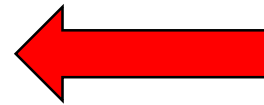


MDR, Draft Report & Website



November 2017						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
		31 Benchside Meetings	1	2 Benchside Meetings	3	4
5	6	7	8	9	10	11
12	13	14	15	16 Lecture 3	17	18
19	20 Thanksgiving Recess	21 Thanksgiving Recess	22 Thanksgiving Recess	23 Thanksgiving	24 Thanksgiving Recess	25
26	27 MDR	28 MDR	29 MDR	30 MDR	1 MDR	2



11 days to MDR

December 2017						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
3	4 MDR	5 MDR	6 MDR	7 MDR	8 MDR	9
10	11 Websites due	12 Last day of classes	13	14	15	16
17	18	19	20 Last day of exams Draft report due	21	22	23
24	25	26	27	28	29	30



25 days to website



34 days to draft report

MDR

27th Nov – 8th Dec

MDR Format

- Team Presentation (30 min)
 - ppt presentation
 - demos of MDR deliverables
 - in conference room
 - in SDP lab (or other)
 - embedded pics and videos

- Evaluators Q&A (20 min)

UMass SDP18 MDR – Evaluation Sheet

Team Number/Name

Team Members:

Evaluators:

<p>Presentation (10%) gpa range (4.0 - 2.0)</p>	<ul style="list-style-type: none"> <input type="checkbox"/> (4.0) A professional presentation that demonstrates knowledge and practice. <input type="checkbox"/> (3.5) The presentation should have been practiced more. <input type="checkbox"/> (3.0) The presentation was confusing at a few points. <input type="checkbox"/> (2.5) The presentation was confusing at more than a few points. <input type="checkbox"/> (2.0) The presentation was poorly organized or presented.
<p>System Requirements (10%) gpa range (4.0 - 2.0)</p>	<ul style="list-style-type: none"> <input type="checkbox"/> (4.0) The system requirements are clear, complete, and appropriate. <input type="checkbox"/> (3.5) A few necessary system requirements are missing or unclear. <input type="checkbox"/> (3.0) More than a few system requirements are missing. <input type="checkbox"/> (2.5) System requirements are given, but they are either inappropriate or very incomplete. <input type="checkbox"/> (2.0) Minimal emphasis was placed on system requirements.
<p>System Block Diagram (15%) gpa range (4.0 - 2.0)</p>	<ul style="list-style-type: none"> <input type="checkbox"/> (4.0) A plan to accomplish the project is clearly described by a system block diagram including interfaces and feasible plans to implement each block. PDR feedback is fully incorporated. <input type="checkbox"/> (3.5) A system block diagram is clearly presented, but one or two blocks are not clearly defined in either its interface or implementation. PDR feedback is only partially incorporated. <input type="checkbox"/> (3.0) More than two system-level blocks are missing, either an interface or an implementation. PDR feedback is not incorporated <input type="checkbox"/> (2.5) A system block diagram is presented, but it does not describe how the project will be completed. <input type="checkbox"/> (2.0) A useful system block diagram was not presented.
<p>Demonstration of Deliverables (50%) gpa range (4.0 - 0.0)</p> <p>Name: _____ (4.0 - 0.0) Name: _____ (4.0 - 0.0) Name: _____ (4.0 - 0.0) Name: _____ (4.0 - 0.0)</p>	<ul style="list-style-type: none"> <input type="checkbox"/> (4.0) All deliverables demonstrated. <input type="checkbox"/> (3.0) Most deliverables demonstrated, but given past progress, about one week of work remains. <input type="checkbox"/> (2.0) About half the work to meet deliverables has been performed, and given past progress, two weeks of work remain. <input type="checkbox"/> (1.0) Less than half of the progress to meet deliverables has been achieved. <input type="checkbox"/> (0.0) Little progress towards meeting deliverables has been achieved.
<p>Team Responsibilities and (2017-18) Schedule (15%) gpa range (4.0 - 2.0)</p>	<ul style="list-style-type: none"> <input type="checkbox"/> (4.0) The group clearly defined the responsibilities of each team member and the planned schedule of activities for each team member. <input type="checkbox"/> (3.5) A pattern of clear descriptions was established, but a few tasks were not clearly defined in terms of ownership or timeline. <input type="checkbox"/> (3.0) The pattern was mixed between clear descriptions and either omissions or poorly defined roles and deadlines. <input type="checkbox"/> (2.5) Only a few events had clearly defined owners and deadlines. <input type="checkbox"/> (2.0) The responsibilities and schedules for achieving the goals were not clearly defined

UMass SDP18 MDR – Evaluation (Written Comments)

Team Number/Name

Team Members:

Evaluators:

Presentation

System Requirements

System Block Diagram

Demonstration of Deliverables

Team Responsibilities and (2017-18) Schedule

Other Comments

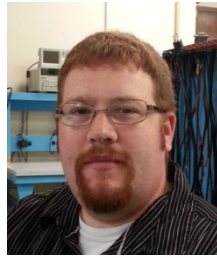
Must Do!

- ~24hr email reminder of day/time/location
- Hard copy handouts of slides (multiple slides/page)
- Separate hard copies of:
 - block diagram
 - MDR deliverables (with individual responsibilities)

Example MDR

Team RCA
SDP13

RCA (Real-Time Concussion Analyzer)



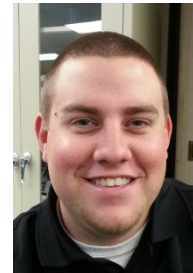
Timothy Coyle, EE
Impact Processing &
Communication



Kenneth Van Tassell, EE
User Interface &
Communication



Scott Rosa, CSE
Server & Data Analysis



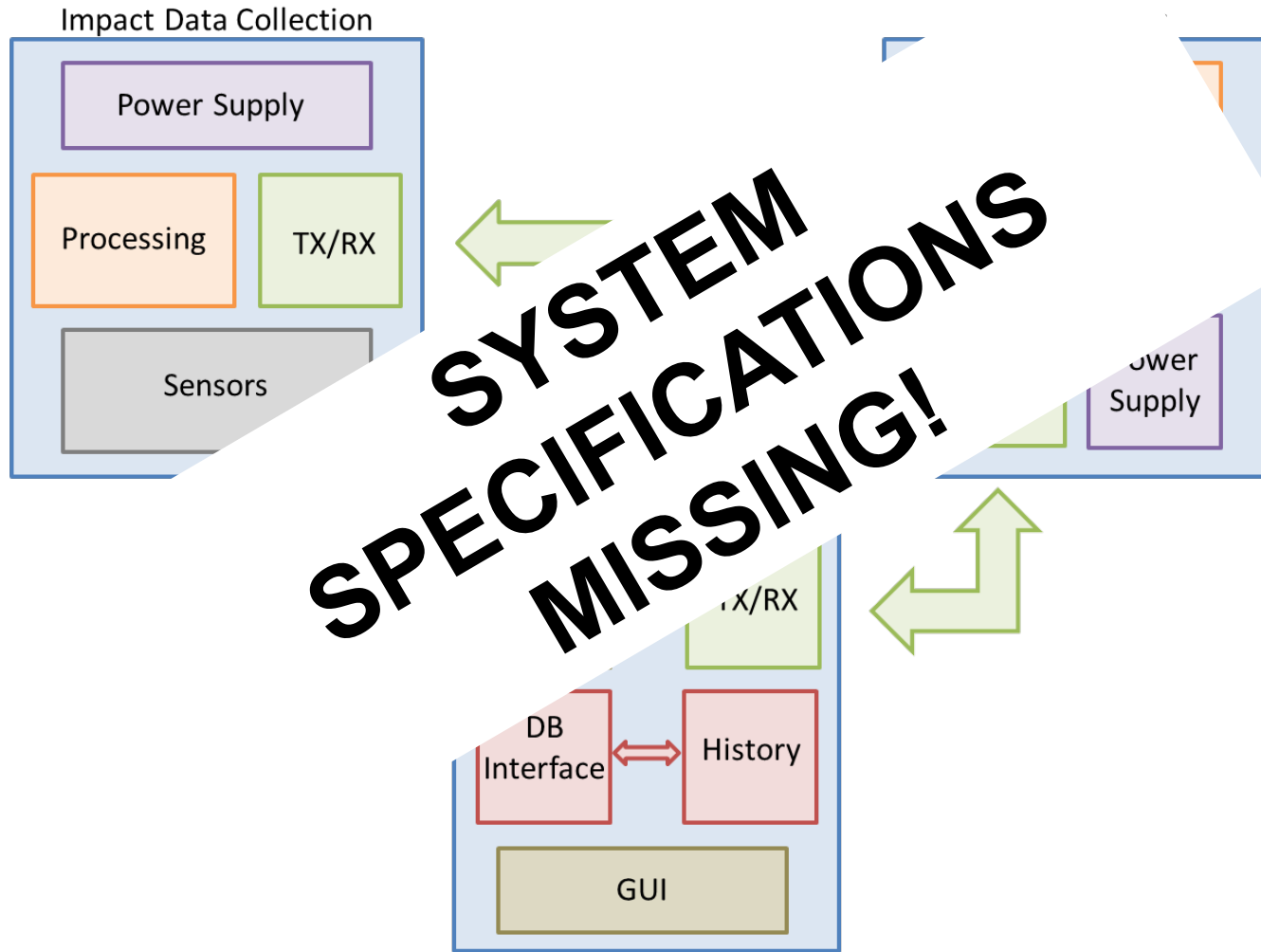
Justin Kober, EE
Sensor Network & Power

