IMPETUS CORPORATION

EE 493 Design Studio -1

Business Statement Report

Elif Merve ÖZALP

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Emre Deniz ŞENEL

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Fahri TÜREDİ

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Melike YILDIRIM

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Yunus YİLMAZ

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INTRODUCTION

IMPETUS Corporation was established in September 2019 by five electrical and electronics engineering students at Middle East Technical University. The very first meeting of the company members took place at Çatı Cafe. The goal which brings the company members together is to produce intelligent solutions to everyday problems. The company pays attention to collect people from different fields of electrical and electronics engineering. The main specializations of the members are electronics, power electronics, and control. This field division among the members is expected to help the company to come up with distinguished approaches to various problems, as well as to create an opportunity for the members to work on their area of specialization.

VISION

Following the guiding mind and science, our aim is to be an innovative and environmental-friendly technology company for a sustainable and livable world.

MISSION

Primarily focusing on the needs of clients, to create innovative, reliable, time and energy efficient solutions in the field of electrical and electronics engineering.

HUMAN RESOURCES

Since the very first gathering of the IMPETUS Corporation, diversity is an essential element of the company. Different ideas and various point of views are the keys of developing a strong culture. For this purpose, IMPETUS Corporation aims to gather experts from divergent specialization areas.

Elif Merve ÖZALP – Electronics Specialist

Specialized in electronics field. Her interests in semiconductor devices and quantum physics lead her to be in electronics division in IMPETUS Corporation.

Emre Deniz ŞENEL – Power Electronics Specialist

Specialized in power electronics and electromechanical energy conversion field. He feels enthusiastic about autonomous electric vehicles and motor drivers.

Fahri TÜREDİ – Electromechanical Systems Specialist

Specialized in electromechanical systems and design. His passion for Formula1 and electric vehicles fosters him to be a part of the IMPETUS Corporation.

Melike YILDIRIM – Control Systems Specialist

Specialized in control systems and bio robotics. Her interests mainly focus on bio-inspired intelligent machines and signal processing.

Yunus YİLMAZ – Computer and Communication Specialist

Specialized in computer systems and communication. His works on communication protocols and mobile applications lead him to be a computer specialist in IMPETUS Corporation.

BRIEF DESCRIPTIONS OF THE PROJECTS

SMART CONNECTED CAT FEEDING SYSTEM

Smart connected cat feeding system is one of the projects that is assigned to EE493 students. The system must be autonomous, smart and refillable. The goal of the system is to overcome problems of manual feeding.

First of all, the system should feed only cats. If there are dogs in the feeding area, the system should distinguish and deter them from the area. The system should have a database which is feeding log. Thus, newcomers to feeding should be identified and recognized later by the system. Cats must be classified according to their weights so that different feeding regimes can be applied to them. Nothing can be attached to the animals. Because the same system can be used in different areas. Status of food supply should be observable via the internet.

The system is designed to make feeding easier. During the operation or charging, the battery level can be seen via the internet, too. So, it should be portable enough to be carried by a single person to charge it in case of a low battery. Battery should be non-removable and last for a minimum of 5 hours.

VALET PARKING

Valet parking is one of the projects given in 2019-2020 education year in the Design course. As we know parking is an issue in the world because people lose so much time on this. This project aims to park clients' cars 100% autonomously, so it saves time and energy. The project consists of a mobile valet system which can park 9 cars in 3x3 grid with accuracy and

safety. Also, in the project, a mobile application is required for the clients to monitor their cars. In other words, when client put his car to the entrance lot, via application he can call the valet parking system and his car is taken immediately, and when he wants to take his car back, using application the valet system gives his car back autonomously. This project has some restrictions in order to have a quality. Some of them are: The weight of mobile valet should be less than the weight of a client's car, dimensions of the parking space cannot be larger than 1.5 times of a single car, valet should carry cars immobilized and without any harm, a mobile application should be built in order to leave the car and take the car back autonomously. Therefore, the idea is that using a vehicle which has different types of motors, different types of sensors and some other components we need to carry the cars from the entrance lot to the grids without any harm and vice versa. To find an empty grid either image processing or some sensor subsystems can be useful. The hardest part of this project is the mechanical workload because it has all-in-one valet system and nine cars. However, as we can imagine, in the future, all car parking areas may be controlled with some autonomous valet and grid systems, so this project is so useful and futuristic.

