ECE Senior Design Project Proposal
For
Swim Team Scoreboard

February 24, 2004

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4.1 - Nathan Keane

4.2 - Sang Hoon Choi

4.3 – Karl South

5. Schedule

6. Budget
1. - Project Summary

1.1 - Project Goal

The goal of this project is to design an informational display system to present current swim meet times and scores for the Inland Empire Swimming Committee.

1.2 - Project Background

The Inland Empire Swimming Committee consists of 19 clubs from parts of Washington and Idaho. All of the clubs share a single scoring system and transport it between meets in a custom-built trailer.

The scoring system consists of a scoring computer, which runs a timer, handles incoming time signals, determines placing and sends this information to a scoreboard. The scoreboard is actually a collection of single, 8.5” x 14” display boards containing anywhere from 1 to 10 of these individual boards. Each display board contains eight 7-segment digits. Because the Inland Empire Swimming Committee has only one of these display boards to use, the useful information is not displayed for a long enough time.

1.3 - Methods to be Employed

To accomplish the project goal, we will employ a wireless transmitter to send the score data to a microcontroller driving a monitor control board with a spare monitor attached to it.

1.4 - Primary Project Objectives

There are four primary objectives for this project. The first objective is to capture the data being sent from the timing computer to the scoreboard. The second objective is to send the captured data to our monitor display system. The third objective involves deciphering the lane times and other information. The final objective is to put the data into a readable format and send it to the monitor.
2. – Project Description

2.1 - Objectives

The first objective is to capture the data being sent from the timing computer to the scoreboard. The second objective is to send the captured data to our monitor display system. The third objective involves interpreting and decoding the lane times and other information. The final objective is to put the data into a readable format and send it to the monitor.

2.1.1 - Secondary Objectives

For our second primary objective, sending the data to our system, a secondary objective is to send it wirelessly. This is not a “must have”, as the data could be transmitted over a hard-wired link, but merely a “nice to have” feature. If the wireless data transmission method is used, another “nice to have” objective would be a data encryption method so as not to interfere with other devices.

Deciphering the data to retrieve the necessary information from the timer computer involves several secondary objectives. Once the data is in the microcontroller, it will need to be decrypted, if an encryption algorithm was used. Then the microcontroller will have to pull out the specific parts of the timer computer information that should be displayed.

The fourth primary objective has several secondary objectives. First, a graphical display scheme will have to be developed. We will need to present a wealth of information in a meaningful way. Software display controls will have to be developed for the microcontroller to tell the monitor control board what to send to the monitor.
2.1.2 – System Constraints

Our monitor display system must operate under several constraints. The existing system is transported in a trailer that is already full, so our new system must be easily transportable. It should be less than 60 lbs and no more than 2’ long by 3’ wide and 10’ deep. The Inland Empire Swimming Committee doesn’t want to spend very much money on this project, so it should be developed as inexpensively as possible. The new monitor display system must not disrupt the operation of the existing scoreboard.

If the wireless data transmission objective is achieved, there are several constraints that the wireless transmitter/receiver system must operate under. We don’t want to interfere with other wireless devices in the area or have to obtain any sort of license to operate our system. The wireless transmission must have a minimum range of 100 yards.

2.1.3 - Design Metrics

The pair wise comparison chart could be used to evaluate how well the design achieves the projects primary objectives. The four primary objectives as discussed above would be used along with several different methods to accomplish the goal. The spare monitor display system would be one solution. Another solution considered was to use the auxiliary computer that is attached to the timing computer to host an intranet page that would display all of the necessary information.

2.2 - Project Significance

Displaying the current event, heat and placements for each lane with their time information for extended periods will allow swimmers to be able to see their scores. It will allow the matches to be more organized, as parents will be able to see what event is currently being swum, and how long until their kids are going to be competing.
2.3 - General Plan of Work

The general plan of work consists of four stages.

The first stage is to capture the data sent to the scoreboard from the deck computer. We will then interpret and decode the data so we can understand how the deck computer communicates with the scoreboard. This data will then be converted into a readable format.

The next stage of work is to send the data that is sent to the scoreboard to a monitor system, preferably using wireless transmission. To display the data on the monitor system we will be using a VGA board with a RS232 output. The data will then be decoded and then displayed on the computer monitor.

The next stage we will implement a user interface and server system so the results can be easily accessed via the Internet after each meet is over.

The final stage will be to build a new 10’x3’ or 3’x8’ scoreboard with light bulbs or LED’s. The scoreboard will display all of the same data as the monitor system, but it will be used in accordance with the monitor system.

2.4 - Description of Methods & Procedures

2.4.1 - Achieving Objective 1

The first objective (capturing the data being sent to the scoreboard) will be accomplished fairly simply. The timing computer sends a signal to the scoreboard through a phono-plug connection. It also has two serial connections that another computer can be attached to. One of these serial connections is used by the auxiliary computer which leaves one serial port free for use. If serial port 2 doesn’t provide us with the needed data, the output on the phono-plug will have to be split between the existing scoreboard and our monitor display system.
2.4.2 - Achieving Objective 2

Wireless signal is the preferred method of data transmission. A wireless transmitter will be attached to the signal coming from the timing computer. Our monitor display boards will be equipped with wireless receivers to intercept the data signal. We will buy the wireless transmitters and receivers. The system must have a minimum range of 100 yards. A software data encryption method will be obtained and implemented from publicly available algorithms.

2.4.3 - Achieving Objective 3

Deciphering the data to pick out all of the useful information will be done largely with custom software developed for the microcontroller. We will communicate with Colorado Time Systems, the manufacturer of the timing computer to find out how to interpret the data signal.

2.4.4 - Achieving Objective 4

The timing computer will send a lot of information to our display system. It will send:

- The current event and heat number.
- The elapsed time for the current match.
- The split times for each lane if it is a multiple lap match.
- The final time for each lane.
- The upcoming event and heat number.

All of this data will ideally be displayed on the monitor display system at the same time. The display scheme will be developed from scratch, likely going through many iterations before settling on one that displays all of the available information in a useful, easy to read, manner.

Besides developing a display scheme, we will need to get the microcontroller communicating with the monitor board. The microcontroller will have to tell the monitor board what to display and how to display it.
2.5 - Viability, Reliability and Impact Considerations

Cost and Manufacturability: The cost of the monitor system will be minimal for the following reason: The monitors and the VGA chips are spare parts that were already purchased. Also the transmitters and receivers used low cost. The manufacturability of this system is relatively simple. It is comprised of a VGA board, transmitter, and a receiver which are all highly compatible.

Environmental Issues: The only environmental issue that could arise is with the wireless system. Since the wireless transmission from the deck computer to the VGA board is at a minimal distance we will be using a frequency below FCC regulation. This will keep our system from interfering with any other system running during the meet.

Social, Political, and Regulatory Issues: The FCC has regulations on the amount of radio interference an electronic device is allowed to create in the United States. We will be using commercially available products that meet these regulations.

Sustainability: The transmitter and receiver we will be using for this project are very low power. Most of the transmitter and receivers will run in the range of 5-10 volts. So an easy to replace 9-volt battery can be used to power communications section of the system.

Ethical and Safety Concerns: There are no ethical or safety concerns related with our project.

2.6 - Technical Advisor

James F. Frenzel is a Professor in the Department of Electrical and Computer Engineering and will be our technical advisor. He will give advice about wireless distribution and microcontrollers. We plan to meet with him every 2 weeks for project updates, questions and to ensure that we are still on track.
3. Bibliography


4. - Biographical Sketches

4.1 – Nathan Keane

Nathan Keane

1529 N. Polk Ext, Apt 1
Moscow, ID  83843

Education:

Undergraduate in Computer Engineering attending the University of Idaho. Expected Graduation: December 2004

Experience:

**DMJMH+N**, Richland, WA (Summer 2002)

DMJMH+N is an engineering and architectural firm. Supported office as a Domain Administrator, Converted extensive Excel files into Access Databases, upgraded computer hardware and software, information technology support, updated AutoCAD files, implemented a web based reference database for tracking in-house documents.

**Intel Corporation**, Folsom, CA (June through December 2003)

Supported DPG-CPD-PDE group working on Silicon to Simulation project. Measured I/V curves for standalone transistors, diodes, capacitors, and BSRs. Performed simulations to correlate the measured data with. Created and updated a website to display the collected data. Created simulations for the measured devices using Cougar.

**United States Antimony Corporation**, Thompson Falls, MT (Summer 2001 - Present)

Website Administrator. Computer technician. Provided computer support as a network administrator, photographer, website designer, document designer.
4.2 – Sang Hoon Choi

Sang Hoon Choi

645 West Pullman Rd #203

Moscow, ID  83843

Education:

BS, Industrial Engineering, Kei-Myung University in Korea, 1999.

Undergraduate Computer Engineering attending the University of Idaho.

Expected Graduation: December 2004

Experience:


Adult[lifelong] education school in Kei-Myung University (Summer 1998)

Teaching assistant, Taught how to use Windows and Microsoft office.

WooSung Industry DaeGu, Korea (March through July 1998)

Efficient Workshop design project. Measured working environment, working condition, and arrangement of machine. Designed efficient workshop to be able to produce more products.

DaeWang Dye Works DaeGu, Korea (March through July 1999)

Occupational therapy research. Measured and analyzed operation efficiency, a mount of work done, the motion of workers, and the progress of work. Optimized the motion of workers process control and schedule.
4.3 – Karl South

Karl South

224 Baker St. Apt 6
Moscow, ID  83843

Education:

Bachelors Science Electrical Engineering attending the University of Idaho.

Expected Graduation: December 2004

Experience:


Other experience includes advance studies of electromagnetics and signals and systems, along with a solid background of microcontrollers and wireless communications.
5. – Schedule

Following is a schedule for the project key dates, deadlines and milestones. The schedule is mainly focused on tasks for the first semester. Those tasks planned for the second semester will be scheduled then.

<table>
<thead>
<tr>
<th>Deadline Date</th>
<th>Milestone</th>
<th>Personnel Involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 5, 2004</td>
<td>Primary Objective 1 Completed. Data is captured from the timing computer.</td>
<td>All</td>
</tr>
<tr>
<td>March 9, 2004</td>
<td>Primary Objectives 2 and 4, send the data to the microcontroller and develop a graphical display scheme, started concurrently.</td>
<td>Karl and Choi – Objective 2 Nate – Objective 4</td>
</tr>
<tr>
<td>March 16, 2004</td>
<td>Graphical Display Scheme design is complete and accepted.</td>
<td>Nate</td>
</tr>
<tr>
<td>March 16, 2004</td>
<td>Software starts being developed to create images on the monitors.</td>
<td>Nate</td>
</tr>
<tr>
<td>March 19, 2004</td>
<td>Data format is discovered and useable data from the timing computer is recovered.</td>
<td>Karl, Choi</td>
</tr>
<tr>
<td>April 2, 2004</td>
<td>Wireless data transmission working.</td>
<td>Karl, Choi</td>
</tr>
<tr>
<td>April 9, 2004</td>
<td>From interpreted data signal, determine times, places, scores, etc.</td>
<td>Choi, Karl</td>
</tr>
<tr>
<td>April 16, 2004</td>
<td>Data sent from wireless receiver to monitor control board, functional.</td>
<td>Karl</td>
</tr>
<tr>
<td>April 16, 2004</td>
<td>Communication between microcontroller and monitor control board is completed; the microcontroller can display things on the monitor.</td>
<td>All</td>
</tr>
<tr>
<td>April 19, 2004</td>
<td>System integration, get all the parts working together.</td>
<td>All</td>
</tr>
<tr>
<td>April 23, 2004</td>
<td>Working model.</td>
<td>All</td>
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6. **Budget**

<table>
<thead>
<tr>
<th>Personnel</th>
<th>1st Sem. Hours</th>
<th>2nd Sem. Hours</th>
<th>Total $$</th>
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<tbody>
<tr>
<td>Karl South</td>
<td>150</td>
<td>100</td>
<td>6250</td>
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<tr>
<td>Sang Hoon Choi</td>
<td>150</td>
<td>100</td>
<td>6250</td>
</tr>
<tr>
<td>Nate Keane</td>
<td>150</td>
<td>100</td>
<td>6250</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>18750</strong></td>
<td></td>
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**Equipment:**

<table>
<thead>
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<th>Quantity</th>
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</thead>
<tbody>
<tr>
<td>Rabbit Microcontroller Development Kit</td>
<td>200</td>
</tr>
<tr>
<td>Wireless Transmitter</td>
<td>50</td>
</tr>
<tr>
<td>Wireless Receiver</td>
<td>50 ea.</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>300</strong></td>
</tr>
</tbody>
</table>

**Total:**

**Labor:** 18750

**Equipment:** 300

**Total:** $19,050