

Overview of the Electrical Team

University of Calgary Solar Car Team
Electrical Technical Documentation Team



1 Introduction

The electrical team deals with all of the electrical work for the University of Calgary Solar Car project. The electrical work can be broken down into roughly four basic areas of work; the four areas roughly are PCB design, the electrical systems, the battery system, and the solar arrays.

2 PCB Design

The PCB work for the car is done by our PCB design team. All of our PCBs are designed in Altium PCB designer. A list of the PCBs designed for the solar car is given below

- The AUX BMS
- The DC-DC Converter
- The CCS
- The Lights Board
- The Driver Control Board
- The CAN Splitter
- The Fan Board
- The Audio Board
- The Strobe Board
- The Relay Board

Some of the more complex boards will be discussed bellow

2.1 The Central Control System

The Central Control System or CCS is a board designed to control the CAN network of the car. The primary use of the CCS in the car is sending data from the CAN network to the Raspberry Pis. A picture of the CCS hardware is given in figure 1

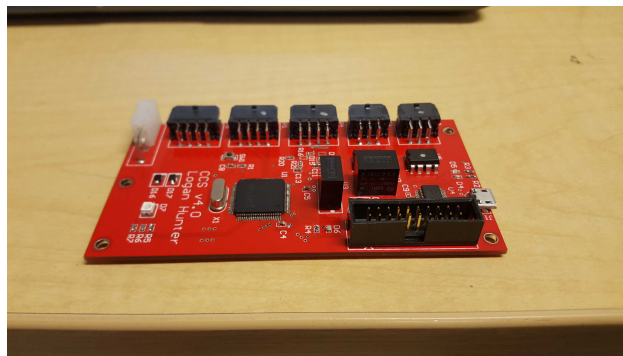


Figure 1: The CCS board Hardware

2.2 The Driver Control Board

The driver control board manages all driver inputs from the car and distributes the inputs over the CAN network. The inputs include but are not limited to acceleration and regen brake pedals, buttons for lights, drive control. A picture of the driver control hardware is given in figure 2

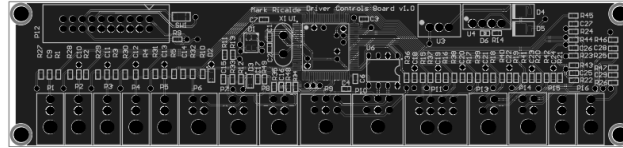


Figure 2: The Driver Control Hardware Schematic, as designed in Altium

2.3 The Lights Board

The purpose of the lights board is to control all of the lights on the car, such as the headlights. The basic operation of the lights board the CAN network will tell the lights board which lights to turn on and then the board will send power to the necessary lights. Future upgrades that the team would want to make to the light board include integration of the emergency strobe board into the lights board and a sufficient power system to run the cars horn on. A picture of the lights board is given in figure 3.

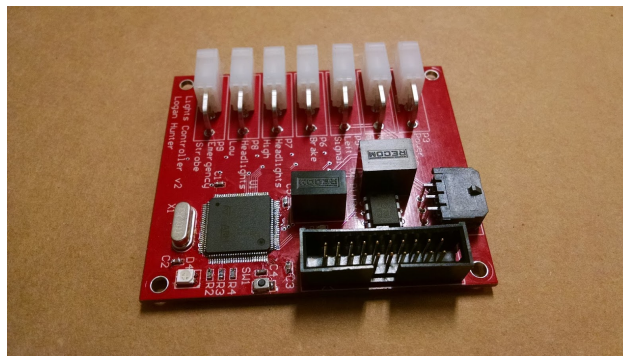


Figure 3: The Lights Board Hardware

2.4 The Audio Board

The audio board will be used to add a media player into the solar car. It is designed to take aux input from a phone or other audio source and send it to two speakers which will be integrated into the car. The audio board is currently under active development. A picture of the audio board hardware is given in figure 4

