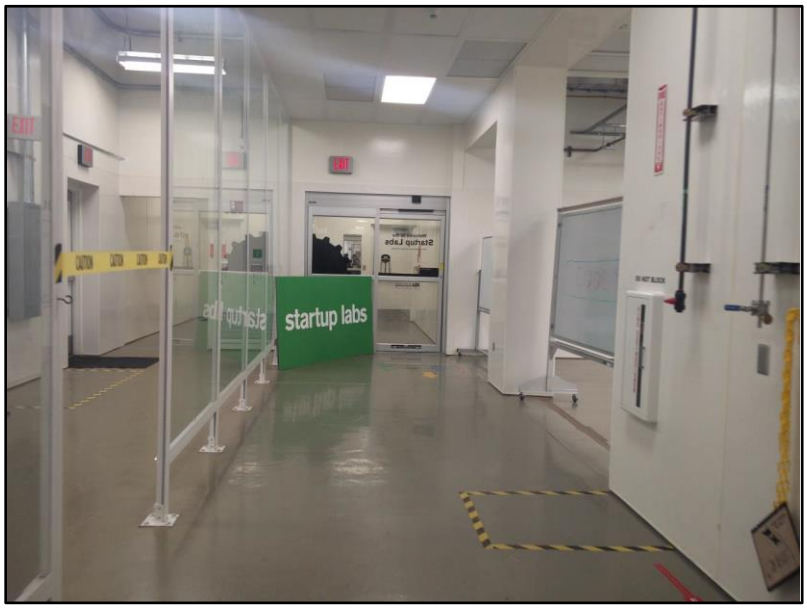
SOFTWARE DESIGN CSE564

Student Journal

This report contains a brief day to day activities and learning of the course throughout the semester.



"Anyone who has never made a mistake has never tried anything new."

-Albert Einstein

Includes date wise experience with the course and lessons learnt through mistakes done while building a robot.

Vaishak Ramesh Vellore

1212953233
vvellore@asu.edu

11/23/2017

We started building a socially interactive robot which gave us an insight about practical and applied learning of Software Design. This paper is a brief update on what we learnt and how we collaborated to build it and where we stand now.

The First Day of Class

21st August 2017

I just had a brief introduction to the subject before the class started and my imagination and take on this subject was totally different.

Class started at 3.05 pm and Dr. Ashraf Gaffar walked into the classroom with a bright smile on his face. He just made us answer a couple of questions about the latest technology on that day. He wanted us to come up with innovative answers. It was exciting for me to learn something Practically. I was happy to know that we would have to build a Robot in this course.

We were also given a handout of the course introduction.

We spoke about latest technologies and innovations that can be the leader of future. My innovative idea was devise less software. Prof. gave a good insight about automated car.

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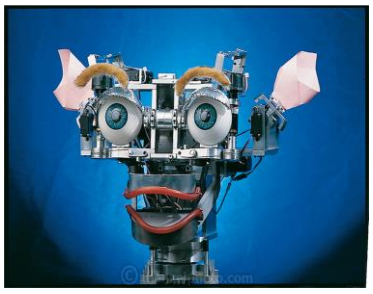
Prof. gave a good insight about automated car. It is being experimented with a lot and in the not so future we will be seeing cars driven by themselves.

Interesting. Robot is one of the most innovative and new robot's are being built on a everyday basis and soon robot's will replace place and its already taking place



Formation of Team

23rd August 2017

Most of us in our team are very new in the States and each of us come from different geographical locations and we speak different languages. Our team was formed on a very adhoc basis. When the professor asked us to form a team, we formed a team based on who were beside us.
Soon after forming a team, we were no more strangers. Our first step was to exchange the phone numbers and start remembering names. We were no longer strangers but friends.

