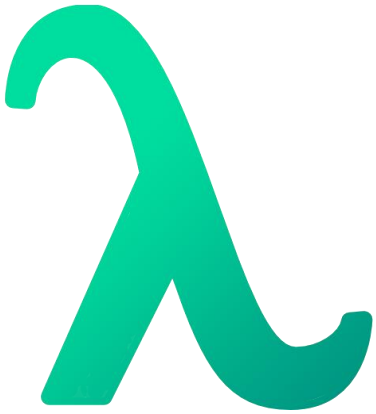
MIDDLE EAST TECHNICAL UNIVERSITY

Electrical & Electronics Engineering Department

EE493 - Engineering Design I

Business Statement Report

Company Name: λambda



Members of Company :

- Berk Erhan Yüksel
- Necdet Can Sönmez
- Mustafa Barış Emektar
- Alper Saraç
- Furkan İtkü

Design Coordinator :

- Associate Professor Dr. Elif Vural

Introduction

λambda Company was established in October 2021 at METU, Ankara. The company was founded by five Electrical & Electronics Engineering students, four of them specialized in the Computer area and one in the Signal & Control area. The company was established to bring innovative, technological, and creative solutions to the problems that people experience in their daily lives. The company, which has been carrying out R&D studies at a great pace since its establishment, has had the opportunity to work on various subjects with its employees. Thanks to the staff, it has the capability to work on embedded systems, machine learning, artificial intelligence, signal processing, and control systems. Reading this report, you can learn about the employees and detailed information about them, the company's mission and vision values, and the designated projects.

Mission & Vision of the Company

Mission

To provide innovative, reliable products and energy-efficient solutions in the field of electronics and system integration, and to make people's lives easier with the projects it produces.

Vision

To be a reliable, innovative, environmentally and human-friendly technology company that maintains its sustainable growth with the values it creates.

Human Resources

Our company consists of 5 engineers who are specialized and experienced in various fields. Although there are 4 computer experts in our company, everyone has had experience and worked in different fields. The experiences and projects were prioritized during the company formation phase, as there should be an interdisciplinary system in the projects carried out. The company, who provides appropriate conditions and innovative developments for its employees, acts consciously and fairly in project design.

- **Berk Erhan Yüksel**

He specializes in signal processing and control systems. Thanks to his internships, he gained experience in the fields of surveillance radar systems, algorithm design, and development. His areas of interest are system integration and control. In addition, he can design various algorithms and system tests on Matlab. There are also a few projects he has prepared on C and C++ environments.

- **Necdet Can Sönmez**

He specializes in the computer field. He is an experienced programmer in Python with knowledge of several modules. He has mostly academic experience in C. He is experienced in machine learning applications due to his internship. He is interested in embedded system design.

- **Mustafa Barış Emektar**

He specializes in the computer field. He gained experience in embedded systems as well as high-level programming languages in his internships. Also, he is experienced in soldering, wiring, and designing-printing 3D models.

- **Alper Saraç**

He specializes in the computer field. He has experience in embedded programming, as well as several programming languages; such as C, C++, C# and Python. He has knowledge of the R&D process and product design thanks to his experience from his internship. He is interested in autonomous device development.

- **Furkan İtkü**

He specializes in the computer field. His interests are embedded system design and signal processing. He is experienced in C and C++ programming languages. Moreover, he gained experience in designing algorithms and user interfaces on MATLAB during his internship.

Description of Capstone Design Projects

1. Orbiter

For this project, the company is expected to design an orbiter. They are also expected to provide an agent, whose main task shall be to move in an arbitrary direction in a straight trajectory; with a velocity no less than 10 cm/s. The orbiter is to orbit the agent, as the name implies. Although the orbit trajectory does not necessarily have to be spherical, the absolute distance between the orbiter and the agent should never exceed 40 cm. Furthermore, the orbiter should be able to catch up to the agent from a distance of up to a meter; although their starting positions shall be random. The orbiter should be able to do at least 2 complete loops within 30 seconds, including the time to catch up.

- Both the orbiter and the agent shall be strictly land vehicles. Furthermore, there shall be no active communication between them; that is, the orbiter shall compute its trajectory with no knowledge of the next move of the agent. The companies are expected to prove that the end product meets the specifications through tests conducted in different environments and different initial conditions.

2. Home Security System

The company is tasked to develop a smart surveillance system for the home. The system must watch and analyze people (and pets) within its line of sight. The system must log every person seen to its database, and match it with the people recorded before if they exist in the database already. The system must be able to deduce if these people are part of the household, are visitors, or are intruders; and act accordingly. To do so, the device must be able to analyze behavior. For example, it may ring the alarm or call the police in case of a break-in attempt, or call an ambulance in case a household member is having a stroke and is unable to.

