Middle East Technical University

Department of
Electrical and Electronics Engineering

EE493 ENGINEERING DESIGN I

Business Statement Report

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Company Name : Duayenler Ltd. Şti.
Members   : Sarper Sertel, 2094449 (Contact Person)
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1   Introduction

As technology is being progressed imperceptibly, the new unresolved problems show up. Moreover, the competition is surging in the tech market. There have been lots of newly established start-up companies to create original solutions. In such a period, DUAYENLER Ltd. Şti. is founded with the initiative of 5 innovative, enterprising and diligent senior electrical and electronics engineering students. They want to create the most innovative product, as they are diligent. Besides coming up with innovative products, they want to market their products as are enterpreneurs. Lastly, all this work could be done with hardworking people just are the 5 members of the company.

In this report, the general information about the company, DUAYENLER Ltd. Şti., possible projects and analyses of them are documented briefly.

2   About the Company

Founded in September 2018 by five electrical engineering students from Middle East Technical University, DUAYENLER Ltd. Şti. is a visionary and promising new robotics start-up company.

2.1   Our Mission

Our mission is to design products for real life problems by creating innovative solutions.

2.2   Our Vision

Our vision is to be the frontier in robotics by intelligently automating the future world.

3   About Us

DUAYENLER Ltd. Şti. was founded in September 2018 by 5 Co-founders, namely, Sarper Sertel, Enes Taştan, Erdem Tuna, Halil Temurtaş and İlker Sağlık (see *Figure 1*). Although all of the co-founders are from similar backgrounds and some of them even have long-lasting pair-relationships, the efforts of the Sarper Sertel brought the group together to establish the company. In this section, we will introduce ourselves as the co-founders of DUAYENLER.

- As a person bringing the group together, Sarper Sertel was laboratory pair with Enes for EE214 and EE313 and with İlker for EE314 laboratory courses. He was also project partner with Erdem and Halil for EE302 Term Project in which they called themselves as "Group Duayenler". As a senior student, he chose the **Electronics** area. And as an engineering student, he is experienced in number of topics and softwares such as: Analog Circuit Design, Digital Circuit Design, LtSpice and Matlab. More information about Sarper can be accessed from his curriculum vitae in *Appendix 7*.

- Enes Taştan, being an Electronics and Physics double-major students, he is interested in physical and theoretical aspects of electronics engineering as well as real-life applications of them, thanks to his summer-practice knowledge. Due to his physics courses, he is planning to graduate next year. Besides, he is planning to chose **Electronics** area. As an engineering student,he is experienced in number of topics and softwares such as: PCB Design, Programming with Python and C, LtSpice and Arduino. More information about Enes can be accessed from his curriculum vitae in *Appendix 7*.

Figure 1: The Members of the Company from Left to Right: Sarper Sertel, İlker Sağlık, Halil Temurtaş, Enes Taştan and Erdem Tuna.

- Erdem Tuna can be considered as the name father of the DUAYENLER Ltd. Şti. as he was the one naming their EE302 project group as "Group Duayenler.". Erdem is also long-lasting laboratory and homework partner with Halil since Physics 106 Laboratory. As a senior student, he chose the **Computer** option. And as an engineering student, he is experienced in number of topics and softwares such as: Text Detection in Images, Programming with Python and C++, Interfacing with Sensors and Wireless Communication. More information about Erdem can be accessed from his curriculum vitae in *Appendix 7*.

- Halil Temurtaş, a graduation student, is the fourth co-founder of the DUAYEN-LER. He is also homework and laboratory partner with Erdem since 2016 and was project partner with Sarper in EE302 project group. As a senior student, he chose the **Control** area. And as an engineering student, he is experienced in number of topics and softwares such as: Raspberry Pi, Arduino, Device Testing, Programming with Python and C and System Analysis. More information about Halil can be accessed from his curriculum vitae in *Appendix 7*.

- İlker Sağlık is the fifth co-founder of the DUAYENLER. He was also a partner with Sarper in EE314 laboratory course. As a senior student, he chose the **Computer** area. And as an engineering student, he is experienced in number of topics and softwares such as: Plug-in Writer for Wireshark , Programming with C++ and C, LtSpice, Matlab and Arduino. More information about İlker can be accessed from his curriculum vitae in *Appendix 7*.

4 Description of the Projects

The analysis of each projects including possible challenges and solutions are given in this section.