GIMME FAST

The project requires a system which can transfer complementary data packets via visible light communication. At the beginning, camera module will take a picture. Then, the picture will be divided into data packets of less than 10 kB. The transmission of the packets will be provided by visible light; that is, light-emitting diodes and photodiodes. First transmission will be done from the camera side to the vehicle side. The vehicle physically carries the data to the receiver side. Second transmission will be done from the vehicle to the receiver side. On the receiver side, the data packets will reconstruct the picture and the picture will be displayed on a screen. There are some restrictions about the project as following:

- Maximum 8 LEDs and 8 photodiodes can be used in the system.
- The vehicle cannot approach terminals less than 5 cm.
- The vehicle must complete at least 5 full rounds to carry the whole picture.
- The transfer should be completed in less than 2 minutes.

According to the restrictions, both transmitter ends may contain 4 LEDs and both receiver ends may contain 4 photodiodes. These 4 pair can transmit 4 packets at the same time at different frequencies. Each photodiode should contain a band pass filter to reduce noise and discard possible received undesired packets. In order to increase the transmission speed, high

frequencies can be selected according to LED's and photodiodes properties. The vehicle should be fast enough to transmit the picture in five full rounds in two minutes.

The project requires a lot of information about the communication theory. The system needs a lot of optimizations. The algorithm behind the dividing the picture into packets and reconstruction of the picture from the packets should be consistent in each other.

WHERE AM I?

In this project, our aim is to design and implement a remotely controlled vehicle that extracts physical and magnetic map and localizes itself. The game field including physical and magnetic landmarks is required to be identified by the vehicle. Afterward, the vehicle localizes itself and estimates the position based on the information of the extracted map. Therefore, there are two main parts for the project.

The first part is map extraction where the vehicle constructs the map of a game field. It is required to identify the position and send it wirelessly to vehicle by a camera which locates at a height of 1 meter outside of the game field. The physical landmarks, which are hidden identical rigids under the surface of game field and have hill-shape with maximum height of 5 cm and maximum diameter of 10 cm, will be detected by the sensors on vehicle. The surface material of the game field should be thin, plain and opaque sheet and allows landmarks to be detected. Whereas, the magnetic landmarks are different hidden cylindrical neodymium magnets under the surface. The game field has a rectangular shape with the size of 1.5m x 2.5m. There should be total number of 10 magnetic and physical landmarks at most. Computations for map-extracting should be done on the vehicle

Localization is the second part where using onboard sensors, vehicle finds its position and sends the information of location to a computer for visualization. The position estimation will not be carried out by the camera. At the end of localization, the accuracy of estimation needs to be compared with actual positions determined by the camera. As in the case of map extraction, both the physical and magnetic landmarks are used for this part. Vehicle should be free of camera and has an appropriate size which allows itself to fit inside a cylinder with a diameter of 20 cm. Localization operation needs to be carried out in minimum time with the highest accuracy.

CONCLUSION

In this report, we introduced our company with its name, logo and members. The identity and personal information of the company members are presented on the cover page of the report together with their picture on top. Thereafter, we shared the mission and vision statements of our company, IMPETUS Corporation. Basically, IMPETUS' vision is to contribute the sustainability and livability of the world by targeting the innovation and environmental-friendly technology to be its core values in the guidance of science and mind. The company puts bringing innovative, time and energy efficient solutions to its clients' needs in the realm of electrical and electronics engineering as its mission. In the following Human Resources part, we described our company composition and division of field among the members. Before the gathering of the five members of the team, we thought that it would be key to the success of the company to have five people with diverse fields of interest and ability. Hence, we formed our company with people who has relatively complementary skills and interests. In fact, we decided on the field division inside the company in the Human Resources part by taking the specialization areas of the members into account. Finally, we provided the brief descriptions of each of the four projects. We tried to answer the questions of what the problem is stated in each of these projects and what is expected from us. In response to these questions, we explained the requirements and acknowledgements of each project. Furthermore, we added our thoughts about the projects suggesting possible solution methods and approaches.

