The goal of our capstone project will be to create a wireless scoreboard for Shore Collaborative in Chelsea, MA. The first major consideration was how best to build the 7 segment displays. Initially, the plan was to wire strands of LEDs together in order to create the 8 displays. However, it was determined to be more time and cost efficient to purchase prebuilt 6.5" displays. Upon arrival it was determined that these would satisfactorily complete the required tasks. They were bright and large enough to be viewed from a respectable distance, and they were not of an obscene current draw. Presently, more displays are being ordered, as initially only two test displays were purchased. The next step will be to mount the displays into a sheet of acrylic. This will be done using a laser cutter to ensure precision and to prevent cracking the acrylic.

The next major subsystem is the scoring circuit. This was initially prototyped in the program Logicworks. The circuit is built using a 74_47 BCD to 7 segment driver and a 74_192 decade counter. Buttons on the remote control will be pressed to increase and decrease the score for both the home and away team. These circuits have already been prototyped on breadboards and worked flawlessly with the 7 segment displays built. The next step is to make more permanent boards by soldering the components onto protoboards. Finally, the boards will need to be mounted into the scoreboard in a way which will prevent them from moving.

The timing section is similar in nature to the scoring section. It has already been designed in the program Logicworks and then put into the CAD software EAGLE. A PCB has been ordered from SEEED studios. It should arrive in the week following spring break. Should the PCB have errors then most likely the components will need to be put onto a protoboard instead as the shipping time for components is very long and would probably hold up deadlines. Once the PCB is confirmed to work, then it will be possible to mount it into the scoreboard housing as with the other components.

A power center will also need to be created for this project. This will be a central location that will allow for all boards to get their necessary voltages from. A 12 V battery will be the source of power for the entire unit, excluding the remote control. A circuit board will be located near the battery with spots for 3V, 5V, and 12V on the board. The 3V and 5V sources will be created using voltage regulators. The 12 V source will be from the battery itself. All boards will also be able to be grounded here to allow for easy debugging. So far no significant work has been done on this section. The voltage regulators were ordered, however they did not arrive with the other components and need to be ordered again. The battery will be ordered at a later point once the frame is more put together so that we can better determine the physical size restrains of the battery. A charger will also be purchased. Until a battery is ordered, work will be

done using a CPU power supply.

The physical scoreboard has been designed on paper. The key now is to build it. The plexiglass that the digits will be built into has been bought and if everything goes as planned will be cut properly by the end of this week. Once the digits are cut out, it will be painted black to create a better image. The frame of the scoreboard will be made out of 2 x 6 panels of wood. Notches will be cut down the sides to hold the plexiglass. The backing will be a piece of plywood that will have all of the circuits mounted to it. Two PVC pipes will be put on the sides to allow the entire unit to be mounted on tripods. This represents a major portion of the work that still needs to be done.

The modular wireless transceiver system is composed of 4 major subsystems. The first major subsystem is the physical transceiver. Multiple radios were considered when researching wireless transceivers. The final decision was to use the XBEE wireless transceiver, as it provided many features that were desired for the project. The XBEE radios can handle multiple networks, and multiple channels, allowing many of the same controller to be used in the same location. In addition to these features, the XBEE radio allows for easy UART communication, and configuration using AT commands over the UART channel. One major obstacle to using this radio is that is operates at 3.3V, requiring level conversion for communication to the radio. At the moment, further prototyping using the radio is stalled waiting for a 3.3V source to use to power and drive the level converters. The XBEE radios have been tested and configured using development boards and test software provided by the manufacturer. The next step is to test serial communication to and from the AVR.

The micro-controller that will be used to communicate with the radios is the ATMEGA168. This is a very powerful micro-controller from the ATMEL AVR family of 8-bit micro-controllers. This was chosen for it's speed, relative ease of use, and the fact that it has an on board UART. To begin the development, a target board had to be assembled for the AVR Dragon programming board. This board is currently completed and has been tested. The target board currently is capable of programming an ATMEGA168 and testing basic functionality using an LED. In the final circuit, the micro-controller will run at 20MHz using an external crystal oscillator. This is to maintain a consistent clock for the UART system, allowing for consistent and reliable communication to the XBEE. The crystals to accomplish this have been ordered and are currently being shipped.

The final wireless circuit will contain the XBEE radio, the AVR micro-controller, and an I/O subsystem. On the transmitter side, this will consist of a multiplexer connected to a bank of buttons. A mux is used to minimize the number of I/O pins used to receive input, as the bank

can be scanned one button at a time very quickly and monitored for changes. On the receiver side, a shift register is used for output for the same reasons that the mux is used on the input. Basic functions to control the mux have been designed, but have not been tested yet. The code to control the shift register is currently being debugged, and should be finished in the near future. The majority of the wireless circuit has been prototyped, and only code has to be written at this point to make the system operational. The final radios will be assembled on protoboard, as they are not exceptionally complicated from a wiring standpoint.