4.1 Devices Competing to Catch Falling Balloons

In this project, we are supposed to design and construct two robots that try to catch falling balloons before they touch the floor. However, we have some limitations with this design. Firstly, the sizes of the robots must not exceed the upper limit provided us. Secondly, robots are not allowed to touch, push or contact each other. Thirdly, the protection from the interference from robots' sensors is required.

There are two major problems related to this project. First problem is moving the robot to the direction of the balloon. To solve this, a built-in camera on the robots can be utilized. We can take a reference point on the camera, and try to make it aligned with the balloon. However, image processing is highly required. Second problem is the way of catching the balloons. Robot arms or vacuums can be utilized in this step. However, we think the vacuums would be much easier. In overall, image processing and algorithm to make robots tend the direction of balloons avoiding collusion are required.

4.2 Devices Trying to Score in Each Other's Goals

In this project, we need to design a device which can play basically air hokey by remote control (no Wi-Fi) in a hexagonal playground. This project is focusing on RF communication and real-time process. No naked eye and onboard camera requirement video transmission should have no lag and right angle. There are, also, some mechanic problems which are how to respond a ball and how to handle with the stuck ball. Our approach to camera angle is using a servo motor and adding a camera control button to controller, so in every condition of the device, player can observe field properly. For

hitting the ball, our consideration has two part using momentum of the ball to respond during the game, so orientation problem can be solved. On the other hand, to solve stuck ball problem and the beginning of the game, we need to push the ball. Therefore, we can add impulsive component to one side. To handle with real-time process, we should have fast algorithm in communication and movement.

4.3 Vehicles Chasing Each Other Around a Closed Course with Varying Properties

In this project, we are required to build a vehicle that can travel around a closed elliptical route as fast as possible. Furthermore, it should stay on the elevated path. At first glance, the main requirement of the vehicle is to have a reliable and quick responsive motion control system. To handle the turns on the path, a differential drive principle can be used as well as direction changing wheels. However, the latter one is hard to build and need to be tested if it is capable of handling the specified path. Another factor that needs to be put attention is the speed of the vehicle. Since it is a race between two vehicles, it is better to come up with the most practical and feasible solutions for the controls system so that the processing load is minimized. After all, the vehicles are required to complete the path in less than 20 seconds.

The winner is defined to be the vehicle that can approach to other one from the back less than 5 cm. Therefore, the vehicle should have a function that when the winning event occurs, it can stop the race by so called handshake protocol. The overlooking cameras are not allowed but it is not a feasible way either. It is because processing the image and sending the necessary informations to vehicle so that it performs accurately is too much process and would take longer compared to data coming from sensors onboard. Also, a suspension system might be needed to achieve stability against rough surfaces or disturbances. In addition, there needs to be protection system on the vehicle so that the collision with the other one never occurs.

4.4 Devices Trying to Extract the Plan of Their Surroundings

The project requires a mobile vehicle that can travel in a meaningful path such that the device neither crashes any of the obstacles nor the exterior walls but can map the whole playfield accurately. The main limiting factor in the solution is the use of same color for both the obstacles and the exterior wall. This limitation prevents the implementation of a simple color thresholding solution for the object detection with the help of a imaging system such as a camera. A possible way to handle the object detection problem would be to use "shadow games" so that light shades of the color indicate a possible object whereas the dark shades of the color might mean exterior wall. Certainly, mapping the playfield is important as much as object detection. The vehicle should be able to get the distance of it to its environment.

The overall solution requires a combination of many steps, mainly, image processing, direction automation with respect to surroundings, an algorithm to create map.

5 Conclusion

In this report, the general information about the DUAYENLER Ltd. Şti. is given and the co-founders of the company are introduced. Afterwards, four possible Capstone projects were explained from the co-founders perspective in brief details. DUAYENLER will definitely be working diligently to realize one of four projects in an innovative way. The appendix of this report also contains the time table for the tasks including the assignment of responsibilities until the submission of the proposal report.

A Weekly Schedule

Days	Tasks
15-21 October	*Early research on projects. *Writing Bussiness Statement Report.
22-28 October	*Deeper research on projects and finding possible solutions for all projects. *Defining problems and solutions for all projects *Project decision meeting
29 October - 4 November	*Proposing more possible solutions for the project. *Defining technical requriments for the project. * Defining system & subsystem requiremets for the project.
5 - 11 November	*Writing Proposal Report.

Figure A.1: Weekly Schedule

B The CVs of the Team Members

The CVs of the each team member are presented in the following pages.

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