APPENDICES

APPENDIX A

Table 1: Tentative Timetable until the Proposal Report

<table>
<tr><th></th><th>Elif Merve</th><th>Emre Deniz</th><th>Fahri</th><th>Melike</th><th>Yunus</th></tr>
<tr><td rowspan="2">Week-1 (11 October - 18 October)</td><td>Cat Feeding System Solution Research</td><td>Valet System Solution Research</td><td>Where am I? Solution Research on Mapping</td><td>Where am I? Solution Research on Localization</td><td>Gimme Fast Project Solution Research</td></tr>
<tr><td colspan="5">Brainstorming on all projects. Deciding what project we will be working on using the weighted table of all the projects.</td></tr>
<tr><td rowspan="3">Week-2 (19 October - 25 October)</td><td colspan="5">Defining the Problem Statement and Societal Impact of the Project.</td></tr>
<tr><td colspan="5">Brainstorming on the Project. Discussions on the Project Requirements and Objectives</td></tr>
<tr><td colspan="3">Outline of the Requirements for the Standards of the Product Will Be Decided</td><td colspan="2">Deliverables and Expected Outcomes of the Project Will Be Decided</td></tr>
<tr><td rowspan="2">Week-3 (26 October - 1 November)</td><td colspan="5">Brainstorming on the Project. Approach to the Solution of the Project</td></tr>
<tr><td colspan="2">Time Plan Will Be Prepared</td><td colspan="3">Cost - Budget Analyzes Will Be Done</td></tr>
</table>

APPENDIX B

CVs are added below starting from the next page.

Elif Merve ÖZALP

Undergraduate Senior Student of Electrical and Electronics Engineering of Middle East Technical University

Location: Ankara / Turkey
Telephone: +90 537 882 19 97
Email: elif.ozalp@metu.edu.tr

Professional profile

I am a senior student in the Department of Electrical and Electronics Engineering of METU. My interests are electronics, solid state devices, semiconductors, and infrared sensors. I'm working on infrared sensors and semiconductor technologies as an undergraduate researcher. I want to be an academician and a qualified researcher.

Career Summary

June 2019 – Present **Quantum Devices and Nanophotonics Research Laboratory, Ankara**
Undergraduate Researcher

Outline
As an undergraduate researcher, my goal is to experience research environment and to be included on it before graduation.

Key responsibilities
- To obtain the necessary theoretical background.
- Processing thermal imaging sensors

June 2019 – July 2019 **ESEN System Integration, Ankara**
Student Intern

Outline
As a summer intern, my goal was to experience a workplace environment and use my theoretical background in industry.

Key responsibilities
- Implementation and testing UART module via Kintex KC-705 Evaluation Board and VHDL.
- Implementation and testing HDMI module via Kintex KC-705 Evaluation Board and VHDL.

May 2018 – June 2019 **CEMMETU, Ankara**
Undergraduate Researcher
Full-wave optimizations of nanoantenna arrays via MLFMA and Genetic Algorithms

August 2018 – September 2018 **Bozankaya Inc., Ankara**
Student Intern

Outline
As a summer intern, I've observed production and research-development stages of an electrical bus.

September 2016 – August 2017	**Hacettepe University Printed Circuit Board Laboratory, Ankara** **Student Assistant**

Key responsibilities

- Manufacturing printed circuit boards (PCB) by using LPKF
- Manufacturing PCB's by wet process

April 2017 – August 2017	**Hacettepe University Robotic Society, Ankara** **Chairman**
August 2016 – October 2016	**POPEYES, Ankara** **Cashier**

Education and qualifications

April 2017 – Present	**Middle East Technical University, B.S.** Electrical and Electronics Engineering
August 2015 – August 2017	**Hacettepe University, B.S.** Electrical and Electronics Engineering (Until I was transferred to METU)

Projects and Publications

Pinball Game Design with Verilog, METU EEE Logic Design Project, April 2019 – June 2019

Wireless Communication System Design, METU EEE Analog Design Project, April 2018 – February 2019

Solar Tracking System Design, METU EEE Circuit Laboratory Project, December 2017 – February 2018

Skills

- C Programming
- FPGA Programming with VHDL and Verilog
- Siemens NX

Hobbies

- Flute
- Pilates

Emre Deniz ŞENEL

Undergraduate Senior Student of Electrical & Electronics Engineering of Middle East Technical University

Location: Ankara / Turkey
Telephone: +90 539 587 02 18
E-mail: emre.senel@metu.edu.tr

Professional profile

After graduating from the high-school I became 749th in the university entrance exam (YGS-LYS) in Turkey in 2015. Currently, I am a senior student of Electrical & Electronics Engineering in METU. My interests are power electronics, electric vehicles and autonomous systems. Current, I am conducting two STAR EEE Projects in my university on induction machines and autonomous driving systems. My goal is to establish my own electrical autonomous vehicle brand.

Career Summary

June 2019 – July 2019 **ASELSAN Electronics Inc., Ankara**
Student Intern

Outline
As a summer intern, my goal was to observe defense industry and experience practical implementations of my theoretical background.

- Designed interfaces using MATLAB and GUIDE software.
- Analyzed intrinsic and extrinsic parameters of cameras.
- Implemented a simulation software of a camera.
- Analyzed different feature detection and feature extraction algorithms.
- Tested runtimes of different matching algorithms.

July 2018 – September 2018 **TOYOTA Motor Manufacturing Turkey, Sakarya**
Student Intern

Outline
TOYOTA's manufacturing system is observed. Analyzed assembly division problems and conducted a symptom management project in maintenance engineering department.

- Controlled and observed the manufacturing process of the TOYOTA assembly factory.
- Joined to the meetings and observed how project management is done.
- Conducted a symptom management project which is a dust sensor.
- Joined Programmable Logic Controller tutorials and built a short-run code.

Education and Qualifications

- **Electrical & Electronics Engineering B.S,** Middle East Technical University, 2015 – Present (Currently Senior Student), CGPA 3.44/4.00
- **High School Graduate,** Gazi Anatolian High School, 2011 – 2015, Grade 93.06/100.00

Projects and Publications

Coordination of Autonomous Electrical Vehicles for Energy Efficient Driving, METU EEE STAR Project, May 2019 - Present

Induction Machine Test Setup Development, METU EEE STAR Project, May 2019 – Present

Pinball Game Design with Verilog HDL, METU EEE Logic Design Project, February 2019 – June 2019

Wireless Communication System Design Photophone, METU EEE Analog Design Project, September 2018 – February 2019

Wireless Fire Alarm System Design, METU EEE Circuit Laboratory Project, February 2018 – June 2018

Solar Tracking System Design, METU EEE Circuit Laboratory Project, September 2017 – February 2018

Organizations and Achievements

Aegean Conference on Electrical Machines and Power Electronics (ACEMP), August 2019, Turkey – Organization Team Member

Borusan Atölye Robothon, November 2019, Turkey – Winning Team Member

Skills

- MATLAB Programming
- C Programming
- MS Office
- Simulink
- VHDL Programming
- Leadership
- Teamwork
- KeyCreator

Languages

- **Turkish** - Fluent
- **English -** Advanced
- **French** – Elementary

Hobbies

- Chess
- Bass Guitar
- Formula 1
- Fitness

Fahri TÜREDİ

Undergraduate Senior Student of Electrical and Electronics Engineering Department of Middle East Technical University

Location: Ankara / Turkey
Telephone: +90 545 245 41 62
Email: fahri.turedi@metu.edu.tr

Professional profile

I graduated from Ünye Anatolian High School with the first graduate degree in 2015. The same year, I started to my undergraduate level study at Electrical & Electronics Engineering Department of Middle East Technical University. I am currently 4th grade student in this department. As my profession option in Electrical & Electronics Engineering, I am proceeding at Power Electronics area. I also took some Control Systems and Data Structure courses from Control and Computer fields. I am currently working on a EE Star project on Coordination of Autonomous Electric Vehicles for Energy Efficient Driving.

Career Summary

July 2019 – August 2019 **ASELSAN Electronics Inc., Ankara/TURKEY**
Student Intern

Outline
During my summer internship, I aimed to learn the company aspects, and experience the engineering environment of the company. I also had the opportunity to apply my theoretical and practical skills I acquired during my education career on a real-life engineering problem to design and develop new software.

Key responsibilities

- Took part in the development of a user interface design project.
- Utilized Microsoft Visual Studio Software to implement a Serial Data Transfer process.
- Implemented two-way Serial Data Communication between a PC and a microcontroller device.
- Applied check-sum error detection (checking) method on the transmitted messages.
- Implemented stop-and-wait acknowledgement technique on the transmitted messages.
- Applied parsing and composing/decomposing techniques on the data to be transmitted between the both end devices.

