Team G- Robographers

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Individual Lab Report 5

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1.0 Introduction

This week our goals were to demonstrate the following:

1. Elevation design fabrication for pan tilt-unit and integration of the mechanical assembly by Rohit.
2. April tag detection and obtaining transfer function from camera by Gauri.
3. Servo motor programming of the pan tilt unit by Tiffany.
4. Extracting the face coordinates from the Intraface head detection by Sida.

My goals for this week were the following.

1. Compiling the Intraface ROS package on 32-bit netbook of the turtlebot.
2. Creating a program that sends images to the workstation from the video if a smile is detected.
3. Moving a turtlebot to a goal coordinate.

2.0 Individual Progress and Contribution

This week my major focus was on compiling the ROS package of Intraface on one of the Turtlebot laptops. Since my laptop has the same 32 bit version 12.04 Ubuntu with ROS Hydro, I decided to compile the package on my laptop. The members of the Intraface provided me a link for the ROS package of the Intraface. This package was partially complete. I was required to install few dependencies, edit the CMakelist.txt file and edit the header files as mentioned in the documentation provided along with the package. After following the steps carefully, I found many errors during CMake as well as the part where libraries are linked to the package. I along with a Master's student from the Professor Katia's lab tried to solve each bugs. There were issues which were fixed by changing the gcc compiler versions, some were fixed by editing CMakelist.txt file where you list all the dependencies of the package. After several hours of work, we were able to get the package compiled only to realize that we had the wrong license of the package. We contacted the concerned member of Intraface regarding this on email as he was not on campus. He provided us with another link where he had updated the ROS version. When we tried to compile that, we had no luck this time solving the bugs and errors even after putting in hours of hard work.

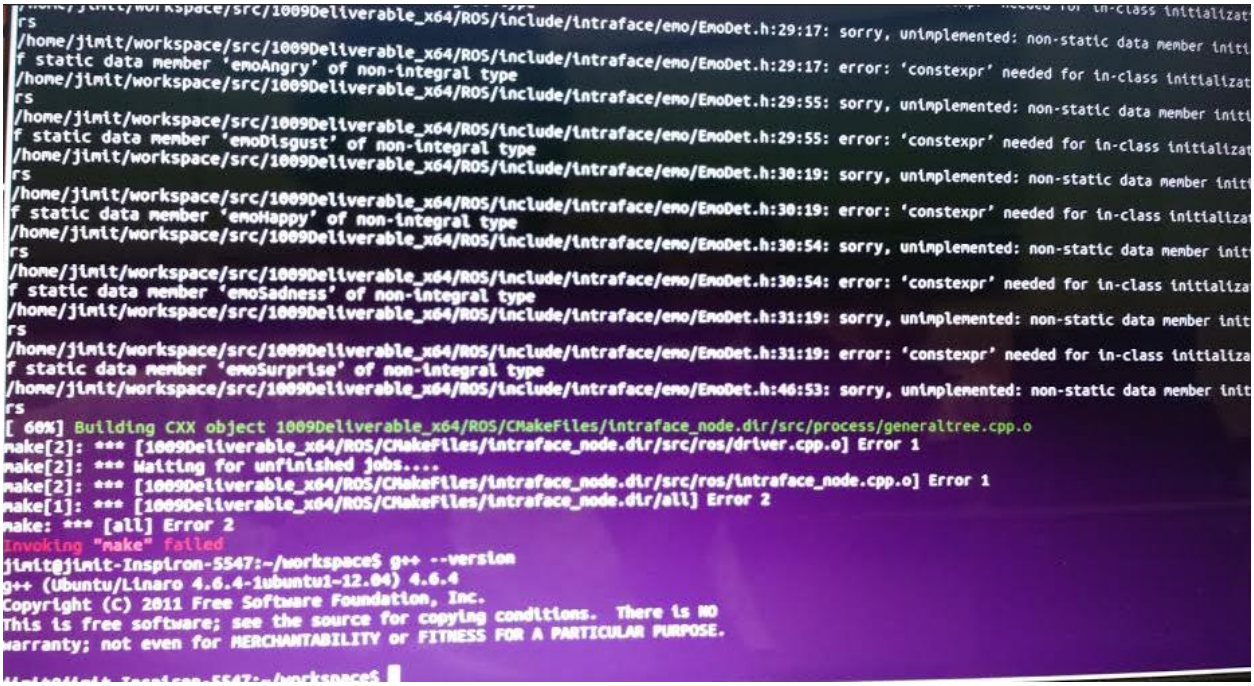

FIGURE 1: The unsolvable error during the compiling of Intraface ROS Package. This occurs after the build of executables is complete which is during the part where ROS links various libraries to the executables. Even spending hours to search for similar errors on interet no successful solution was found.

