CSE 564 : Software Design Laboratory Journal

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Beginning 17 August 2016

Contents

24 August 2016

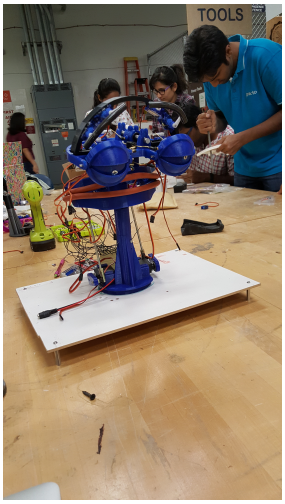
1 Introduction to the Social Robot

We were introduced to the design of a Social Robot. To understand it better we would be focussing mainly on the face of the robot and make him do certain gestures. There can be several gestures possible, like smiling, winking eyes, raising eyebrows or pretending to feel sleepy. This can be achieved by creating a modular design which consists of several movable parts. We would have separate parts for eyes, tubings for lips and eyebrows etc. The movement would be achieved through servo motors and all the parts would be 3D printed. We were asked to make teams and order the parts by collaborating with each other.

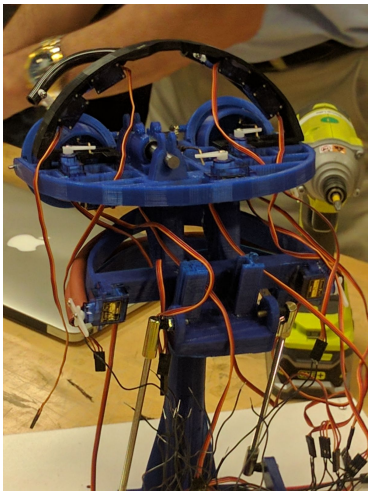
2 Gestures

Some of the gestures can be defined in these ways

- **Smiling:** The servo motors on the edges of the lips will set into action and will bend the lips to create a smiling effect.
- **Winking:** Engage only one of the servo motors in the eye of the robot and use it to open and close the eyelid by programming.
- **Sleepy:** Move the neck of the robot sideways and close the eyelids via a program.
- . . . and so on



(a) Completed front



(b) Completed back

Figure 1: Completed robot example.

29 August 2016

1 Team to Team Collaboration

We made sure that everyone had ordered the required parts for the robot. Some parts were arriving late but it was manageable as we did not require all of them at once. We also learnt about team to team collaboration. Some team members stayed in the class to figure out the blueprint and robot design while the others went to the lab to understand the 3D printing. Figure 2 shows the most abstract idea of all the motors in the robot.

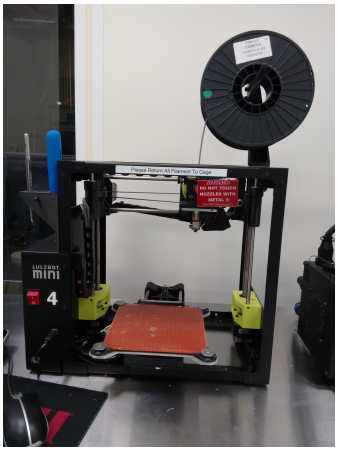
	MOTORS	
R Eyebrow Inner		L Eyebrow Inner
R Eyebrow Outer		L Eyebrow Outer
R Eyeball Lat		L Eyeball Lat
R Eyeball Vertical		L Eyeball Vertical
	Eyelid Group Vertical	
	Eyelid Group Open/Close	
	Jaw open/close	
R Lip		L Lip
R Neck		L Neck
	Head Rotation	

Figure 2: Basic blueprint of the motors.

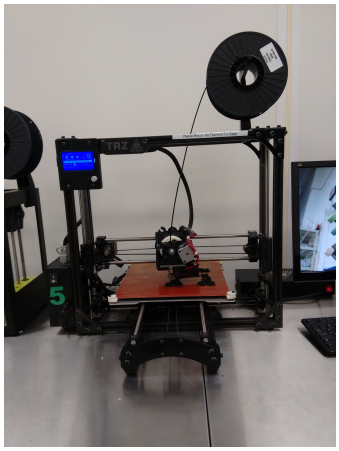
31 August 2016

1 Introduction to 3D printing

We were introduced to the 3D printing lab and we saw how a 3D printer works. We were given a training session which informed us what kind of plastic to use, what precision to use and what are the things we need to take care of. The plastic should be of good quality such that it comes of easily from the board and does not leave a residue. We were told how to set the temperature of the 3D printer such that the plastic solidifies before it's shape is distorted. Figure 3 shows a 3D printer in action.



(a) A 3D printer



(b) 3D printer in action

Figure 3: A 3D printer.

2 Started printing the parts

We booked a slot on 2nd October 2016 and started printing out the 3D parts.