- All of these must be logged in the database, which the user should be able to access through an interface. Doing so, it must also consider privacy factors; for example, it should not record nude footage. Furthermore, the user must be able to control the line-of-sight of the device remotely, for example through tilting the camera through a remote controller or a smartphone.

3. Intelligent Agriculture at Home

Today, many people try to produce their own food at home due to various reasons like naturality and taste. However, growing edible plants is usually difficult and time-consuming. Therefore, an automated system that can grow a plant at home has a great chance in the market. This automated system should take appropriate actions at the right moments to make the plant grow healthily.

- In this project, the system should use various sensors to detect the present condition of the plant. Moisture, temperature, and light may be some of the factors to consider in order to decide the plant's current state. The system continuously monitors the plant with these sensors to water the plant, add fertilizers as needed, detect any diseases and change the environmental conditions to ensure optimal growth. The environmental conditions may include but are not limited to, lighting, temperature, ventilation, and humidity.

4. "Cısss!"

In this project, the company is tasked to design a device to control undesirable behaviors of pets. The behaviors may include climbing on kitchen tops, going into rooms they are not supposed to, fleeing the house, and so on.

- The device is to consist of 2 units; the master unit and the tags. The master unit should be the brain of the device and be wearable by the pet. This unit should detect that the pet is approaching forbidden areas. The Master unit should be powered by a battery; therefore, it should have low power consumption. In case of violation of forbidden areas, the main unit should warn the pet. These warnings could be electrical, mechanical, or acoustic, etc. Of course, these warnings must not harm the pet. These forbidden areas are to be determined by tags.

- Tags are to be produced in two different types; area tags and passage tags. These tags, which should be small in size, will be placed in designated forbidden zones. Area tags should be for the detection of the pet's entry into an area, while the passage tags are for the detection of the pet's passage through a doorway, whose width shall be no less than 90 cm. The company should also provide a test jig to prove that the device is working as intended.

5. Smart Shopping Cart

The shopping process in many supermarkets has been the same for a long time. The shopper i.e. the customer loads the goods to their shopping cart then unloads them at the cash register. The products are then scanned one by one by the cashier through their barcodes, often creating long queues in busy times. This project aims to revolutionize the field by changing this process completely. When the shopper loads the item to their cart, the item is registered automatically. This eliminates the necessity to unload the item at the register. The cart also follows them around using the motors connected to its wheels, so that the shopper does not need to push the cart around.

- This project has many subsystems that need to be built carefully. The sensor tracking the shopper and the control circuitry driving the motors accordingly must be designed well to avoid crashes or disconnections between the shopper and the cart. The cart should follow its owner, and must not turn around the follow another customer. It also must not crash into the owner or customers and must have the maneuverability to do sharp turns. The item sensing subsystem should be accurate so that it does not miss any items. This is also necessary to inhibit any individual's ability to steal items from the market. All of these facts result in a project that is multi-disciplinary because of its many different subsystems.

Conclusion

In this report, the motivation behind the establishment of the λambda has been given with its necessary specifications such as name, logo, mission, vision, and human resources. Basically, the mission of the λambda is to make lives easier by providing innovation and environment-friendly technologies. It provides efficient solutions to clients' needs in the electrical-electronics engineering area with its human resources having complementary skills.

Also, potential projects that can be worked on are explained and considered one by one. Each project has its own set of challenges and advantages. We discussed what we understand from the projects, what are the critical points and what is expected from us in detail.

Finally, the capstone project is the most crucial and last component of our engineering traineeship. The importance of this project comes from the reality that most of the current electrical-electronics engineering students will be a part of various projects in the future. The Engineering Design course is similar to a tutorial which shows us the difficulties and problems we may face in the process of project development in the future.

Appendices

Appendix A

Time table for the tasks including the assignment of responsibilities until the submission of the proposal report:

		Choose Project	Debate	Research	Writing Report
Proposal Report Timetable	6-Nov				
	7-Nov				
	8-Nov				
	9-Nov				
	10-Nov				
	11-Nov				
	12-Nov				
	13-Nov				
	14-Nov				
	15-Nov				
	16-Nov				
	17-Nov				
	18-Nov				
	19-Nov				
	20-Nov				
	21-Nov				
	22-Nov				
	23-Nov				
	24-Nov				
	25-Nov				
	26-Nov				

Appendix B

CV's of Company Employees: