  
**Design Studio #4 - Weekly Progress Report #5**

DS Instructor: Gülbin DURAL

Partners:

* Fatih ÇALIŞ
* Fatih ÇAM
* Recep GÜNAY
* Huzeyfe HİNTOĞLU
* Sarah ILYAS

In the last weekly meeting, our supervisor stated that we should not only focus on the game part of this project. She indicated that the most important part of this project is the communication subsystem. She has suggested that we should apply this project to other fields as well. As a result, we figured out that we should not only try to communicate with the robot from some distance away, we should also be able to control this robot from any other city or country. Therefore, by applying this idea to our project, we will be able to extend this project to many other applications such as smart homes and smart cars. After making research, we have realized that the solution that we need is Internet of Things concept. The Internet of Things, or IoT, refers to the billions of physical devices around the world that are now connected to the internet, collecting and sharing data. Thanks to cheap processors and wireless networks, it's possible to turn anything, from a pill to an aeroplane, into part of the IoT. This adds a level of digital intelligence to devices that would be otherwise dumb, enabling them to communicate without a human being involved, and merging the digital and physical worlds. Considering the Internet of Things concept, there are two issues that need to be handled for out project. The first one is connecting our robot to the Internet, and the other one is controlling the robot from anywhere. Before we move our interest to control mechanism, we first decided to make research about how we can apply the IoT concept to out project. After making more research we came up with the idea of using 3G, 4G, or LTE shields that are compatible with Raspberry Pi. With this modules we will be able to easily connect our robot to Internet, and also Raspberry Pi can be used to control the robot after finding the control mechanism solution. (Fatih ÇAM)

If we decide to combine our robot with the Internet of Things concept, we must find a way to connect the robot to the Internet without WiFi since it is prohibited. This connection can be done over 3G or 4G bands. 3G band has the maximum download rate of 14.4Mbps and maximum upload rate of 5.76Mbps. Considering the video that the robot will stream during the game, this data transmission rate is not enough. Therefore, 4G band which has the maximum download rate of 150Mbps and maximum upload rate of 50Mbps would be more useful. There are different Raspberry Pi compatible modules for this connection, however their cost is quite high. These modules with prices are as follows:

* Sixfab, Raspberry Pi 3G/4G Base Shield V2 : 34€
  + Requires: Quectel 4G Module : 60€
  + Antenna : 5€
  + Total : 100€ = 115$
* 4G + GPS Shield for RPi + LE910 : 274€
* PiAnywhere, 4G Hat for RPi : 250€
* Linkwave, “The Pilot”, 4G Hat for RPi : 95£ = 120$

Considering the budget limit and the tutorials, source codes etc. that the company supply, the 1st one seems a good choice. (Fatih ÇALIŞ)

While we are considering the Internet based communication for the video and command data as a design choice, we are also working on the first method that we came up for the video transmission which is FPV camera. We have researched about how FPV cameras are used in video transmission in a number of applications mostly in drone applications. We have roughly determined what model FPV camera, transmitter and receiver considering our budget limit and requirements. We have generally understood how it works and how to make the circuit connections among the components through literature research and observing the working of the system in different applications. In order to get a better idea about the system, we have met with a friend of ours who has the components we need and uses them in his drone application. We asked him some questions about the FPV cameras and the transmitter/receiver system. Fortunately, he had some spare components for every piece and we borrowed from him an FPV camera, a transmitter, a receiver and a monitor from him to experiment under different conditions such as through walls and from a distance. If we observe that the system works under the required conditions, we might buy our own components which will be less costly than his components, and form our video transmission system in that way.

Also, for the transmission of the commands to control the robot, we are considering the possibility of designing our own control center by using a transmitter and a joystick like device. We think that designing our own control center can reduce our total cost than in the case of buying an RC remote controller. We can take apart a joystick and connect an Arduino inside for the input connections and the transmitter. We can give the necessary commands by the Arduino to the transmitter according to the inputs of the joystick. The rest of the operation is the same as in the case of buying an RC remote controller from the market. We will obtain the transmitted commands by a receiver placed on the robot and give the corresponding signals to the parts of the robot. We will make a budget analysis and compare the costs of buying an RC remote control and designing our own control center and decide which one is better. Also, in order to check the operation of the transmitter, we will make an experiment setup in which we will use an RC remote controller to send signals to drive a motor or light an LED under different conditions. We can create this setup with components we have now since Fatih Çalış has an RC remote controller and a receiver of his own and we have other components to design the test environment. If the transmission turns out successful, we can guess that it will work if we design our own control center or if we buy an RC remote controller since the RC remote controllers use similar transmitter as the ones sold in the market.

Therefore, we now have two experiments to perform involving a video transmission and a command transmission system. We plan to make perform these experiments in two weeks while continuing our research about other communication systems and the subjects discussed in the standard committee meetings.(Recep Günay)