

---

# OREGON STATE UNIVERSITY ROBOTICS CLUB

SWARM Team Soccer Playing Robots

**2010 - 2011**

*Circuit Board Rev. 0.2*

*Erik Lane*

*January 15, 2011*

## INTRODUCTION

The goal of this robot is to compete in the 'RoboGames' International Soccer Competition.<sup>1</sup> A team of five robots competes in matches against other teams. A central computer with overhead vision system is allowed to provide control of the robots, although human intervention will disqualify a team, with the exception of stopping/starting the program in the case of a referee's whistle pausing/resuming the game.

## RULES

The robots are limited to the dimensions of 7.5 cm<sup>3</sup>, with a mass of 650g. They are not allowed to try to push other robots or to attempt to damage any of the robots in any way. They are allowed to indirectly push another robot if they are both in contact with the ball and are struggling for control of it. This is all at the discretion of the referees. The ball is an orange colored golf ball, and the two teams are directed by the referees to have a team color of either blue or yellow. There are many more complicated rules<sup>2</sup> that can be read if there is interest in the competition.

## DESIGN GOALS AND STRATEGIES

For this competition, it was attempted to keep the robot as simple as possible, both with the goal of having a simple and robust machine, as well as to extend the battery life to allow such a small robot to operate for long enough to compete well in the games. The motors were first chosen after review of videos of games in past years. It was decided that at some points having a burst of speed available gave some teams a large advantage and that was unacceptable to give up. With the speed of the motors and the size of the wheels, it was calculated that top speed was on the order of 8 ft/sec, which will keep the robots from being disadvantaged in that regard. This speed will only rarely be needed, but the other choices were deemed too slow.

The robots will be connected wirelessly to the host computer, which will be using computer vision from an overhead camera to sense the robots' positions and speeds on the field. After making strategic calculations, commands will be sent to individual robots with individual motor speeds and durations. The default will be to have a maximum duration allowed in a command on the order of 1-2 seconds, so that in the event of a system failure the robots will simply stop moving within a short period to keep from damaging anything.

The team decided against having any kind of wheel speed or motor current sensing ability, as the robot speed could be calculated from the vision system, and the motor current could be limited by duty cycle limitations set in firmware on the microcontroller. Many pins of the microcontroller were broken out to connection pins in the event that any sensing should be desired in the future. The Atmel Atmega 48/88/168/328<sup>3</sup> series was chosen for the large

---

1 <http://robogames.net/>

2 <http://www.robogames.net/rules/mirosot.php> The 5:5 'Medium League' rules.

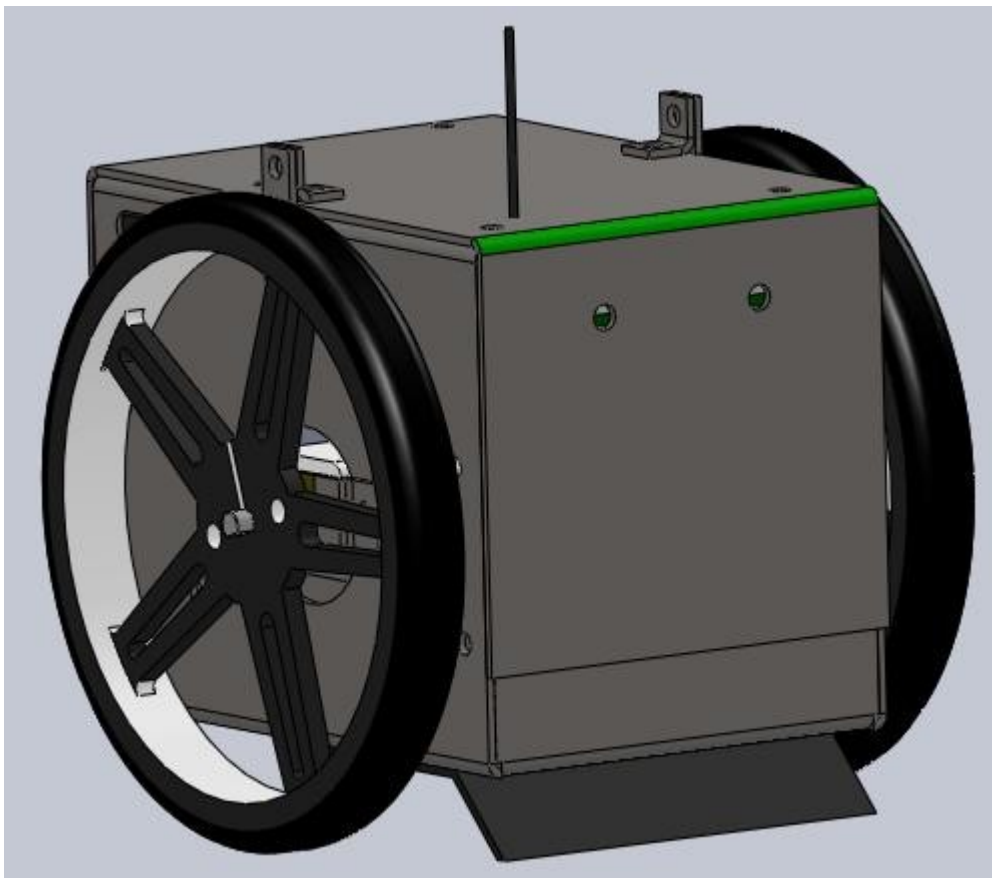
3 [http://www.atmel.com/dyn/products/product\\_card.asp?part\\_id=4720](http://www.atmel.com/dyn/products/product_card.asp?part_id=4720)

expansion possibilities and the possibility of having over-the-air firmware updating possibilities via the Xbee wireless module and a bootloader.

For the wireless communications, the popular Xbee<sup>4</sup> wireless module was chosen, to provide a simple, almost transparent serial interface end-to-end. It is unclear if the internal oscillator will provide a reliable signal for the serial communication, so a spot on the board is provided to the connection of an external crystal, should that be needed.

Circuit protection is provided via a PTC resettable fuse, and a Schottky diode. This will provide protection against over-current, over-voltage, and a battery that is installed backwards.

There are two status LEDs provided. One is connected directly to the 3.3V power line, so anytime the power is on that light should be on. The other is connected to a pin of the microcontroller, to provide more information on the microcontroller's state. They were designed to resemble eyes, to give the robot a little personality.



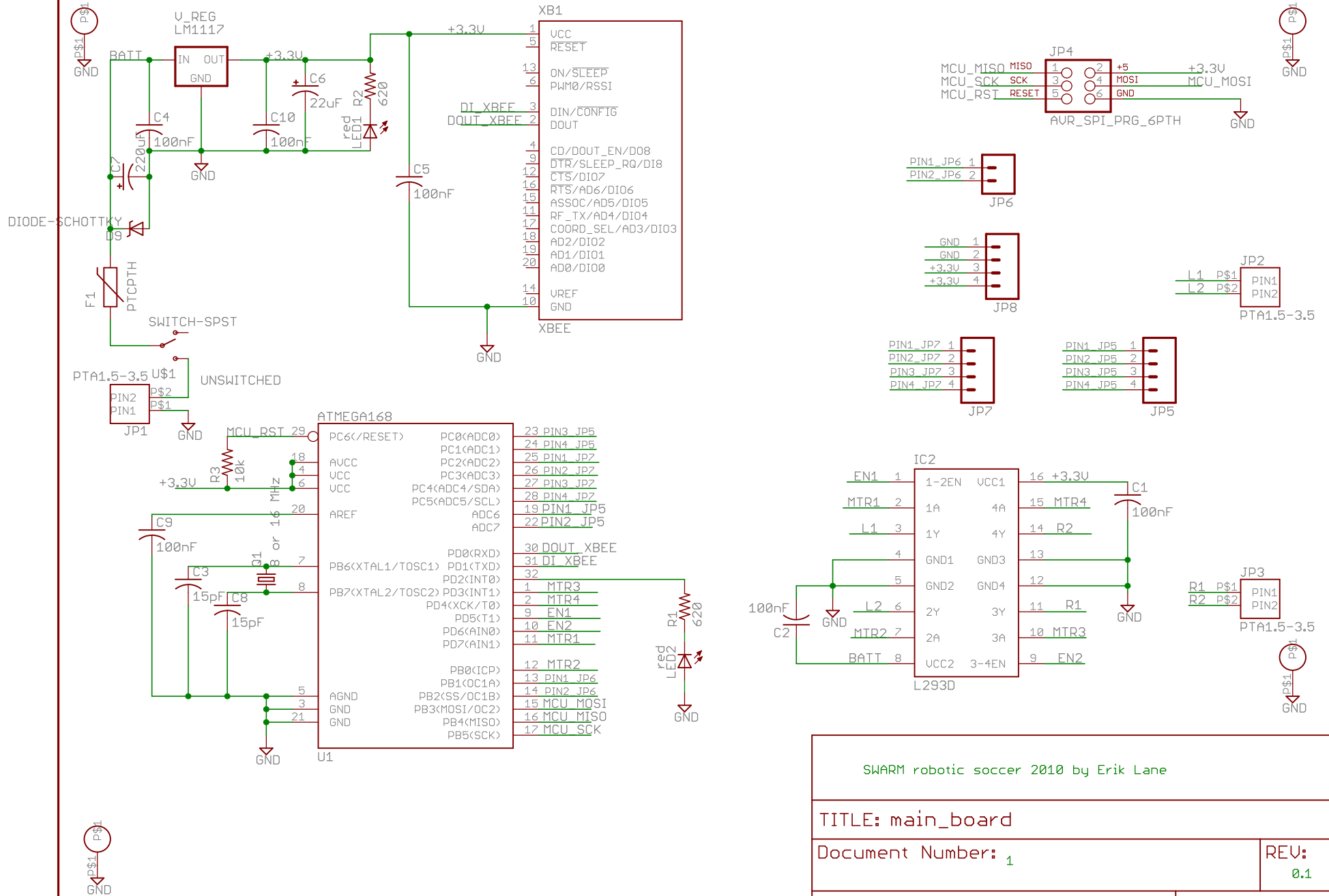
**ILLUSTRATION 1: CURRENT STATE OF MECHANICAL TEAM'S DESIGN.**

For any further information on parts used, the BOM<sup>5</sup> can be consulted.

---

4 <http://www.digi.com/products/wireless/point-multipoint/xbee-series1-module.jsp>

5 <http://tinyurl.com/swarm-team-electrical-bom>



SWARM robotic soccer 2010 by Erik Lane

TITLE: main\_board

Document Number: 1

REV: 0.1

Date: 1/8/11 8:11 PM

Sheet: 1/1

