Team G- Robographers

Progress Review 3

Individual Lab Report 4

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1.0 Introduction

This week our goals were to demonstrate the following:

1. Elevation design for pan tilt-unit by Rohit.
2. Turtle bot calibration and testing by Jimit and Gauri.
3. April tag detection and obtaining transfer function from camera by Gauri.
4. Face detection and tracking algorithm implementation on Matlab by Tiffany.
5. Image reconstruction from multiple camera views by Sida.
6. Fall validation environment set-up by all.

2.0 Individual Progress and Contribution

This past two weeks after Progress Review 2, we revisited the functional, cyber-functional architectures for Preliminary Design Review. Accordingly we set up our Fall Validation experiment goals and decided the goals for the rest Progress Reviews 3 and 4 accordingly. I did the Turtle bot calibration task. There is an online source file for this purpose. The calibration is an iterative process where the Turtle bot has to be placed facing a wall. Once the calibration launched file is executed the Turtle bot makes two complete revolutions at one speed. Then stores the error from the wall by rotating in reverse direction until it again detects the wall. Again the Turtle bot makes one complete revolution at higher speed, checks for the error and repeats this process for two different speeds. Upon completion it prints out two values. One is the gyro correction and the other is IMU correction. We then launch the reconfigure interface on ROS using rqt package of ROS, edit the new corrections of gyro and IMU.

Repeat the above calibration launch process until we get the correction values as close to 1 as possible mostly in the range of 0.998 and 1.02. I and Gauri did this for 3 Turtle bots and got them calibrated. After this I performed teleoperation of Turtlebot by making a launch file which launches the Tele_operation node and turtle_bot node. I could control the Turtlebot rotation, speed, translation forward and backward movement. We also mounted the pan tilt unit on the top of Turtle bot to determine which speed would be optimal for the camera to get steady reading as was pointed out by Professor Dolan in the team meetings.

Figure 1- Turtle bot performing calibration (screenshot of the video shown during Progress Review at Advanced Agents Technology lab)

Apart from this I was also involved in the creation of schematic and board layout of the Power Distribution Board task which is pertinent to our project. This Power Distribution board will be used to supply power to the servos of the pan tilt. The errors were eliminated. Since I am not from electronics background I took help from Gauri in working out the errors and concerns raised by the MRSD mentors in their feedback on width of the wire and clearances. In the meanwhile I also made an attempt to create launch files for progress reviews where in the system would click a photograph of a person using webcam when he smiles. Unfortunately the integration with IntraFace seems to be tricky and we will have to fix it up with the Intraface people. Today after Progress Review 3, I instantiated a random number generator which acts as a fictitious smile cost function. When this number crosses a certain threshold, the image of the video frame will be stored in the workstation desktop.

2.1 Challenges Faced

The challenges that concern me is still that we have no control over the Intraface[1]. So we may have to design our system around the working of the Intraface [1]. We are in process of developing other risk mitigation strategies which will involve interacting with Intraface people as well as taking advice from Professor Dimitri. Another major challenge that I found was the

inexperience of any member of the team with ROS which we are still working on. Since our project is more software oriented, we decided that two people should familiarize and learn openCV as fast as possible while others get their practice on ROS.

Team Work

Rohit designed the pan tilt elevation axis on CAD. To test his concept he applied his frugal innovation and created a temporary elevation rod using aluminium rods in the lab. Sida worked on 3D reconstruction from multiple cameras to obtain a single point cloud of the face of the person. Gauri apart from helping me in the above tasks, also worked on getting some experience playing with the various Kinect libraries. She obtained point cloud data, depth data using the camera. She tried to detect april tags using Kinect but that is still work in progress. However she successfully detected April tag information using web camera. Due to this we are still reconsidering whether to use Kinect or not. Tiffany developed a human detection algorithm that tracks the persons head and gives real time updates using Lucas Kanade tracker. We will use this updates in future to control the pan tilt camera such that it could track the head of the person.

3.1 Future Work

We plan to move as per our work breakdown structure. Next week's agenda includes the following.

1. I would focus on more on navigation part of the Turtle bot like moving the bot to the desired location autonomously.
2. Gauri would get the April tag detection via camera/Kinect and it would help me in the navigation of Turtlebot.
3. Rohit will work mainly on making the elevation rod of the pan tilt.
4. Tiffany will try to actuate the pan tilt unit using the tracker updates. (We will also explore the part where tracker updates can be obtained by Intraface as well as Professor Dolan suggested).
5. Sida will work on detection part, trying to concoct various strategies as how to obtain optimized facial expression reading using multiple camera. (e.g. Either by multiple reconstruction or by any other method)

3.0 References

1. Intraface Software - Fernando De la Torre† , Wen-Sheng Chu† , Xuehan Xiong† , Francisco Vicente† , Xiaoyu Ding† , Jeffrey Cohn†‡ †Robotics Institute, Carnegie Mellon University, (http://www.humansensing.cs.cmu.edu/intraface/)