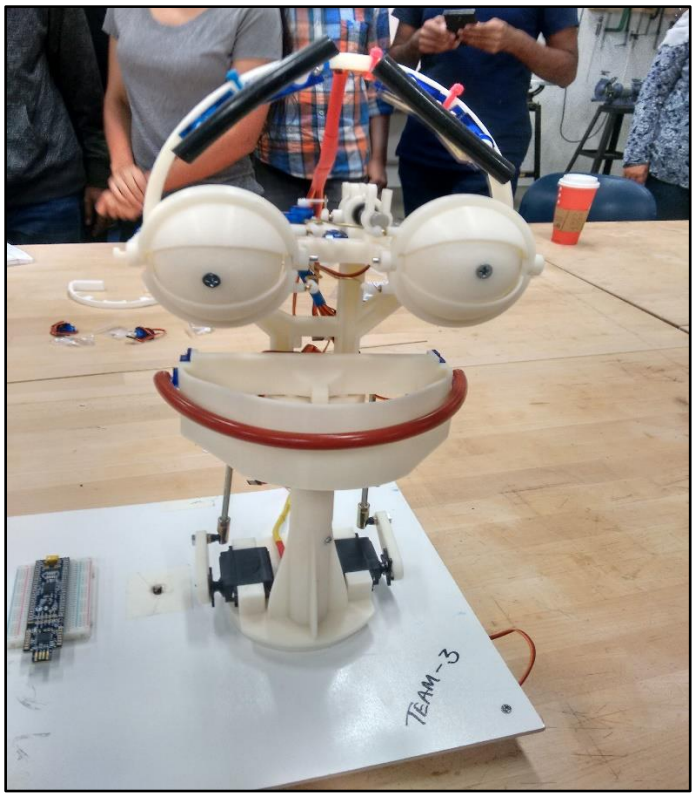
The most important thing prof spoke that day was about team to team coordination. According to which it is not only important that you coordinate within the team member's, you will also coordinate with other teams.

Team to Team Coordination: it is not only important to coordinate within the team members, we should also coordinate with other teams as well.

The Beginning of our Project

28th August 2017

Prof shared a spreadsheet containing the parts to order. We were initially confused on what and why these parts are used and what the parts would do. Our curiosity was high. There were many parts which were not available online. We were spoon fed on what products to order and from where? This was the first day I saw where the sound of the robots come. 'Servo' motors.



We had a great discussion within the team at Hayden for choosing the color of the robot. We had multiple options. Later we decided to go with what other teams would do. Also, we were very curious about the micro- controller Prof asked us to use. i.e PSoC 5LC

The Complete list had 26 parts along with various other components that were essential to bring our robot to life

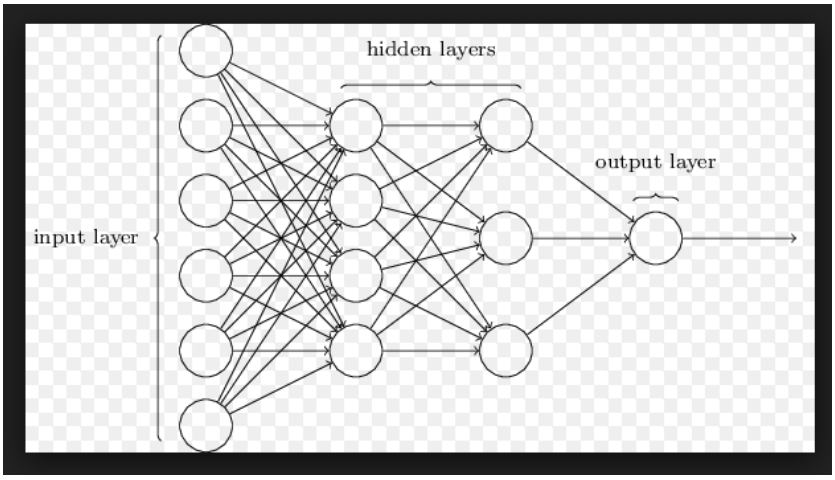
The Below picture is the Micro-Controller which was used.