August 2018 – September 2018 **FNSS Defense Industry Inc., Ankara/TURKEY**
Student Intern

Outline
In my first internship experience, I tried to gain experience on the field of business life. I observed the company culture and ethics, and the relationship among the engineers and their seniors. I also had the chance to participate in the engineering process of the company by working on several projects at R&D department.

Key responsibilities

- Worked on two separate projects. In the first project, designed and constructed a single pulse width modulation system for the triggering mechanism of the weapons.
- Designed the circuit that implements the single pulse width modulation process on the input pulse signal on the LTSpice simulation software environment.
- Utilized the KiCAD software program for the PCB drawing of the designed circuit.
- In the second project, worked on the Hardware in the Loop (HIL) simulation software for the testing and development of the real time control/embedded systems of a combat vehicle.
- Utilized Vector CANoe comprehensive software program to create a simulation environment and interface for the testing of different scenarios related to the engine speed, lock status/position, ramp status/position and ignition status of the combat vehicle.

Education and qualifications

➢ **Bachelor, 4th year**	Middle East Technical University Electrical & Electronics Engineering C.GPA = 3.34	2015 – Present
➢ **Graduate**	Ünye Anatolian High School Diploma Grade = 92.46	2011 – 2015

Conferences, Certificates and Awards

➢ Aegean Conference on Electrical Machines and Power Electronics (ACEMP)
Optimization of Electrical & Electronics Equipment Conference (OPTIM)
IEEE Joint International Conference ACEMP – OPTIM 2019, İstanbul/TURKEY
Organization Team member

Interest Fields

- ➢ Electromechanical Energy Conversion and Power Electronics
- ➢ Electrical Machines
- ➢ Energy Efficiency of Automated and Connected Electric Vehicles
- ➢ Control Systems

Languages

- **Turkish**: Native Language
- **English**: Upper Intermediate Level

Projects and Researches

- EE213 Electrical Circuits Laboratory Term Project: **Solar Tracking System**
- EE214 Electrical Circuits Laboratory Term Project: **Wireless Fire Detection System**
- EE313 Analog Electronics Laboratory Term Project: **Design of an Optical Wireless Communication System: Photophone**
- EE314 Digital Electronics Laboratory Term Project: **Fake Quidditch Game Design Using FPGA Board**
- METU EE STAR: **Induction Machine Test Setup Development**
- METU EE STAR: **Coordination of Autonomous Electric Vehicles for Energy Efficient Driving**

Yunus YİLMAZ

Undergraduate Senior Student of Electrical and Electronics Engineering of Middle East Technical University

Location: Ankara / Turkey
Telephone: +90 537 506 54 79
Email: yilmaz.yunus_01@metu.edu.tr

Professional profile

I am Yunus Yilmaz, student in METU Electrical and Electronics Engineering and undergraduate researcher at CEMMETU.

Career Summary

June 2019–July 2019 **TAI - TUSAŞ, Ankara**
Student Intern

Outline
As a summer intern, my goal was to observe aerospace defense industry and experience practical implementations of my theoretical background.

Key responsibilities
- Designed AC-AC, AC-DC, DC-DC converters
- Designed switched power supplies
- Analyzed current mode control techniques
- Debugged VHDL designs

August 2018 – September 2018 **ELESTAŞ Electricity Production Inc. Eskisehir**
Student Intern

Outline
ELESTAŞ is a green energy company. The company builds only renewable energy centrals.

Key responsibilities
- The selection of cables that are going to use in the central
- Continuity of the production
- Principles of the inverters and productivity

December 2017 – Present **CEMMETU, Ankara**
Undergraduate Researcher

Outline
As undergraduate researcher, my role in the research group is designing composite structures and antennas according to required electromagnetic properties and testing designed structures by different algorithms.

Education and qualifications

- **Electrical and Electronics Engineering, 2,61/4 –** Middle East Technical University – 2020
- **High School, 91/100 –** Çanakkale Science High School – 2015
- **Primary School, 94/100 –** 75. Yıl Primary School – 2011

Publications and research

Investigation of Waveguide Structures Using Surface Integral Equations, CEMMETU (02/2018 – Present)

Investigation of Layered Spherical Structures, CEMMETU (10/2018 – Present)

Pinball Game Design with Verilog HDL, METU EEE Logic Design Project, February 2019 – June 2019

Wireless Communication System Design, METU EEE Analog Design Project, September 2018 – February 2019