Finally our PhD advisor Sasanka Nagavelli suggested that we waste no more time on this and have it fixed by the concerned person whenever and however possible. I focused my attention towards creating a ROS program that would publish the video frames to another subriber node if and only if the smile expression reading from the Intraface software would be more than certain threshold which would be 50 %. Since the Intraface was not working I introduced a random variable. If this variable was above certain threshold the video frame would be published as a message using the sensor_msgs/image package in ROS. Since there will be a stream of images received I am yet to figure out as to which frame is to be captured and stored on the computer as the final photograph.

FIGURE 2: Two nodes created. One node i.e. /image_publisher publishing the frames only when the smile variable is above certain threshold. Another Node /image_listener is subscribed to the topic

My third task was to navigate the turtle bot by setting a navigation goal. I created a launch file which would move the Turtlebot forward for 10 seconds and turn the turtle bot for 5 seconds in anticlockwise sense at a given known/set speed. The reason we will use time and not distance or coordinates is because we are not using maps and the wheel odometry of the turtle bot. The odometry of the turtle bot was a major unsolved challenge which even the team Roborn faced last year. We do not want to delve in to that right now since none of our team members have much knowledge or experience in state estimation as well as Kalman filters.

I plan to use time as follows. Suppose I want to travel x meters at a particular angle phi. With known turtlebot angular and translation velocity I can calculate the time as distance/speed. This will give me an approximate time. This concept will be used along with the April tag detection which will also continuously update the distance remaining to final destination goal. Since we expect the system to reach the human within approximate distance of 3-3.5 feet, this attempt is worth a try for the Fall Validation set up. Once we get the feel of how things turn out, we may proceed and take measures accordingly seeking guidance from MRSD advisors and lab advisors.

One of the small task that I performed but was not a part of the goals was that I also upgraded one of the turtle bot laptops to ROS Indigo. This was suggested by pur PhD advisor since he was optimistic that Intraface would compile on ROS Indigo. This also required me to perform the Turtle bot Bringup tutorial on ROS -
http://wiki.ros.org/turtlebot_bringup/Tutorials/hydro/TurtleBot%20Bringup

2.1 Challenges Faced

The challenges I faced is the Intraface ROS package. Our project majorly depends on the Intraface software and this needs to be fixed at high priority. This software is a complete black box to us and there is a high possibility that our project integration will not be as trivial as we thought it would be. For example, we had a ROS package of Intraface which successfully compiled but did not have the correct license. I used that package and tried to link it with another sample subscriber file which would listen to its topics. While compiling I had to include various dependencies some of which are not very obvious. Few were solved but some still remain a mystery to me as to how to fix it. The only solution is to thoroughly understand the ROS package of Intraface and how it works.

The other challenges which I think will be a problem will be the integration of the various subsystems which are being developed by other team members. For instance, using Intraface facial detection and head pose information to control the servo motors will be one of the task.

Another challenge which came to light this week is when Rohit integrated the entire pan tilt unit with elevation axis on one of the turtle bots. The challenge is that as the turtle bot moves, there are unwanted vibrations in the camera. The mechanical part fabricated by Rohit was

stable but the Turtle bot itself has extra degrees of freedom in each of its own wheel. This causes the entire turtle bot to sway to and fro while moving thus vibrating the camera.

Team Work

Rohit fabricated the elevation axis and integrated the system to the turtle bot. Sida worked on extracting face coordinates from the video from the Intraface library objects. She successfully did that. Tiffany completed her work on calibrating servos to the Arduino. To explain in detail she actually calculated the angle by which the servos should pan or tilt if the face coordinates displace by x pixels across and y pixels in vertical direction. This would enable us to track the face and adjust such that the face is in the center of the frame. Gauri worked on making a ROS package for April tag detection and created a subscriber listening to the April tag coordinate messages generated using sensor_msgs package.

3.1 Future Work

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

1. Sida and I will try to fix the issue we are facing with the Intraface since it is an urgent issue that needs to be dealt with
2. I would focus on navigation part of the Turtle bot like moving the bot to the desired location autonomously.
3. Gauri will focus on finding a transfer function between camera and April tag such that we can set a goal coordinate for Turtle bot Navigation.
4. Sida and Tiffany will be working on finishing the integration of Intraface to Arduino which controls the pan tilt.
5. Rohit will be helping us out in navigation subsystem integration as well as in understanding more about Intraface.

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/)