A Talk on Neural Networks

30th August 2017

Some points that we learnt:

- There is an input going through hidden layers giving an output.
- No particular pattern is followed to get an output
- The neural network is adjusted for it to learn the possible probabilities.
- There are two modes with it one using training data (training mode) and other using test data (using mode)
- Training data is usually 80% of the data set to train the model and make it learns.
- Usually there are 4 layers by default – input, output, hidden layers.

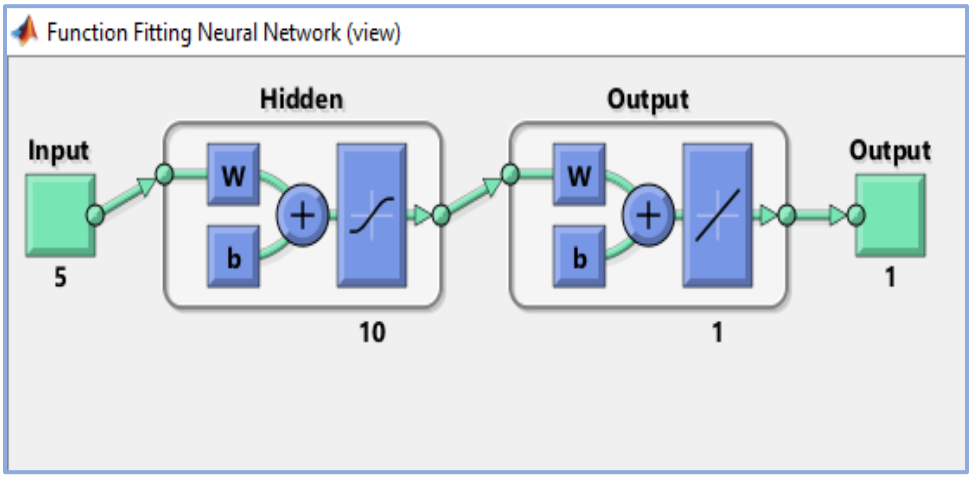


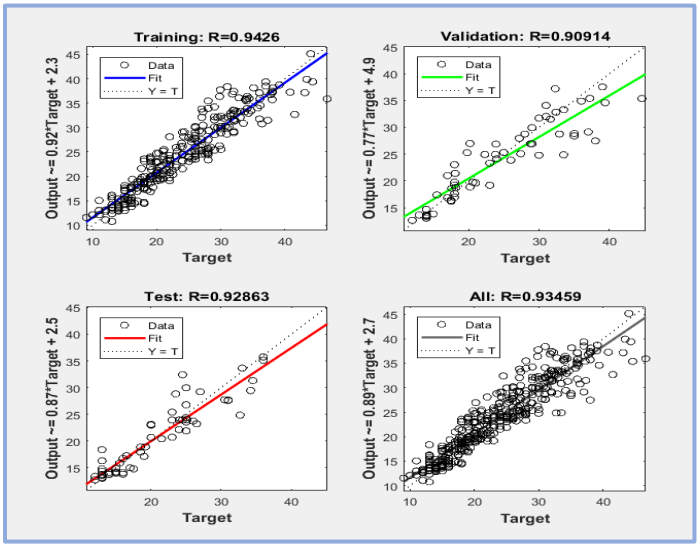
Major types of Neural Networks:

- feed-forward Neural network – Uni direction, the flow is only one way.
- Weight (w) ranges between 0.1 (slow, better) to 0.9 (fast)
- Weight update phase:
- Topology used:
- Activation function is needed to be applied on the Neural Network.
- No. of neurons can be adjusted.
- A lot of trial and error is seen.

We had an assignment in Neural Networks and also a quiz on it. The assignment was very helpful in understanding how Neural Networks works.

We had to build a neural network using MATLAB to estimate the MPG (Miles per Gallon) based on the database provided which consists on the input variables and the target values.





Yes, it might sound easy but it sure wasn't. I spent 2 whole nights and days to replicate the Neural Network. But I learnt how MATLAB simulation works and at the end, everything worked out well.

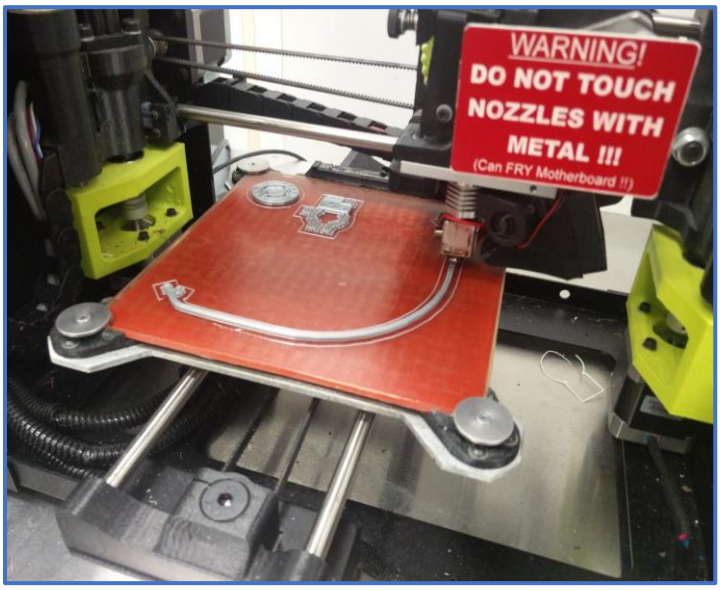
We had a midterm exam on what Neural Networks were and how they work. The paper was intriguing but was well put out to understand. We were given two chances to increase our grades so there wasn't too much pressure on us.

STARTUP LAB

Our First Lab-September 6th, 2017

As per ASU policy, we were required to have a hands-on training on using 3D printer. We were demonstrated on how to use the printer and showed some simple designs that were already done.

We had totally 16 motors of 2 types. One motor was used for movement of eyes, eyebrows and mouth while the other was used for the movement of the neck.



3D Printing – An Official Kick Start of our project

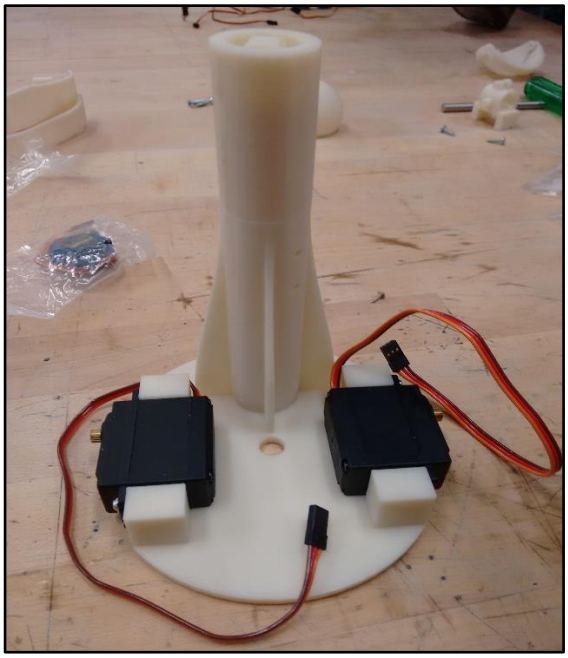
September 11th 2017

Though there was a lot of race to book a correct slot and printer, we managed to get a decent one. We got all the files and started to print. The printing took longer time than expected. Though Starting the print was easy, it took way longer to get the Parts than expected. By then we had already placed the order for Motors, wires etc which were very essential for building the social Robot that we were so excited about.

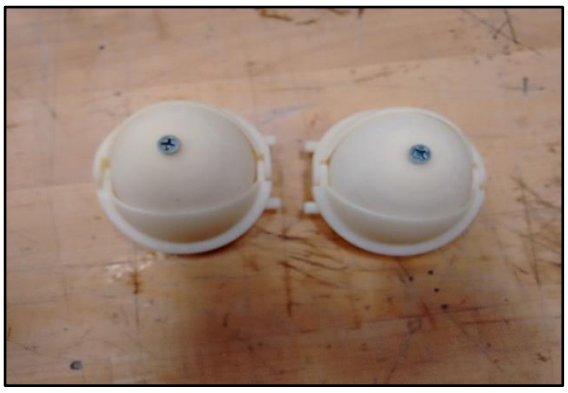
Assembly

September 27th

We finally got all the parts for the robot and we didn't waste any time to start building the Robot. My task was to assemble each of the parts as they were very delicate and had to be handled very carefully and also because I had the smallest and the safest pair of hands. LOL! I clicked pictures of individual parts and tried to identify where goes what.

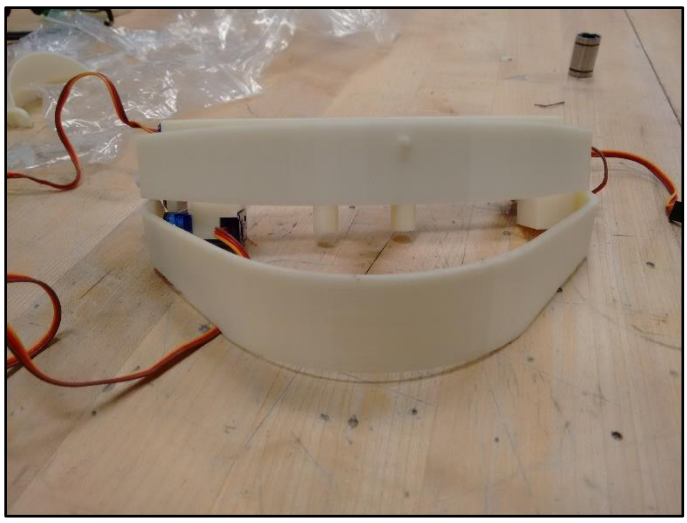


Our Social Robot had a normal sized neck along with some big, gloomy and amazing eyes.

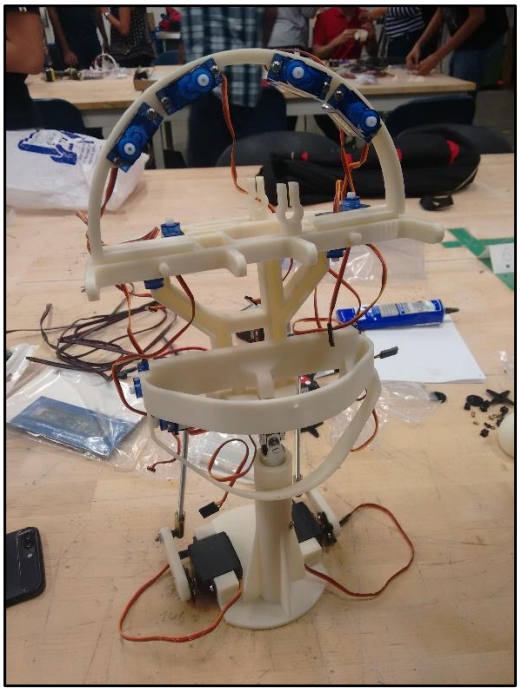


THE UPHEAVAL TASK

I've previously worked on building line and maze followers but this was more harder to build as it consisted of larger number of parts and the intriguing task of making all of them work in sync. The journey of assembling was very fun and a big learning process too. We as a team learnt how to come together when needed. We did have our fair share of challenges, had to remove each of the parts numerous times either because the parts didn't fit or because we had to make bigger holes to accommodate the screws.



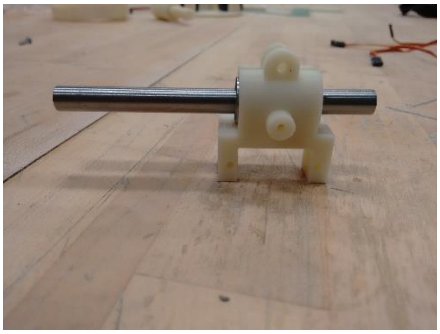
We let go of our weekend and met up every Saturday to work on our Robot and it was wonderful to see every team doing the same. The Hardware was not the only part of our robot but the software as well. We were given the task of making small changes to the code and see if it works for each of the motors.

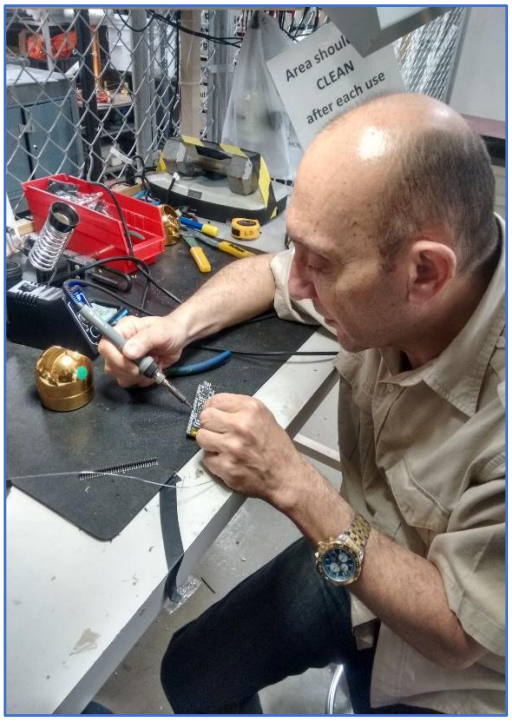


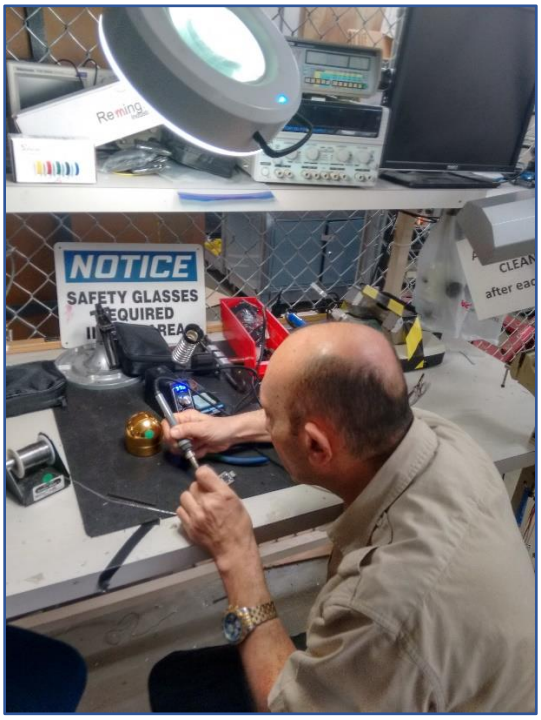
We had to be as creative as possible to differentiate from every other team. After building the entire robot, now it was time to wire each of the motors for power supply and we decided to make our robot more appealing by braiding its hair and to be frank, it looked beautiful. Haha!

The biggest problem though was the eyes. The eyes had a universal joint to fit it to the head and it was very difficult to place them. Not to forget the thin metal rods used for each of the movements of the eyes and the eyelids. But this never stopped us from moving forward and were the 2ND Team to complete the whole robot and later we sought out to help other teams.

