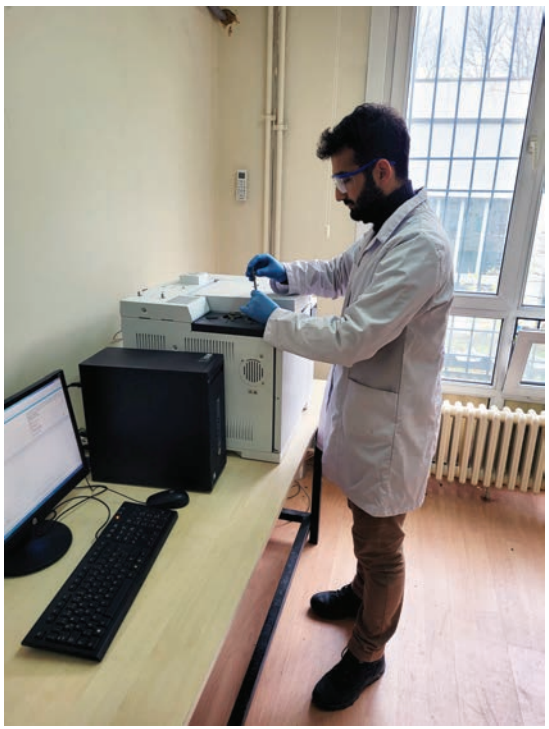
Field of Research: Unmanned Air Vehicles

Project Team Members: Hasan Ekin Doğan

Project Supervisor: Prof. Nuray Demirel, PhD.

Abstract:

Underground coal mining involves inherent risks for mine safety and health due to its characteristics. Concentration of harmful gas in mine atmosphere contributes to these risks significantly. This research study aims at identifying noxious gases and their concentrations of a coal bed in an underground coal mine. The research methodology essentially entails 6 major steps: (i) comprehensive literature review, (ii) mine site selection, (iii) sampling, (iv) field trip, (v) experiments, and (vi) analysis of result. The results of the study reveals that three major-level factors temperature, size, and location of coal affects the concentration of CH4 and CO2 in underground coal mines. Research findings are expected to contribute to understand safety and health risk associated with coal mining, and hence, to improve better working conditions. For the future studies, the project can be extended to analyze spontaneous combustion of coal.



Coal Gas Characterization by Gas Chromatography

Name of the Project: DRILL4PRO: Production Integrated Drilling Simulation for Open Pit Mines

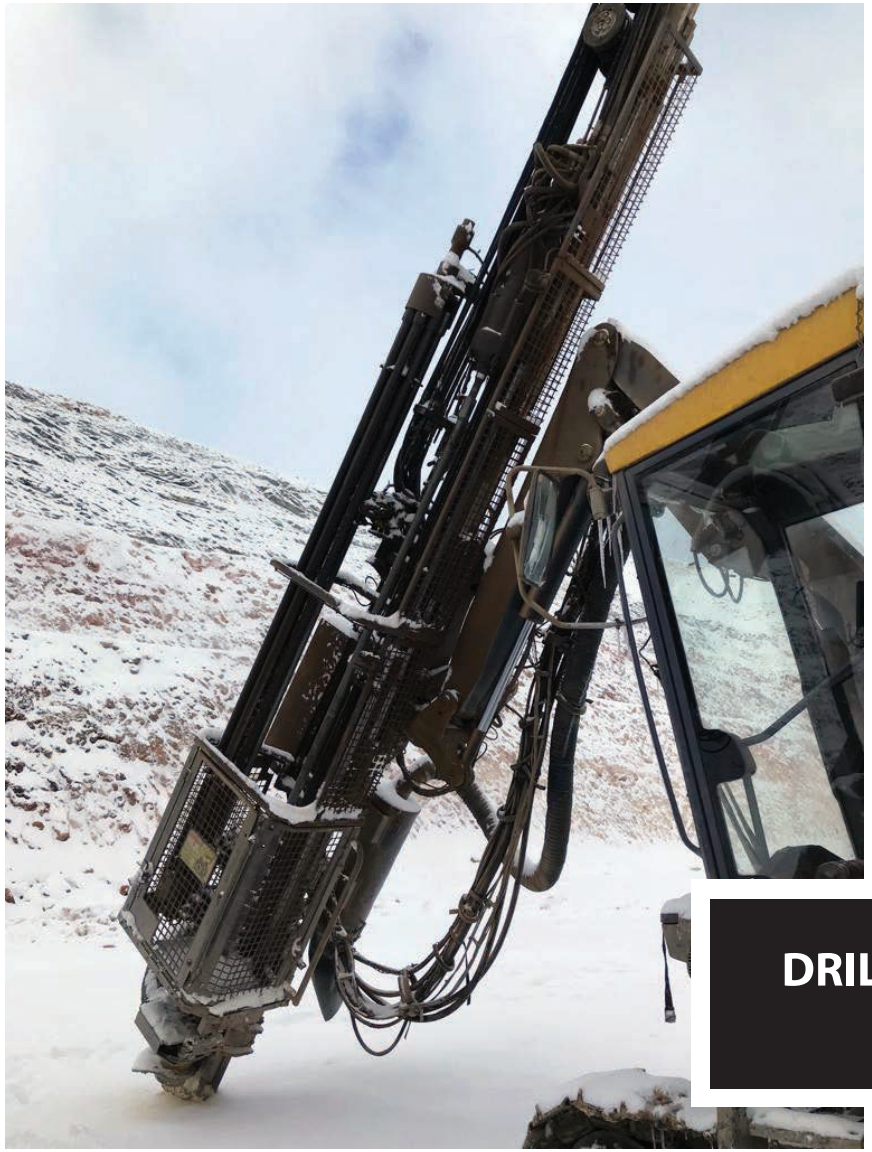
Field of Research: Mining Engineering, Drilling Operation, Simulation Applications in Mining

Project Team Members: Artun Yıldız, Eylül Eroğlu, Kaan Murat Akpolat & Veli Can Çetin

Project Supervisor: Asst.Prof. Onur Gölbaşı, PhD.

Abstract:

Open pit mining is the most common way of metal extraction and entails precise coordination of geological works, production planning, operational activities, and mineral processing phases. The tangible production process in open pits is observed after drilling and blasting operations, designed, and approved following a detailed short-term plan. Drilling productivity is crucial for blasting efficiency, pit geometry, and production advance in phases and is motivated by various internal and external uncertainties in the compliance with production plans, driller performance, crew competency, formational interactions, and weather conditions. This research intends to build up a dynamic drilling simulation, which is triggered stochastically by operational and productional parameters, to highlight the potential bottlenecks and financial consequences caused by drilling operations.



DRILL4PRO: Production Integrated Drilling Simulation for Open Pit Mines

Name of the Project: History of METU Department of Architecture: The Archive of the Academics and the Courses

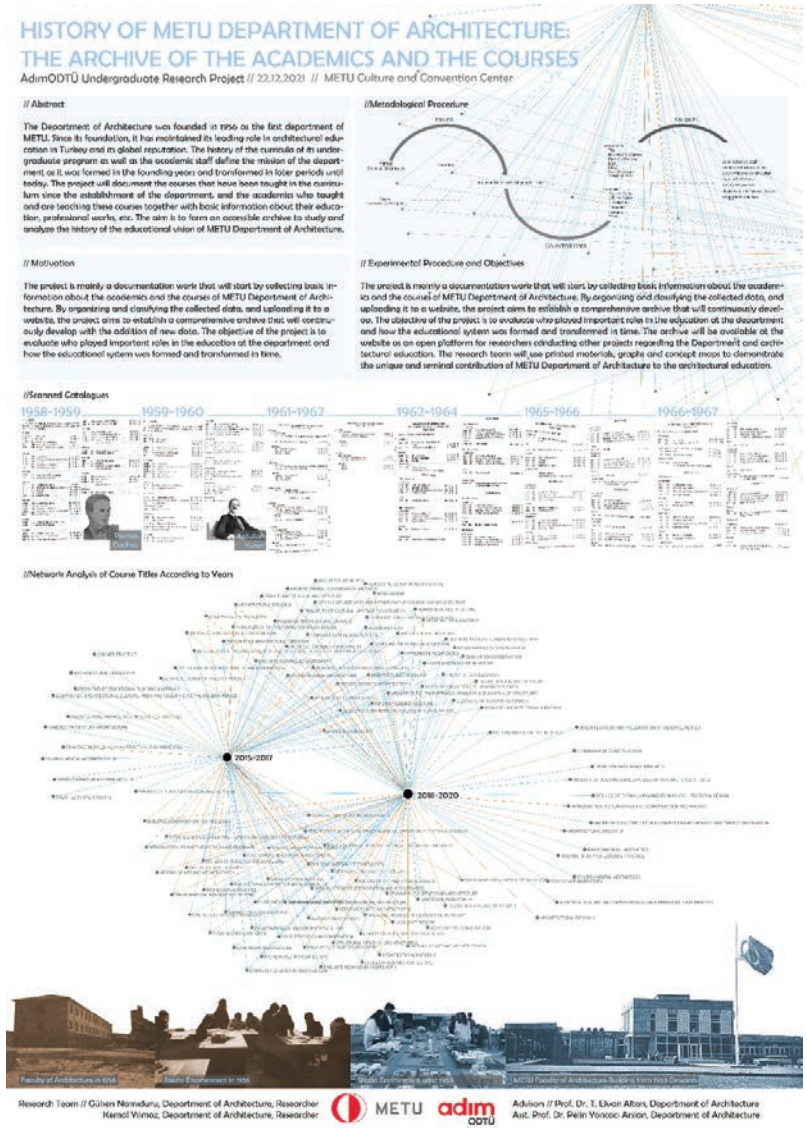
Field of Research: History of Architecture

Project Team Members: Kemal Yılmaz & Gülsen Namıduru

Project Supervisors: Prof. Tomris Elvan Altan, PhD. & Asst.Prof. Pelin Yoncacı Arslan, PhD.

Abstract:

The Department of Architecture was founded in 1956 as the first department of METU. Since its foundation, it has maintained its leading role in architectural education in Turkey and its global reputation. The history of the curricula of its undergraduate program as well as the academic staff define the mission of the department as it was formed in the founding years and transformed in later periods until today. The project will document the courses that have been taught in the curriculum since the establishment of the department, and the academics who taught and are teaching these courses together with basic information about their education, professional works, etc. The aim is to form an accessible archive to study and analyze the history of the educational vision of METU Department of Architecture.



History of METU Department of Architecture: The Archive of the Academics and the Courses

We would like to express out deep gratitude for all METU alumni and friends for their valuable support.

https://adimodtu.org.tr/projeler

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY