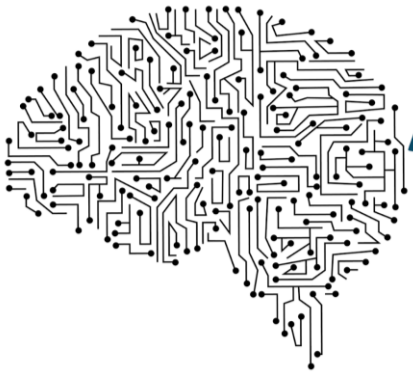

AUTOMATA
TECHNOLOGIES

Design Studio #4 - Weekly Progress Report #2

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Partners:

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In the previous week:

After the meeting with the instructor, we decided on a suitable time for our own meeting. We planned to meet on Thursdays. The main topic of the meeting was choosing the project. For that reason, we have discussed each project separately. After a brainstorming session, we especially focused on hockey project since general trend was choosing that one. We thought about the budget and the researched roughly about the prices of product. We searched for FPV camera for live video streaming purposes, a radio controller, battery, motors, motor drivers, chassis etc. Since we wanted to make the robot semi-autonomous, we checked the cost of Raspberry Pi and a camera, which is not the camera of FPV because it has only analog output, whether we can manage the budget with that or not. After that it is understood that it does not seem like we can manage semi-autonomous vehicle with the given budget limit. A detailed analysis will be conducted in the following weeks. Then, we listed our problems and talked how we can solve these problems. Roughly analyzing and talking about the problems, we assigned everyone according to their specialization areas doing research on special topics. Everyone was expected to do research on their topics. In the following section, some of them will be stated. Rest will be explained in the next weekly reports. (Huzeyfe Hintoğlu)

As we decided in the weekly meeting, I have made researches about two topics. The first one is looking for other devices, modules or protocols(rather than wi-fi protocol) for live video streaming issue instead of using First Person View cameras in order to decrease the cost. The idea I came up with was Bluetooth 5.0. Until recent years, Bluetooth versions were capable of doing limited processes due to low bandwidth, speed and other features, but with this new version provides 800 fits outdoor range, maximum 50Mbit/s transfer speed, and 2Mbps bandwidth. According to my researches, for 640x480 resolution and 30 FPS video streaming requires 1Mbps bandwidth. Therefore, it seems that Bluetooth 5.0 can handle this. On the other hand, because this is a new technology, limited sources are available. We need to make deeper research on in before deciding to work with it. My second topic to make research on was Raspberry Pi. The reason behind this is that FPV cameras

give analog output, and we need to convert this analog output to digital so that we can make image processing. That is required for the autonomous mode of the robot. So we considered to have another system that works for autonomous part. Therefore, I have tried to find out if we can make image processing with raspberry pi camera on 640x480 resolution and 30 fps. It was obvious that Raspberry Pi's processor's clock speed is not enough to handle this problem. I found out that we can use another controller such as Tiva C Series controller with Raspberry Pi so that Raspberry Pi camera gets the images and Tiva Controller can function as a buffer. In this way we can deal with speed problem but other problems come up such as time delay. This solution needs deeper search as well. (Fatih Çam)

This week, we have researched about the video transmission techniques in general.We have decided that we would use a FPV camera for this purpose since it is a generally accepted method and it is relatively inexpensive. However, the video format of the FPV cameras are not suitable for image processing purposes. Therefore, we need to convert the output of the FPV camera to a suitable format for image processing if we decide to do the hockey project semi-autonomous. We can see that there are suitable parts meeting our requirements in the market at a glance. Also, in order to view the received video signal on a monitor, we need another converter that converts the video format of the FPV camera to HDMI. We have found the parts we need to record the video, transmit the video and convert the video into suitable formats to view and process in the market and they do not exceed the budget limit as a whole. Furthermore, if we decide to make the defense mode of the project autonomous, we can process the recorded and converted video using a Raspberry Pi or another electronics card. (Recep Günay)

Following the brainstorming session last week, I conducted research on VTx combinations for FPVs. Standard FPV camera and VTx combinations send and display video in a standard definition format, often around 600tvl (TV Lines) or 768 x 494 pixel resolution. Therefore we would need a display which would be appropriate for our needs. Also, by virtue of my research, I learnt about the various low latency systems available for FPVs. Low latency is imperative in a system such as ours because any delays or excessive lag in our feed could be the difference in our reaction time to an obstacle or any headway made by the opponent.Thus, for the hockey project, a low latency system is indispensable. I found that some cameras which utilize onboard image enhancement such as WDR (Wide Dynamic Range), have higher latency than others and therefore we would try to steer clear of such cameras. For achieving low latency it would be reasonable to opt for HD FPVs; after some research I discovered that an HD FPV's price range could be $70-$80. The price, however could be a barrier and therefore after some deliberation, we will decide which kind of FPVs to opt for in order to achieve low latency and to avoid overspending on our FPV camera, alone. (Sarah Ilyas)

Choosing the Project

Although we tend to choose the hockey project, we have decided to make a comparison using the process mentioned in the lecture. The first thing is to determine the criterias of the project. We have made a voting to determine the criterias from most important to less important whose results are as follows:

- "Creativity" which enables us to come up with original solutions for the problem
- "Experience" in different topics that we expect to gain during the project
- "Fun" that we expect to get during/after the project
- "Marketability" of the robot that we will build
- "Easiness" of the design, build and test procedures of the robot
- "Cheapness" of the components that we will while building the robot

After these, we prepared the pairwise comparison chart, which is shown in Table1, to determine the weights of the criteria.

	Creativity	Experience	Fun	Marketability	Easiness	Cheapness	Total
Creativity	-	1/2	1	1	1	1	4.5
Experience	1/2	-	1	1	1	1	4.5
Fun	0	0	-	1	1	1	3
Marketability	0	0	0	-	1	1	2
Easiness	0	0	0	0	-	1	1
Cheapness	0	0	0	0	0	-	0

Table1: Pairwise comparison of the criterias

After the pairwise comparison, the weight are calculated to be as follows:.
Creativity: %26.2, Experience %26.2, Fun: %19, Marketability: %14.3, Easiness: %9.5, Cheapness: %4.8

With the weights obtained, the next thing is to vote and to calculate each point of the project. The result of the vote is shown in Table 2. Note that, the points are the average point given by the team members.

	Creativity	Experience	Fun	Marketability	Easiness	Cheapness	Total
Catching Balloons	4.4	6	5.2	3.2	5.6	6	5.41
Hockey Game	9.2	7.2	9.4	8.8	7.2	3.6	6.96
Chasing Each Other	4.8	4.8	4.4	4	7.6	5.6	6.05
Mapping a Region	8.8	7.6	5.2	7.6	1.6	2.8	4.04

Table2: The result of the weighted voting about the project

As seen in the Table2, the most rated project is Hockey Game and the second one is Chasing Each Other. Note that the calculations in the process of choosing the project are done in Excel.

(Fatih ÇALIŞ)