Individual Lab Report 4

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Team B : **Space Jockey**
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ILR04
Submission date : **November 7, 2013**

1. Introduction

This report gives a brief description of our team progress along with my individual contribution so far towards the MRSD project. After our last progress review on October 24, 2013, I was working on designing the board layout of power distribution board.In the main project my role is to develop the electrical board including the power distribution board, main controller board and also circuit board for each subsystem.

2. Individual Progress

2.1. Power Distribution Board Design

Last week we had completed a schematic design of the power distribution board. This week I managed to design the PCB board layout based on the schematic. There are things need to be considered such as the width of trace route regarding how much current it provides. Based on IPC-2221 from The Institute for Interconnecting and Packaging Electronic Circuits, the trace width is calculated as follows:

First, the Area is calculated:

Area[mils^2] = (Current[Amps]/(k(Temp_Rise[deg. C])^b))^(1/c) ;*

Then, the width is calculated:

*Width[mils] = Area[mils^2]/(Thickness[oz]*1.378[mils/oz]) ;*
For IPC-2221 internal layers: k = 0.024, b = 0.44, c = 0.725 ;
For IPC-2221 external layers: k = 0.048, b = 0.44, c = 0.725 ;

Where *k*, *b*, and *c* are constants resulting from curve fitting to the IPC-2221 curves.

By assuming that the temperature rise is 20 degrees of Celcius and1 oz/ft^2 thickness, we can measure the details as follows:

- Li-Po battery channel input (7.4V, 10A): the routing to the battery shall be wide enough to provide 10 A of current. The width of the trace route shall be no less than 484 mil;

- Two unregulated servo channels output need to be running at 10 A, so the width of the route shall be no less than 484 mil;
- Three peripheral output channels that will be used for sensors or camera in the future development will need at least 1 A, so the width of the trace route shall be no less than 20.2 mil;
- One unregulated channel for the Arduino DUE power, runs 1A , so the width of the route shall not be less than 20.2 mil.

Based on the requirements listed above, I designed the board as shown in figure 1. The components have to be placed neatly so that we can get the most efficient size of the board.

Things I have learned

By designing the board layout of power distribution board, I learned that the width of the trace route for each component has to be calculated precisely in designing the board layout, using the standard IPC-2221.

3. Challenges / issues

3.1. Placing the Components in an Efficient Way

Our team faced the challenge of placing the components on the board layout in order to get the most efficient size of the board yet achieved the minimum requirement for width of the trace. Placing switches on the board used too much space on the board, so we put the port for wire instead and planned to place the switches off the power distribution board.

4. Cross-referencing with the work of fellow team members

While working on board layout design, Nate helped me in checking the width of the trace and placing the components. We worked together to achieve the most efficient size of the board layout. While working on this board layout, Songjie was designing the mechanism of detachment of the robot foot. We also had meeting with Dimi seeking for his advice about the mechanism of attachment and detachment of the robot when climbing the wall. Brian was working on the GUI and ROS RViz, and already created a simulation to control the angle of servo position using the GUI.

5. Plans / goals for following week

My future work for the project is to design and develop the electrical system of the robot including the power, main processor, motor controllers and sensors. For the next following week I will help the team to assemble the PCB board and work with Songjie to test the adhesiveness of the V-10 for one foot. We will figure out how much weight can one foot lift.

6. Figure(s)

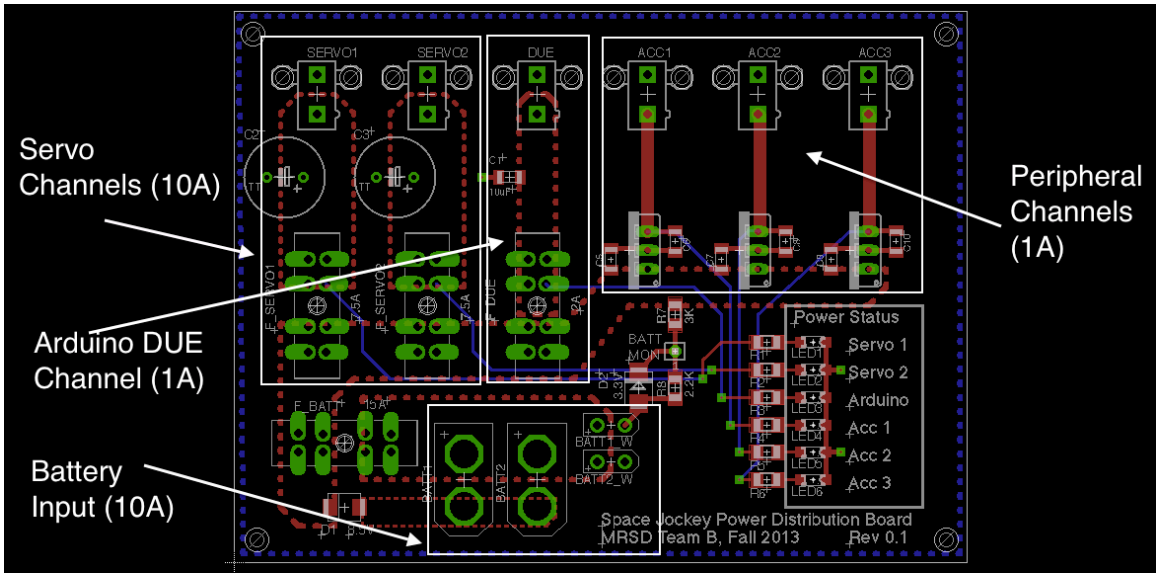

Figure 1. Power Distribution Board – PCB Board Layou