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# X-Cali

Business Statement

Version 1.0

17/10/2017

Design Studio Section:

3

Presented by:

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Göksenin Hande BAYAZIT

Emre DOĞAN

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Burak SEZGİN

Introduction

In this report, brief information about our company X-Cali, about our co-founders and the approaches of our co-founders to the designated projects are included. Also, detailed information about our co-founders in their CVs is present in the Appendix.

Mission and Vision of the Company

Mission

To produce reliable, affordable and high-quality products and to provide satisfaction to all stakeholders.

Vision

To become the leading technology company in Turkey and one of the most productive companies in the world by creating value in the global market and to ensure long-term sustainable growth.

Human Resources

Our company consists of 5 electrical-electronics engineers that each of them is specialized in different subjects.

Göksenin Hande Bayazıt is experienced on power electronics and control systems. She is in the research team of Asst. Prof. Ozan Keysan and participated in several machinery projects.

Oytun Akpulat is experienced in the computer area. He has a knowledge of embedded system design and programming with C++. He is also interested and experienced in control systems.

Taha Doğan is experienced in digital system design and image processing. He is in the research team of Prof. Gözde Akar and participated in several projects on image processing.

Emre Doğan is experienced in signal processing and cognitive science areas. He is in the research team of Assoc. Prof. Fatih Kamışlı and participated several projects on machine learning and deep learning.

Burak Sezgin is experienced in the software area. He was in the research team of Prof. Nevzat Güneri Gençer studying on signal processing. He also participated in several projects on machine learning.

Description of Capstone Design Projects

Project 1: Vehicles leaving and re-joining a convoy of similar vehicles, marching in single file

In this project, at least two robots of a convoy have to be designed and constructed. One of the robots should be the leading one, which will never leave the convoy as the path-setter. The other one should be one of the followers of the leading robot and it should leave or re-join the convoy upon command. The robots in the convoy are also expected to indicate if they are leaving the convoy or if they are the last robot in the convoy.

As the implementation of this project does not require a complex mechanical system but a powerful knowledge of signal processing, software, and control, it is quite consistent with the background of the members of our team.

Project 2: Robots collaborating to balance on a see-saw and keep the distance between them

Robots collaborating to balance on see-saw project aims that two robots should stay in balance on a 50cm plank that is located on a cylindrical object with 10-12cm diameter.

This project has a unique property that is the functionality of the robot depends on the other robot at the other end of the plank. That is, this project is a problem that consists an advanced control design. The advantage of this project is there is no need for image processing. However, this means that a very sensitive accelerometer must be used, which might be very expensive. Another mind-bending issue is that the restrictions of the designs. One can use large arms or one can use gyros inside the robot. Thus, such kind of flexibility may cause a time waste for some companies.

Project 3: Robots taking part in a basketball shoot-out

In this project, two opponent robots will take part in a basketball shoot-out. Each team will design and construct one of the robots.

In the game field, there will be three parallel lines that consist of two baselines and a center line. These lines will be spaced equally by 1 meter. Centerline will separate the game field into two similar half-fields and each half-field will be constructed by one of the design teams. There will be no markings in these half fields except the baselines.

At the beginning of the game, 6 balls will be arbitrarily placed behind the baseline for each robot. The balls should be compatible to ping-pong balls in terms of size. Each robot is supposed to pick up a ball, carry it to the center of the game field and drop or shoot into the common basket which is placed on the center line. Robots will repeat this action until the basket is full. The team with more balls in the basket will win the game.

Throughout the game, robots cannot deal with more than a ball at a time. Crossing the opponent’s half field or touching the basket is not allowed, any violations of these rules will be penalized.

In my opinion, basketball shoot-out project may be a good choice for our project design team. It requires hardware, software, and image processing knowledge and all of the group members can contribute to process of design of this project.

Project 4: Robots collaboratively carrying a long object through an open-top maze

In this project, two robots will carry a long object through a non-predefined maze collaboratively. It is required to carry the long object above the maze walls.

This project definitely requires a well-designed communication system between the robots. Two robots must be able to decide when to turn the plank with some angle. But in the restrictions, it is written that direct communication between robots is not allowed. So, solving this issue may become a big issue. Maze solving code does not seem like a problem. Also, the mechanical structure of this robot will not be too complicated but collaborating with the other robot may require some hard work on communications and control systems.

Yet still, this project may be a good option as it does not have too complicated mechanical systems, the challenging part is mostly based on setting a relation between the robots and this relation can be created by different methods.

Project 5: Vehicles chasing each other on an obstacle course, by going over walls and under bridges

In this project, two vehicles compete with each other. However, there are some obstacles such as walls, bridges, and sticks. They should overcome those obstacles somehow. At that point, the project gets harder to achieve the aim since to jump from the wall and locate the angle of the bridge and enter accordingly is not easy to obtain.

The most difficult software utilization part of the project is image processing part since both speed of the car and quality of the image processing works inversely proportional. In other words, if the vehicle moves faster, image processing quality gets low which is not a desired. It is because the vehicle has to move faster to compete with the other one. The most difficult mechanical application part of the project is going over the wall. To implement that jump, the vehicle has to be solid so that vehicle must not be damaged during landing. And also a mechanism to provide jumping is necessary and hard to apply. After all, these taken into account, the project seems to be a fancy one but also the hardest one.

Conclusion

Capstone Project is the final and the most important stage in our engineering traineeship. METU EEE Department has arranged this course in a way that we can gain skills in a simulation of company and business life. Each project bears different difficulties and indigenous advantages. In this report, these properties are examined and are going to be examined in our next studies. Additionally, the vision and mission of our company are defined. Justification of the composition of the team has been done. In other words, "What did the group members rely on when they got together?" explained and to show that their expertise and experiences were shared one by one.

To conclude, Capstone Project is course is a milestone in our engineering education. We must proceed very carefully and seriously throughout the whole process. Considering the hardships of the projects and their difficulties, we are going to end up with a convenient one for our team members' skills and experiences.

Appendix 1

Timetable for the tasks including the assignment of responsibilities until the submission of the proposal report is given below.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Proposal Report Timetable | | | | | | | | | | | | | | | | | | | | |
|  | 21 Oct | 22 Oct | 23 Oct | 24 Oct | 25 Oct | 26 Oct | 27 Oct | 28 Oct | 29 Oct | 30 Oct | 31 Oct | 01 Nov | 2 Nov | 3 Nov | 4 Nov | 5 Nov | 6 Nov | 7 Nov | 8 Nov | 9 Nov | 10 Nov |
| Choose Project |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Debate |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Research |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Writing Report |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Appendix 2

CVs of the team members are attached in the following order:

* Oytun Akpulat
* Göksenin Hande Bayazıt
* Emre Doğan
* Taha Doğan
* Burak Sezgin

























