
Background:

Having SPDL on your resume has landed you a job on the pilot development team for ESPN0xFF, a new absurd SPoRTS TV network. Dozens of studies have shown that some of the most popular varieties of SPoRTS involve a mash-up of two seemingly unrelated activities, such as skiing and shooting (biathlon) or chess and boxing. As a team member, you are charged with pitching examples of absurd biathlon-inspired SPoRTS games that will be used to entertain the next generation of discerning media consumers.

In a focus group study, the Simulated Presentations of Ridiculous Technological SPoRTS (SPoRTS) will be viewed and enjoyed not only by your fellow ME218 students, but also by a throng of interested people (including children, 218 alumni, and random people off the street) who may know little of the technology involved. Your design should be suitable and appropriate for viewing and use by a multitude of interested potential players of all ages.

The SPoRTSs will be displayed and demonstrated on tables in the Bldg. 550 Atrium. Keep this in mind when designing your machine.

Purpose:

The underlying purpose of this project is to give you some experience building an electro-mechanical widget. We expect that this will involve working with sensors, driving actuators, designing event driven software and implementing that software in C on a pair of 'C32 Boards. These are the elements that we expect to see in every solution.

Your lab kit contains sensors, signal and power transistors, although you are not limited to using only the parts in your kits. You are, however, limited to an expenditure of **\$160.00/ team** for all materials and parts used in the construction of your project. Materials from the lab kit or the Cabinet Of Freedom do not count against the limit; all other items count at their Market Value.

On the night of the presentations:

The auditions for the new series will take place in the Atrium of Bldg. 550 (our classroom building) where the SPoRTS will be presented. They will be distributed around the Atrium and the space leading to the glass garage door. The guests will wander around the room visiting the various SPoRTS and experiencing the different teams' interpretation of what constitutes sets of engaging Absurd SPoRTS. You should strive to make the experience an exciting, active, electro-mechanical one. *Give the audience not the SPoRTS that they need, but the SPoRTS that they deserve.*

Specifications**SPoRTS Operation:**

- The SPoRTS will power up into a lockdown (inactive) mode to maintain safety and security. The only way to exit this lockdown mode and enter the game will be the use of an access badge. The access badge will be an SPDL-supplied card emblazoned with a unique pattern of secret markings. Your SPoRTS will be required to optically detect the pattern on the access card and start operation of the SPoRTS.
- The producer of the series has demanded that the SPoRTS should include interactions with two users. The head of development has dictated that this requirement be met by assigning one 'C32 to each user's interactions.
- The team in Market Research has determined that continuous interaction between the players is essential for overall player satisfaction, so gameplay of your SPoRTS should not progress without the active involvement of both players.
- We all know that the attention span of the average TV viewer is very limited, so the average player should take approximately 30 seconds to interact with your SPoRTS. No one except Emil Svendsen should be able to complete the process in less than 20 seconds.
- In the event that the users are unable to complete the interaction within 45 seconds, the SPoRTS should stop interacting with them, return to lockdown mode and indicate that it is ready for new users.
- Your SPoRTS's gameplay should involve at least 3 distinct user interactions for each competitor.

- The process of interacting with your SPoRTS should progress through several stages, with the SPoRTS responding differently in the different stages depending on either user performance or choices
- Your SPoRTS should require large scale motion on the part of the user for at least one of its interactions.
- At least 2 of the interactions with each user must each produce different effects based on the stage within the gameplay of the SPoRTS.
- Each SPoRTS should include a creative display of the passage of time. **7-segment displays don't count.**
- Each SPoRTS should include an indication of when it is active (and therefore responsive to interactions) and when it is powered down.
- When the players complete the game, the SPoRTS must provide an exciting audio and/or visual experience that will inspire hope and joy in the hearts of viewers everywhere.
- Each 'C32 in the SPoRTS must react not only to events that it detects directly, but also to events seen by the other 'C32 and to the passage of time. Each 'C32 should be capable of conveying at least 8 distinct messages to the other 'C32 (you are not required to use all 8 messages in your gameplay). Communication should be triggered by the occurrence of significant events, and not continuous.
- Interactions with a user on each 'C32 must influence the gameplay of the other 'C32.
- The SPoRTS should be usable without human instruction. Any static instructions must be only in pictorial form (Think: Ikea assembly instructions).

