The Robographer: Progress Review #11

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Team: G (The Robographers)
Teammates:
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ILR No.: # 10
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1. Individual Progress

Responsibilities: Project management
Mechanical Design and Development

Softwares/tools Used: Google Drive, Google Calendar, Microsoft Excel, Solidworks, Makerbot Desktop

Task Description:

Following tasks were assigned to me and completed before the progress review 11:

a. Conducting team meeting and deciding goals for PR#11
b. Fabrication of the remaining pan tilt unit using additive manufacturing
c. Completion of the mechanical assemblies
d. Checking the pan tilt unit operability
e. Aesthetics improvements

a. Setting the goals for PR#11:

1. Fabrication of the remaining pan tilt unit
2. Complete hardware integration of 3 turtlebots
3. Successful localization of the turtlebots
4. Aesthetic improvements

b. Fabrication of the third pan tilt unit using additive manufacturing:

Figure 1 : Pan tilt units (rev 2.0)

We had fabricated a working prototype of the pan tilt unit (rev 1.0) in the Fall semester using 3D printing. Moreover, I re-designed and developed 2 more pan tilt units with better specifications. As the 3D printers in the lab were not working properly, I decided to work with the 2 newly fabricated units along with the older one. However, due to inherent differences in their designs, I found difficult to use them in collaboration. Hence, I manufactured another pan tilt unit (rev-2) by the additive manufacturing process using the Makerbot 2X Replicator 3D printing machines present in the MRSD laboratory. Figure 1 depicts all the 3 pan tilt units (rev-2) developed and assembled before the PR#11.

c. Completion of the mechanical assemblies:

After completion of the pan tilt unit assemblies, next task was to integrate these assemblies with their respective turtlebots. Before the PR#10, I had already assembled the 2 remodelled pan tilt units (rev-2) and had integrated them with their respective elevation rods and the turtlebots. Before the PR#11, I decided to integrate the 3rd pan tilt unit along with the third turtlebot. This also required using new elevation rod of 30cm x 30cm size along with the newly designed pan tilt holder and elevation rod holder parts. However, the latter 2 parts take around 8 hours each for their fabrication using 3D printing. Hence, to save on time, I decided to use the same turtlebot, already fitted with the previous 40cm x 40 cm elevation rod along with the pan tilt holder (rev-1) and elevation rod holder (rev-1). Figure 2 represents the complete Robographer system consisting of 3 turtlebots integrated with the pan tilt elevate units.

Figure 2: Complete Robographer system

Moreover, we are using the global cameras mounted on the ceiling for localizing the turtlebots. Hence, one more requirement was to fit the AprilTags horizontally and with their surface facing the ceiling. For this, I decided to use the AprilTag plates manufactured by the Team Roborn (MRSD 2014-2015) instead of manufacturing them again. This was already planned and taken care of during re-designing the pan tilt elevation units. Figure 3 represents one of the turtlebots fitted with the AprilTag plate using the traditional nut-bolt fastening with the elevation rod. Moreover, as the AprilTag plates are lightweight, it becomes difficult to localize the tags using the overhead cameras. Hence, I used the cable ties for providing extra support which produced good results.