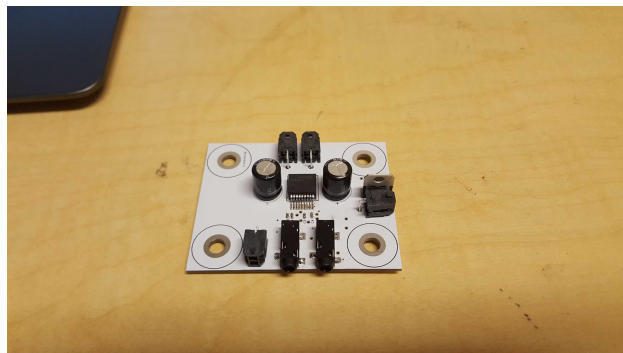


Figure 4: The Audio Board Hardware

The AUX BMS and DC-DC converter will be talked about with the battery as they are directly inside the battery.

3 Electrical Systems

The electrical systems consist of the connection of all of the electrical components we make, such as the PCBs and battery, and the ones we purchase pre-made. All of our electrical devices in the car communicate over the CANbus network. One of the largest systems in the solar car is the high voltage system. A brief diagram of the cars electrical systems is shown in figure 5

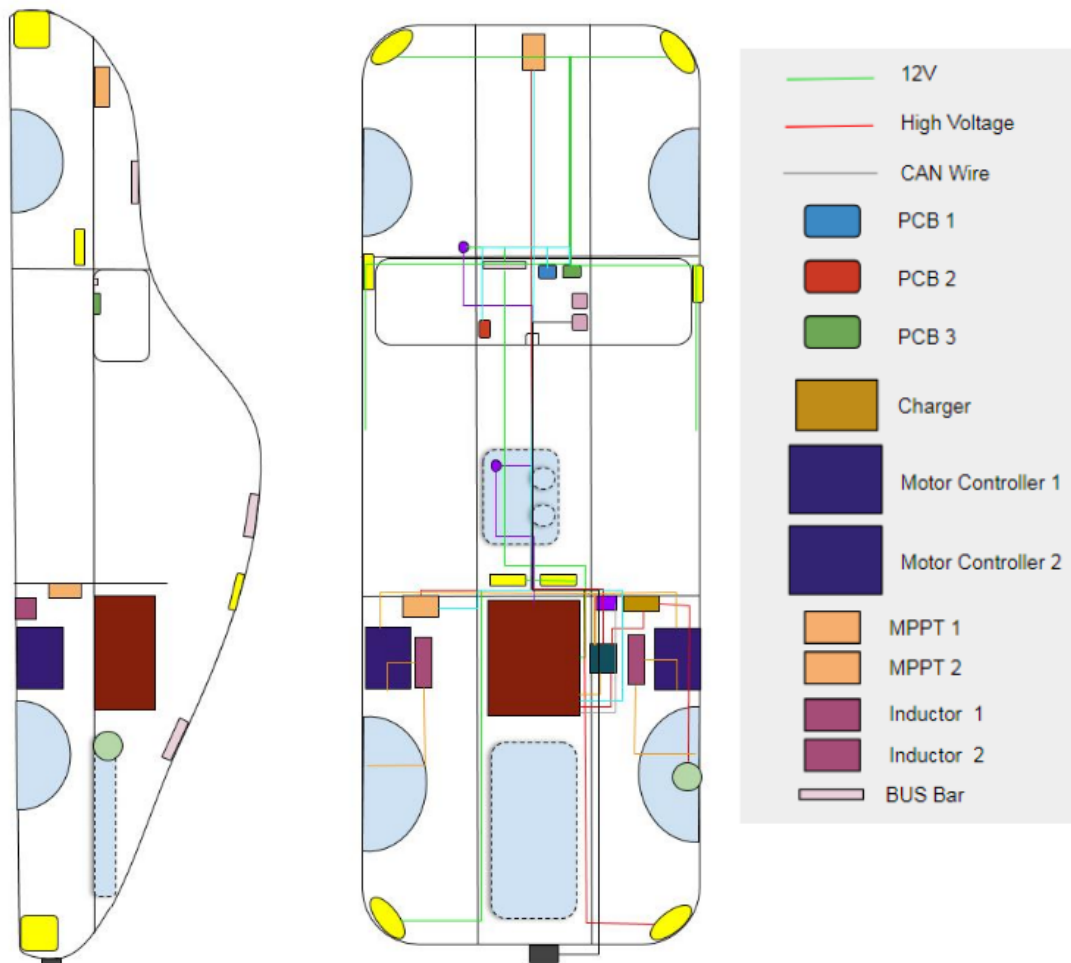


Figure 5: A rough schematic of the electrical systems in the car

The high voltage system consists of our motors, the motor controllers, and the charge system. Multiple of the high voltage components are shown in figure 6

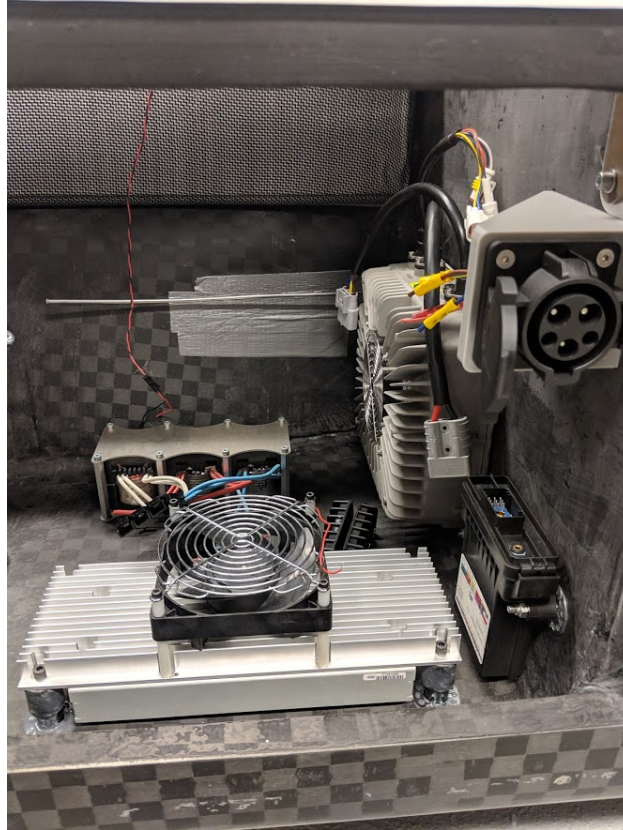


Figure 6: Some of the high voltage components of the car. Shown in the top right is the J1772 charging port, the bottom is one of the Tritium Wavesculpter 22 Motor Controllers, behind the motor controller is the motor inductors, and on the right is the charger and charge controller.

The motor controllers used in the car are Tritium Wavesculpter 22s. There is two motor controllers, one for each of the two motors. The internals of the motor controller are shown in figure 7. Each of the motor controllers costs about \$4 500 ¹. With our next generation vehicle we are planning to replace the current motor controllers.

¹All prices are given in USD unless otherwise stated



Figure 7: The internals of one of our Tritium Wavesculpter 22 Motor Controllers

The motors used in the car are Marand Arial Flux Surface Mount Motors. The motors are 98.7% efficient. They are 3 phase brushless DC motors that sit in the wheel hub. The motors can drive the car at up to 95 *km/h*. A picture of our motors are shown in figure 8.



Figure 8: The motors built into the back wheel

In the next generation car we are looking to replace our motors with an estimated cost of \$40 000 per motor.

Another of the major systems in the car is the lights system. The lights are all turned on or off through the lights control board. The lights on the car are head lights, left signals, right signals, rear lights, break lights, and the emergency strobe light. There is plans to add interior lights to the car for at demo events. A picture of the car with the lights on is shown in figure 9



Figure 9: A picture of the solar car with all of its lights on from Beakerhead 2019

4 Battery Systems

5 Solar Arrays