Basic Specifications:

- A team of four class members will construct each SPoRTS.
- Each SPoRTS must have parts that visibly move under the control of each of the C32s.
- Each team must construct a SPoRTS. While it is permissible to use consumer devices as components, the intellectual property requirements of the network require that such devices must be substantially modified before incorporation into your project. We don't want you to just buy significant portions of your project. If there is any question as to whether or not the purchased component has been modified significantly enough, please see the teaching staff.
- Each SPoRTS must respond to at least three distinct inputs/interactions.
- At least one of the user interactions with each C32 must be interpreted as an analog input from the user.
- In addition to the analog input, at least one of the user interactions with each C32 must involve non-contact sensing.
- Each SPoRTS must provide the user with feedback about his/her actions. The feedback must include at least one of: haptic/audio/tactile feedback. Multiple modes of feedback, including modes not listed here, are encouraged.
- The complete SPoRTS must be a self contained entity, capable of meeting all specifications while connected only to the project power supply that will be provided.
- In order to fit into the trunk of the Batmobile that ESPN0xFF bought last year, the SPoRTS **MUST** fit into a footprint no more than 18" wide by 18" deep by 36" high. During operation, the user interaction may occupy no more than an 24" wide x 18" deep x 80" high volume in front of the SPoRTS. Two SPoRTS must both be usable while sitting together on one of the 5' wide tables in our classroom. The entire SPoRTS must be easily and safely moved from the construction site to the grading session and then again to the Atrium for the presentations. Make sure that you plan for this.

- The emphasis in the project is on *robust* electronics, software and mechanical systems built with *real craftsmanship*. Paint alone does not add to either functionality or craftsmanship. This is not to say that you may not decorate the machine, simply that it should not become a focus. Any painting that is done near the SPDL must be done using appropriate masking so that **no** paint residue is left on the building, furniture, sidewalk, driveways, grass or trees. **No Painting in the SPDL!**
- While it is normally not a good practice, the finished circuitry may be constructed on your proto-board. This has been done to allow you the maximum time to spend on your project, without having to learn electronic prototyping techniques as well. Be sure to secure the proto-board and connections so that they will not be disturbed by the moving process.
- Accurate schematics and state diagrams are such a useful aid in debugging that **you should be prepared to show your up-to-date schematic or state diagram to any coach or TA whenever you ask them for help on your project.**

Safety & Hygiene:

- The SPoRTS must be safe for both users and spectators.
- Be considerate of your neighbors in the lab when debugging any audio output; use headphones.
- Corporate counsel for the network insists on a strict ban on toxic materials. This prohibition includes Volatile Organic Compounds (VOCs) (i.e. hydrocarbon based spray paints or other noxious fumes). **This prohibition also includes while you are working on the exhibit in the SPDL.**
- No Painting in the SPDL!**
- No part of the SPoRTS may become ballistic outside the 18"x18"x36" size envelope outlined above.
- No pyrotechnics or fire of any kind!
- If the SPoRTS contains any liquids, they may not be conductive (with the exception of water) or corrosive, and **MUST** be packaged in a fail-safe manner.

Check-Points

Design Review:

During the day and early evening of November 6th between 9:00am & 7:30pm in various rooms in the Peterson building (our classroom building) we will conduct a design review. Each group should prepare a few **simple** PowerPoint slides (scans of sketches are OK) showing your ideas, a preliminary event list, with responses and a list of how you are going to meet the user interface requirements. **No code, no state diagrams, no circuits.** One member of the team must bring a laptop and any necessary adapters to produce a VGA video signal to be used in connecting to the screen for your presentation. You will present these to other members of the class, members of the teaching staff and coaches so that all may hear about your ideas and provide feedback and advice. **At this time you will be required to identify the core functionality of your proposed design and how it meets the interaction requirements.** *It all starts with the play-calling!*

First Check-Point:

On or before 11/08/13, you must submit a schematic of at least the core functionality initially identified on 11/06 and a refined set of events with details on the responses. Modifications to the core functionality may take place up to this point. A Protel schematic plus a word document describing your core functionality should be left in your "Reports" folder. We'll sweep your "Reports" folder at 5pm. Only one team member needs to submit your check-point documentation. *We've got a game-plan, now we just need to stick to it!*

Second Check-Point:

On or before 11/14/13 you will be required to demonstrate a minimal level of function:
 The hardware & software necessary to do each of the following independently on each 'C32
 sense inputs (Access card reader and at least 3 user inputs)
 make decisions (state machine with at least 3 states driven by keyboard input)

implement electro-mechanical actuation for end of game display and user feedback
communicate at least 8 independent messages back and forth between the two 'C32s

Submission of a Protel schematic of your circuit will also be required. *If you're not practicing, somebody else is!*

Third Check-Point:

On 11/18/13 you will be required to demonstrate integrated functionality of all sensing inputs, plus software and timing, full communication between the 'C32s plus activating all actuators that will be required. In other words, everything should be complete with the exception of improvements in user experience, and fit, finish, and appearance. *Don't practice until you get it right. Practice until you can't get it wrong.*

Grading Session:

On 11/20/13 you will be required to demonstrate your fully integrated and finished machine. *Pain is only temporary but victory is forever.*

Report:

Draft due on 12/02/13 at 4:00pm. Final version with revisions due by 5:00pm on 12/06/13. *Hit the showers. No really... shower!*

Evaluation

Performance Testing Procedures:

All SPoRTS will be tested by a demonstration performed by a pair of team members that should show all of the possible user interactions.