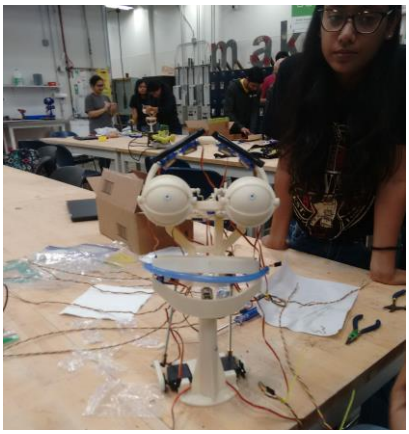
The one you are looking it gave us a bit of a problem. The Rob had to be slowly placed as the 3D printed parts were very delicate and we did end up breaking it and had to constantly glue it all together







Dr. Gaffar was really instrumental and helped us out with everything since the inception. His joy of working with the robots made us get have the same enthusiasm. Each of the parts had to be modified from time to time and Dr. Gaffar took the initiative to do all the work for us from drilling, cutting, soldering and gluing the parts together. He mentored us every step of the way and we were finally done with our Robot.



We named our weird eyed, high as always and constant smiling friend as **"Bob"**

Paper Presentations

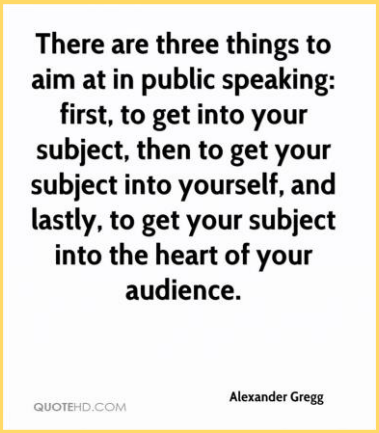
2nd October 2017

Each team were given a set of some interesting papers to go through and give a creative presentation on it. The topics were all related to the innovations in software and how the robots are designed to make them more acceptable in today's world. This practical knowledge was better than any book knowledge.

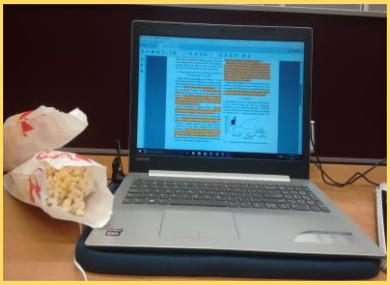
We had to discuss with each of our peers about the different papers and each of us had a very different understanding and opinion and it was very interesting to listen to each of their views. Dr. Gaffar created a platform for us to talk and get better at public speaking. This opportunity was immense and lots of preparation had to be done to make it as fun and interesting as possible.

Wide range of topics were covered and some of them are as follows,

- A study of effective social cues like *gaze, attention, preference*
- Designing a self-learning Social Robot
- Teaching and Collaboration with Robots and their feedbacks
- Involving Robots to solve real world examples
- Persuading and Recognition of Social-behavior
- How closely Robots needs to monitor Human actions
- Problems and Future scope of Robots



This is what every team set out to do and accomplished that. It was well planned and each of the individuals kept the crowd attentive throughout the presentations by constantly asking questions randomly. Lots of real world examples were considered and this made it more appealing to the crowd.



Spent a whole lot of time at Hayden and yes, I was hungry, and they were giving out free popcorn.

"Burning the Midnight Oil"

MOTION SICKNESS

SIM building Lab

November 22nd

We were asked to help the research going on the display screen of the simulator equipment of a moving car. The goal of the ongoing research was to exactly replicate real world scenarios. They had different settings and different weather's like driving in the city during day, night and in fog and driving on the highway under the same conditions.

The coolest thing about this simulator lab was that the car was providing the right feedback. The moment you hit a sudden brake, you will hit forward. These were really important to simulate a real-world experience.

They had replicated everything you would experience in the real world, from movement of the car to the usage of buttons inside. We were asked to use an iPad while driving which shows our attentive nature and behavior with different traffic density and speeds and location. It was a very good experience. As the title says, it did cause motion sickness cause we had to do the simulation for almost an hour. Tiring and Gruel some but Loved it. The data collected from the simulation was very necessary for their ongoing research so we had to carefully drive the car around like we do in the real world. Did kill a few people though.