Individual Lab Report 05

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16-681 MRSD Project

Team B: Space Robot

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Individual Progress

My work last week still mainly focused on the foot design and gecko material casting. Also I helped Nate together finished the redesign of our SolidWorks for robot chassis (see figure 1). Now we had our basic robot chassis and subsystems like linear motion system and rotation system.

For the robot leg part, I also changed the shape of the foot pad and designed to combine with using mold covers that will make more convenient for gecko material casting (see figure 2). Here I need to thank Brian for bringing this new idea and this was the first time we casted the material on the foot pad successfully.

Also I have designed the ball joint in our robot leg (see figure 2). There was a very stiff spring inside the leg and its two sides were fixed by two 1/8 inch size screw. In this way, the whole robot leg can have the ball joint function and at the same time that the rotation angle is limited to less then 10 degree. This is what we want to prepare for the robot to climb curve tube, so the foot pads can have some rotation angle to have a better attachment on it.

Challenges/Issues

For my part of the work, there were two main problems.

First was that the failure of the 3D-printed original footpad, I printed on Thursday and then got the failed part (see figure 3) on Friday. And at first time, I just thought it was 3D printing machine's problem because this happens sometime during usual time. However I tried to print the second time with the same .stl file and got the same result on Monday. I asked my friend who is doing research on 3D-print machines and he told me might be the tool path's problem in my .stl file caused this problem. And then I changed the design. Here one of the challenge in the future will be the time cost by the 3D-print machine and also the schedule of the machine shop. Even if you update the design quickly and want to print it again, you still need to wait for the availability of the machine. In order to solve this problem, and we decided to make the whole foot component separately to two parts, one is the foot structure and one is the pad. This will be better because once we finalized the idea about the foot structure , we can just redesign the pads then assemble to the foot structure to test. 3D-printing pads only takes short time and also can be printed by SolidDoodle in the lab.

The second one was about the gecko material casting. This casting problem really took us a lot of time. Even this time we simplified our design by using Brian's idea for the casting, the result was still not so good (see figure 2). I found that the shape of the foot pads would be one of the reason

because this new edition design just had less contact area. Also because of the viscosity of this gecko material during the period of casting is really high. So actually we could find that the gecko material after casting was not flat surface at all. The middle was little lower than the edges. This also brought the problem that when we were attaching the robot leg to the flat surface, it was not surface contact at all. It was more likely to be edge contact in fact.

Cross-reference/Teamwork

Nate redesigned the whole robot chassis in SolidWorks and finished the laser-cut majority of the components. And he together with Brian had finished the assembly of chassis and developed a calibration sequence for basic operations of servo motors. Nate gave the presentation this time.

Brian was still working on software part. He finished some basic gait generations that can help to move the robot forward. Also he came out a new idea for our molding which helped a lot.

Dipta had finished testing our PD boards and also help the assembly of our robot frame. He together with me finished another iteration of our robot foot casting.

Plans/Future Work

Because next week will be the last week before the first validation demo, so I will try to separate our foot design. This is because we don't want to waste too much time on 3D-printing for our foot pads test. I also will help to assemble and redesign our whole robot system. And prepare for our first validation demo in fall semester.

Figures

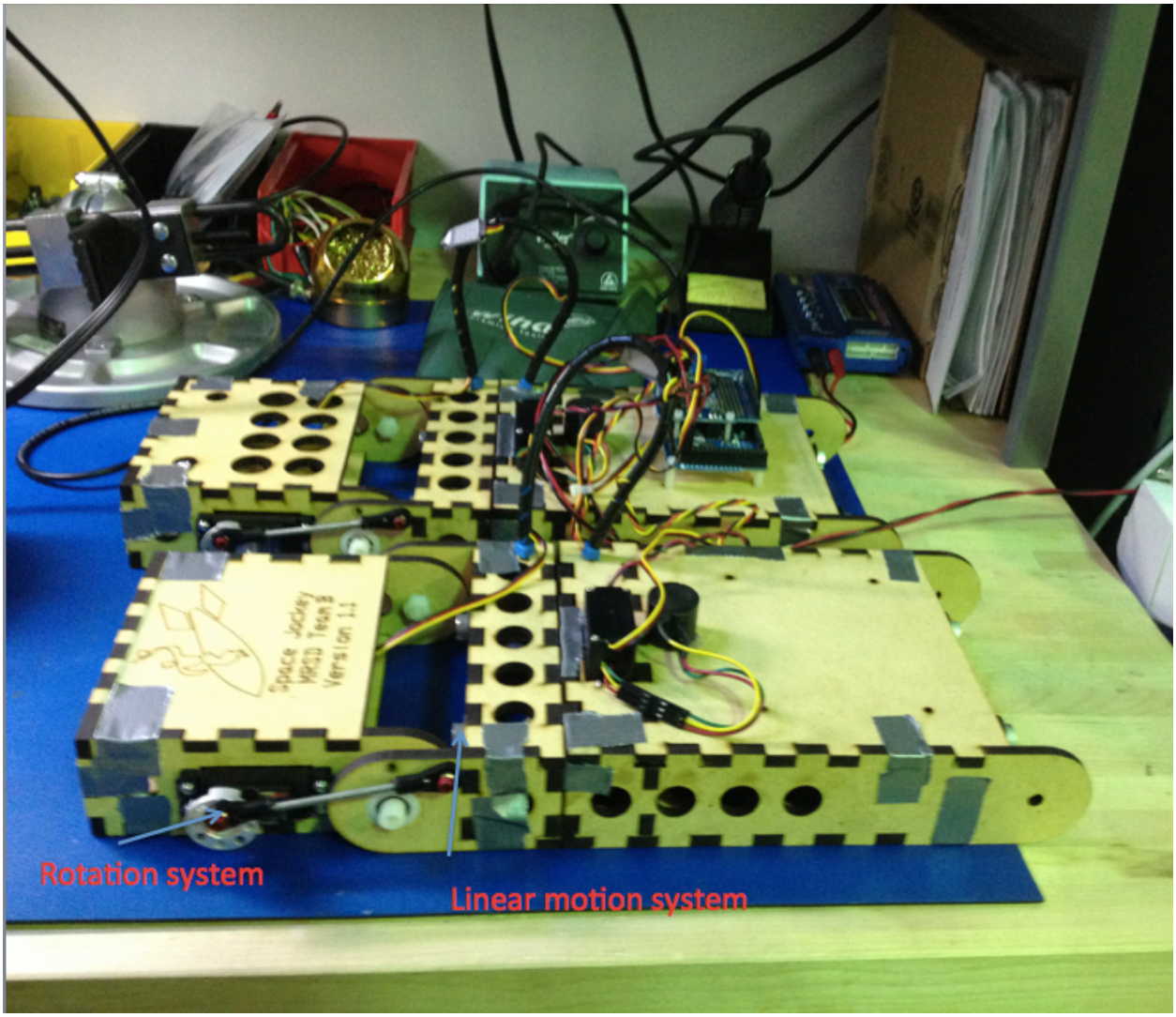

Figure1: robot chassis and subsystems

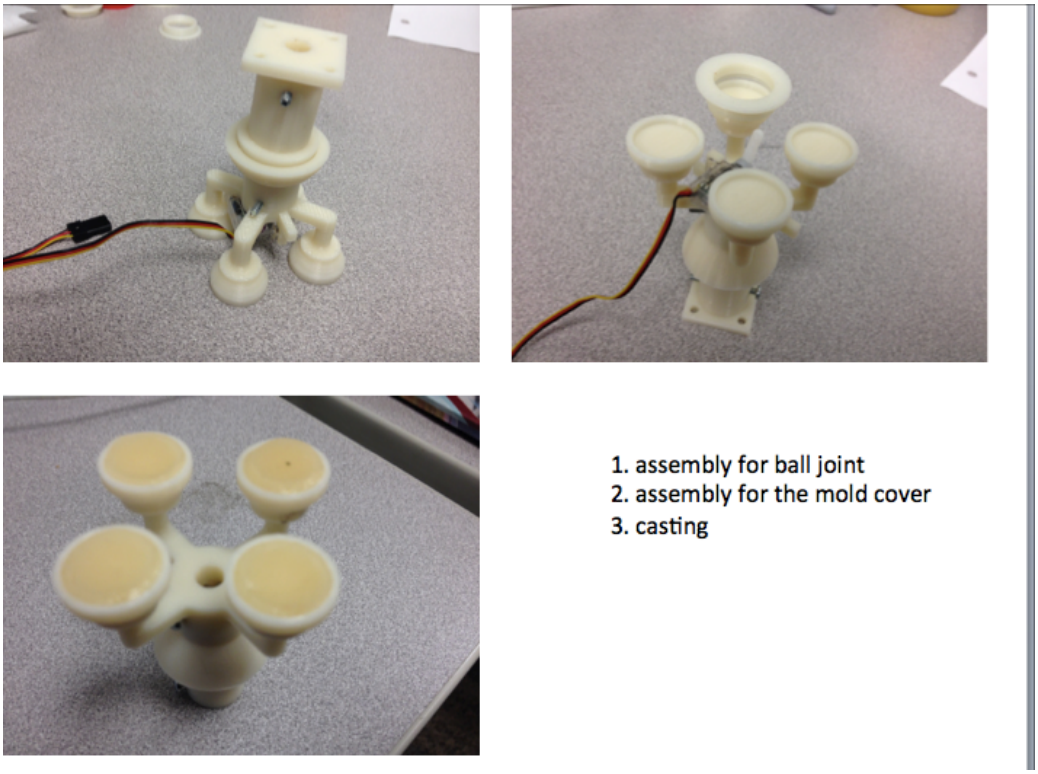

Figure2: whole process of the new edition robot foot

Figure3: failure of the 3D-printed footpad