Grading Session Presentation:

Each team should prepare a **30 Sec.** (no more) presentation to introduce the SPoRTS. This presentation should highlight the unique features of the design, not the circuit details. As an example, think back to the xylophone descriptions that were played on the first day of class. You will be setting up your SPoRTS, one at a time, and delivering your presentation in room 202 Thornton between 10am & 5:00pm on the day of the presentations. During this time each team and their SPoRTS will be photographed. Starting at 5:00pm you will move your SPoRTS into the Atrium for the public presentation, which will begin at 7:00pm.

Grading Criteria:

- Concept (20%)** This will be based on the technical merit of the design for the SPoRTS. Included in this grade will be evaluation of the appropriateness of the solution, as well as innovative hardware, software and use of physical principles in the solution.
- Implementation (20%)** This will be based on the prototype displayed at the evaluation session. Included in this grade will be evaluation of the physical appearance of the prototype and quality of construction. We will concentrate heavily on the craftsmanship exhibited by the final product.
- Performance (40%)** Half of this (20%) will be based on the results of the Check-points, the other half will be based on the results of the performance testing during the evaluation session. Full performance credit will be given only if the machine works on the first attempt during the grading session. Performance will be judged first on the ability to demonstrate the core functionality and second on any embellishments to the core functionality. **To earn the Performance points, you must demonstrate at least the core functionality.**
- Report (10%)** Preliminary project reports are due December 2, 2013 at 4:00pm. The report should be in the form of a stand-alone web site and must include schematics, pseudo-code, header & code listings, dimensioned sketches/drawings showing relative scale, a complete Bill-of-Materials (BOM) for the project as well as a 1 page description of function and a "Gems of Wisdom for future generations of 218ers" page. The web-site must be submitted as a **single Zip file** (7-zip is installed on all the workstations in the lab). It is critical that your report be in the Reports folder on time so that the peer reviewing team will have an adequate opportunity to review it before class the following day. Final versions of the reports, incorporating the review comments are due (also in the form of a single zip file) by 5:00pm on 12/06/13. The front page of your project description must be in a file called `index.html` at the root folder of the web site. Test your zip-file by unzipping it into an empty folder. Once unzipped, you should be able to view the entire site starting from the `index.html` file. **Do not embed video files** directly into your site. If you want to include video, link to a You-Tube or other video sharing site.

- Report Review (10%)** These points will be awarded based on the thoroughness of your review of your partner team's report. Read the explanations, do they make sense? Review the circuits, do they look like they should work? Could this SPoRTS realistically be built for \$160? If, during grading, we find things that don't make sense or circuits that won't work we will consult your review. If the review caught them, then the team will lose points on their report. If the reviewers missed it, then they will lose points for their review. The report review should be submitted in the form of a word document that you place into one of your team members folders by 4pm on 12/03/13.

Suggestions

We understand that the project definition is probably a bit more open than you might be used to. To help you get your creative juices flowing we offer some reflections that you might want to consider.

- Don't just think buttons. Think about novel ways to sense an action and give feedback. Remember, you have more than just fingers available to actuate and you are mechanical engineers (at least most of you). Think fun linkages!
- The Tao of 218:** Simplicity Leads to Reliability. We are extremely skeptical of the need for more than one of your proto-boards to hold the finished circuitry. Remember, you only have 456 hours available to complete the project (and tend to the other things in your life) before it is due.

Resources

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|--------------------------|--|--|
| <input type="checkbox"/> | www.sparkfun.com
www.seeedstudio.com
www.jameco.com
www.mouser.com
www.newark.com
www.ponoko.com | www.adafruit.com
www.hackaday.com
www.digikey.com
www.mcmaster.com
www.hobbyking.com
www.servocity.com |
| <input type="checkbox"/> | J&M Hobby House in San Carlos
Jameco in Belmont
TAP Plastics in Mountain View | |

Exercise your creativity:

We encourage, and hope to foster, a wide range of solutions to the problem. This will make for the most enjoyable presentation for your audience. There is no 'Best' way to solve this problem, so don't spend time looking for it. While brainstorming, think about how you might parody your favorite SPoRTS.

Remember that we interact with electronic devices every day. People tend to have more fun with projects that don't try to emulate the look and feel of actual products. ME218 is an opportunity to design things that are fun and whimsical. Take advantage of that.

Make your machine robust:

Your machine must be rugged enough to survive your testing as well as 'testing' by the audience. Don't be timid about playing with your project before the presentation. Play with it as if you didn't know its weaknesses. Let your friends play with it. Find out if it can survive people playing with it *before* the presentation.

While the emphasis in the lecture has concentrated on the electronics, don't forget the mechanical aspect. Historically, machine failures are often due to poor mechanical design or implementation. Pay attention to craftsmanship. It will pay dividends in many ways.

Gems of Wisdom from Past Generations

Will be available on the SPDL Web site. Be sure to check them out for guidance from past generations.