7 September 2016

1 Removing the support material

We got some of our parts printed, while for the others we required a 3D printer with a larger board. We booked a slot for it on the 9^{th} Septemper.
A 3D printer can print easily in 2 dimesions, but sometimes we need to print a loop or a hole. This means that the plastic does not have anything to support it. The 3D printer prints an extra supporting material which needs to be removed once the printing is complete. Some of our parts had this supporting material and we worked on scraping of this material from our parts. We used pliers and filers to remove it and smoothen our parts.

12 September 2016

1 Drilling of neck joint

The robot has a neck which should be freely movable in all the directions, just like a human neck. To make this happen we had ordered a universal joint. But this joint was not fitting inside the neck as the 3D printer was not a high precision printer. To make that happen, we used a drill bit of $1.34cm$. This part was inserted in the base, which was again drilled. The final setup looked somewhat like 4.

Figure 4: Setting up the robot neck with universal joint.

14 September 2016

1 Filing and cleaning and drilling

We got all our parts printed out. This meant we had to clean them of the supporting material, file them to smoothen it and drill some holes so other parts could fit properly. This day of the lab was majorly based upon collaborating with each other and learning from the professor.

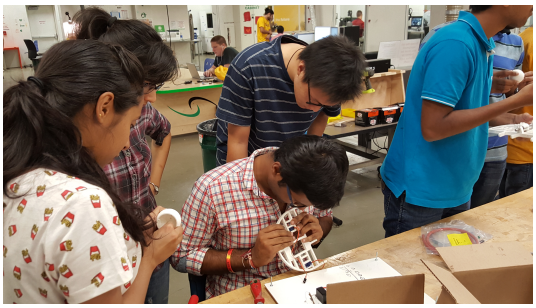


Figure 5: Working together as a team.

19 September 2016

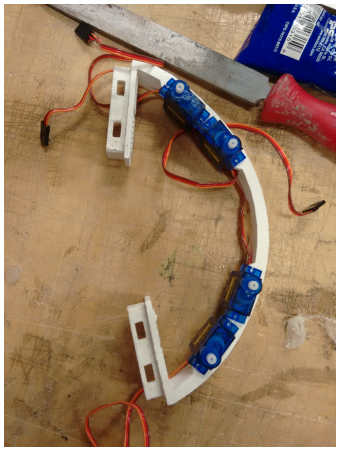
1 Fitting of servo motors in base

We started fitting the servo motors in the robot base. This would enable our robot to tilt its face in the left and right direction. This will be achieved by the use of $32 * 6''$ threaded rods which would be attached on both the sides of the servo motors. Figure 6a shows how the rods and the motors were connected to the base.

2 Fitting of servo motors in head

The eyebrows of the robot will also be controlled by the servo motors. For this we took the head of the robot and filed it so that our motors could fit inside it. Once the cut was made appropriate to the motors, we affixed the motors and ensured that their directions were opposite. This would enable a greater movement of the eyebrows. We will need to initialize the servo motors to their starting positions once we start programming our robot. Figure 6b shows how the servo motors are connected in the head.

(a) Robot with servo motors in base



(b) Servo motors to control eyebrows

Figure 6: Fitting servo motors.

21 September 2016

1 Cleaning the Eye Mechanism

This was a tricky part because the motors could not be inserted directly into the eye mechanism. The wires on the side of servo motors prevented the motors from going inside directly. We could not make the holes bigger as the motor would fall. To achieve the task we filed the socket only to an extent such that the wire could go through the small file.

2 Inserting the servo motors

The servo motors were inserted in a two step process. The motor was opened and inserted from top such that the wire came down. The cap of the motor was then sealed from the other side using screws. This gave a very good fit for our servo motors. A total of 3 motors were inserted this way.

26, 28 September 2016

1 Drilling the eyeball

The eye ball was cleaned and filed such that it looked like a sphere from the outside. A hole was then drilled through the plastic part which would be used to connect the eyeball U joint. This joint is held together by a screw which looks like a pupil in the eye.

2 Connecting the eyelids

The eyelids are connected using a 4mm ball connector which would be then connected to servo motors. The eyelids could now operate independently and were able to close and open.

3 Connecting the U joint

The U joint had to be made in such a way that it allowed movement in every direction. We filed the parts which enabled a smooth movement and then with the help of the professor we connected these parts together.

3 October 2016

1 Discussion about Design

This time we headed to the class where we discussed the use of design in various upcoming technological avenues. We discussed the use of design in the supply chain, Artificial Intelligence and Virtual reality. In this class, professor focused on the deliverables that he required from the students. We also discussed about the progress of the robot.

5 October 2016

1 Started Gluing the parts

We had not been gluing any of the parts as of now because of several design changes along the way. The robot is now getting into the final stage and thus we started gluing all the parts together. We started off with the motors in the head. We glued the head base with the head support and placed the base of the robot on a cardboard sheet.