Fire Alarm System Design, METU EEE Circuit Laboratory Project, February 2018 – June 2018

Solar Tracking System Design, METU EEE Circuit Laboratory Project, September 2017 – February 2018

Skills

- MATLAB Programming
- MS Office
- Simulink
- Verilog HDL Programming
- Teamwork
- Active Listening

Languages

- **Turkish -** Native
- **English -** Advanced
- **German** – Elementary

References available on request

- Özgür ERGÜL, Assoc. Prof. Middle East Technical University, Ankara

MELİKE YILDIRIM

Undergraduate Senior Student of Electrical and Electronics Engineering at Middle East Technical University

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Email: melike.yildirim@metu.edu.tr

Professional profile

I am currently a Senior in Electrical and Electronics Engineering at Middle East Technical University with an interest in robotics, control theory and biomedical. Having an exemplary academic record along with an active involvement in a number of clubs and societies, I have a passion to pursue an academic career. With a high motivation and enthusiasm, I aspire to be the best version of myself.

Career Summary

July 2019 – September 2019 **Max Planck Institute for Intelligent Systems, Stuttgart, Germany**
Research Intern

I took part in two different bio-inspired robotic projects namely Inchworm Soft-Robot and Milli-Scale Soft-Bodied Robot in Physical Intelligence Department directed by Prof. Metin Sitti.

- Performed image processing algorithms with Python and OpenCV for robot detection
- Programmed a motor driver with Arduino Mega
- Calibrated 3D magnetic sensor and current sensor
- Used ROS platform for robot control
- Performed technical drawings on SolidWorks to build a small-scale soft robot on 3D printer and used laser cutter machine for millimetric-scale cutting
- Carried out numerous experiments for the projects and analyzed the data on MATLAB, EXCEL

July 2018 – September 2018 **Schneider Electric, Ankara, Turkey**
Engineering Student Intern

I gained experience in industrial automation systems, low voltage (LV) and medium voltage (MV) networks for electricity distribution-transmission systems.

- Constructed a single line diagram of a LV/MV electrical plant
- Programmed a PLC with ladder logic
- Gave a small presentation about methods of starting an induction motor

Education

2015 – present **Middle East Technical University, Ankara, Turkey**
B.S., Electrical and Electronics Engineering
GPA: 3.66/4.00, Expected graduation: June 2020

2011 - 2015 **Mersin Science High School, Mersin, Turkey**
GPA: 97.2/100, ranked 840th among 1.5 million students in the nationwide university entrance exam

Projects and Researches

- **Estimation of Complete Body Surface Potential Maps from a Limited Number of Measurements – Effects on Electrocardiographic Imaging,** METU EEE STAR Project, April 2019 – Present
- **Pinball Game Design with Verilog HDL**, METU EEE Digital Electronics Laboratory Project, February 2019 – June 2019
- **Optical Wireless Communication System: Photophone,** METU EEE Analog Electronics Laboratory Project, September 2018 – February 2019
- **Wireless Fire Detection System**, METU EEE Electronics Circuit Laboratory Project, February 2018 – June 2018
- **Single-Axis Solar Tracking System,** METU EEE Electrical Circuit Laboratory Project, September 2017 – February 2018

Activities

2017 – 2018 **IEEE METU Student Branch**
Chair of Women in Engineering Project Group

- Organized WIE TALKS, the first global event of IEEE TURKEY Women in Engineering Affinity Group, organized engineering-based technical trips, held meetings and conferences to highlight the importance of gender equality in engineering.

Volunteer

Summer 2017 **Work & Travel Program Student**
Orleans, MA, USA

- Worked as a cashier at Stop & Shop Supermarkets and as a bookstore clerk at Annie's Bookstop for three months.
- Had opportunity to work in a culturally diverse environment and enriched personal skills.

Summer 2016 **Archaeology Volunteer**
Jaen, Spain

- Extracted archaeological elements, collected and recorded data with 25 volunteers from different countries.
- Gained international exposure and multicultural perspective.

Languages

- **Turkish**: Native Language
- **English**: Advanced Level
- **Spanish**: Beginner Level

Skills

- MATLAB, C, Python, OpenCV, Verilog HDL, ROS, MS Office, LTSpice, Kubotek KeyCreator

Hobbies

- Backpack travelling, charcoal drawing, Vinyasa yoga, digital photography.