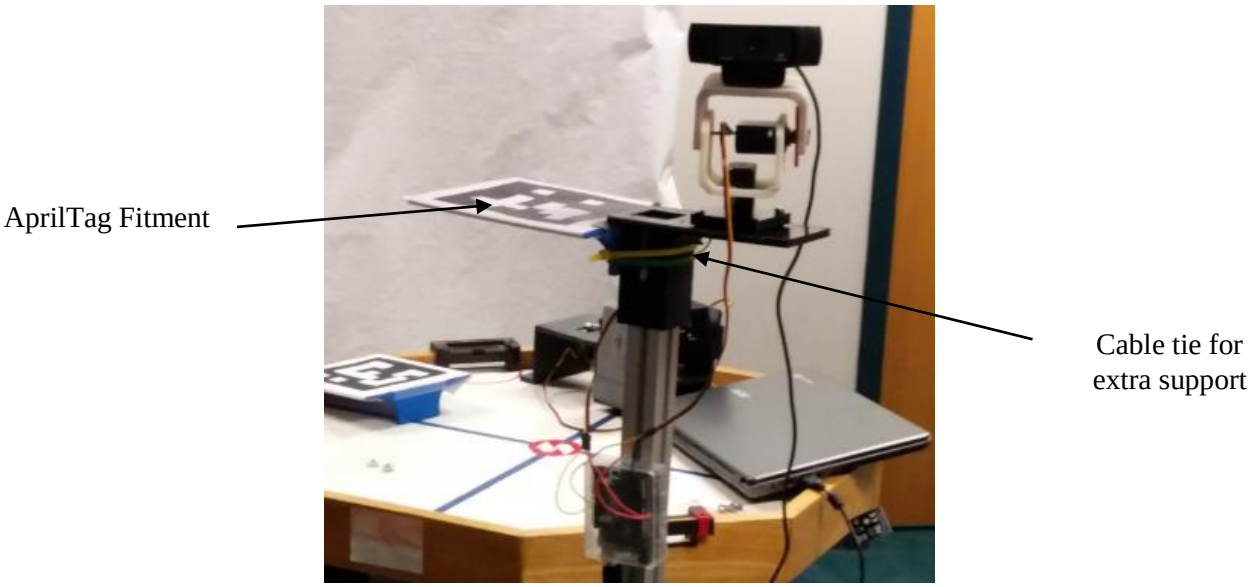

Figure 3: AprilTag fitment for localization using the global camera

d. Aesthetic improvements:

An important aesthetic improvement was made during the work before the PR#11 regarding the Arduino microcontroller fitment. I ordered plastic Arduino casings along with the double sided adhesive tapes. The Arduino cases are made up of transparent plastic material. They are lightweight and provide open passages over the pinhole placements and USB connection ports. I fixed these cases with the Elevation rods using the double sided adhesive tapes at appropriate positions, suitable for easy wiring with the pan tilt servos. This was a design consideration made prior to fabrication of the integrated turtlebot systems.

2. Challenges

Though my tasks for the PR#10 were quite straightforward, the completion involved some major challenges as described below:

1. **Printers stopped working, again:**

   Our fabrication methodology heavily relies in the 3D printing procedure. However, none of the printers were not working in the last week end. Also, that being a weekend, it was not possible to obtain technical support. Hence I decided to have another go at the printers and repaired[i] them by myself using the methodology described in the ILR#09. However, this time my attempt was unsuccessful and I was unable to repair the printers. I and Paul also informed the MRSD instructor's team about the issue. The response was very quick again and the printers were taken care of on Monday before the PR#11. This problem caused some delay in while manufacturing the 3rd pan tilt unit.

2. **System crashing:**

   After manufacturing the pan tilt units, next task was to test their operability. I wrote a test code to check the face tracking performance. I collaborated with Tiffany for this task. However, the Chromebooks crashed every time we tried to run the face tracking node. This lead to problems and restricted us to not letting work upon the collaborative pan tilt camera movements. We investigated this issue along with our advisor

Sansanka and found out that the non-updated Ubuntu kernel version was the main cause for the same.

3. Teamwork

Since the start of the project, I have taken the responsibility for the completion of the mechanical work subsystem. With the work done before PR#11, the mechanical subsystem now stands completed totally for the project. Jimit and Gauri once again worked tirelessly to complete the localization and navigation part. Even though they had some consistent problems in navigating the bots, they managed to complete the localization module successfully. Tiffany and Sida worked to calibrate the cameras and then interface face tracking along with the pan tilt units. However, she had a few problems to implement the same for all the three units. Sida also worked on interfacing the voice command, asking the person of interest to smile in order to grab his/her attention. She successfully completed this task. We were able to complete most of our subsystem work this time. However, we had problems during integrating everything together. Hence, our overall presentation for the PR#11 did not go very well.

4. Future Plans

My individual plans for the PR#12 for the Robographer Project:

1. **Calibration of the cameras:**
   The pan tilt cameras need to be calibrated for better accuracy. I plan to do this before the PR#12.

2. **The final touch:**
   The fabrication of the mechanical part of the system is now complete with 3 turtlebots, fitted with the pan tilt camera units. A permanent arrangement for some important components such as the Arduino Microcontroller, the AprilTags for localization has also been made. However, the system requires better wiring arrangements so that there remain no open ended, hanging or loose wire in the system for safety and aesthetic purposes. I have planned to complete this work before the PR#12 and will make sure to present the integrated Robographer system with an aesthetic look of a finished product.