Concussion Detection in High School Football

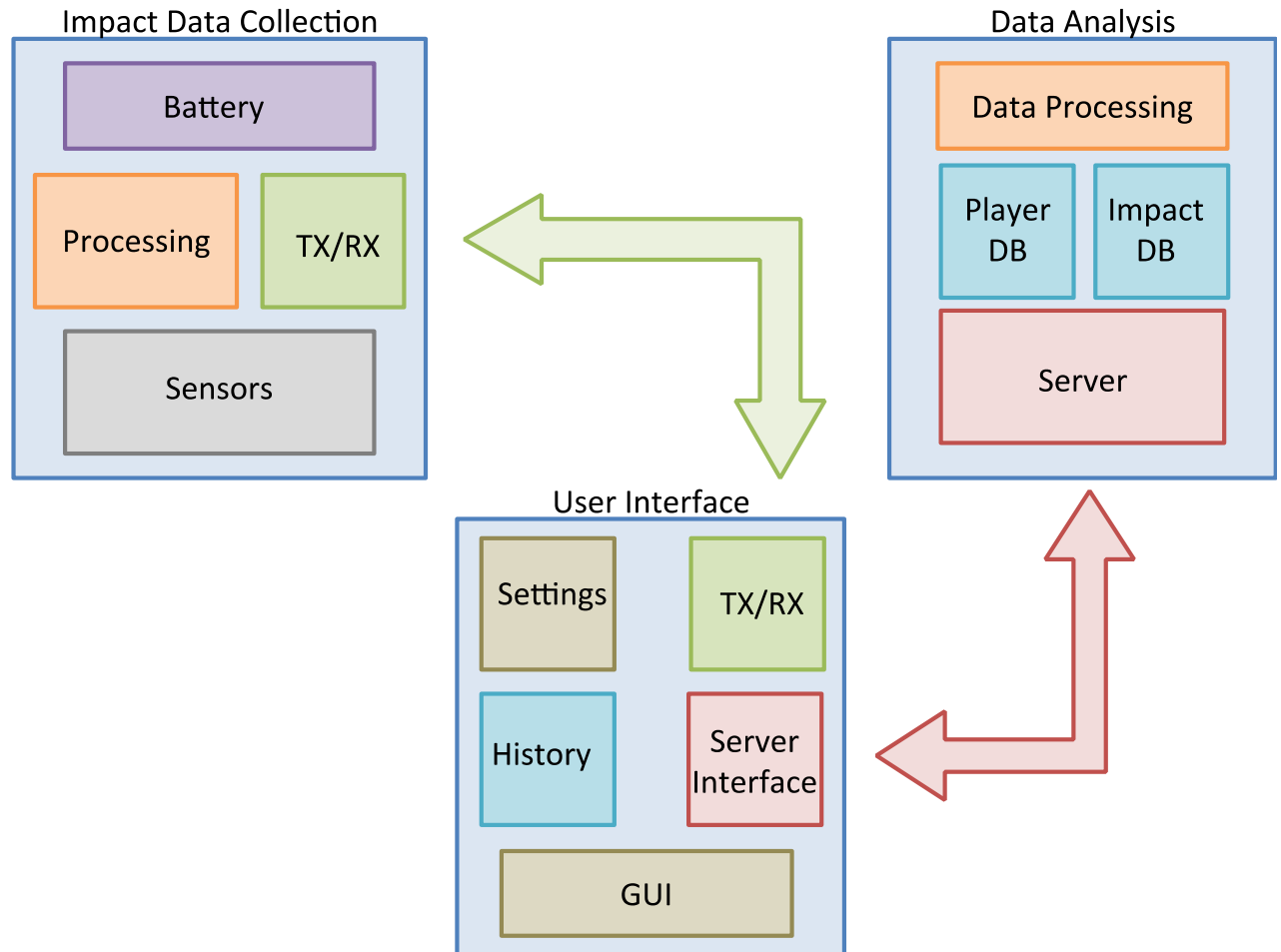
- Current concussion detection
 - Train coaches to recognize symptoms
- Players may hide or not report symptoms right away
- RCA will monitor each player and alert the coach of risk of concussion after each collision
- Customer feedback
 - College trainers and high school athletic director

PROBLEM STATEMENT!

Our Previous Solution: Block Diagram



Our Redesigned Solution: Block Diagram

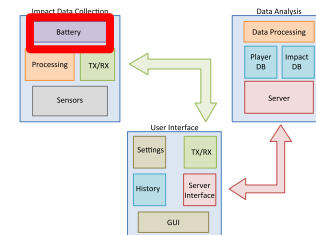


- Bluetooth
- Android
- Server

Battery Selection

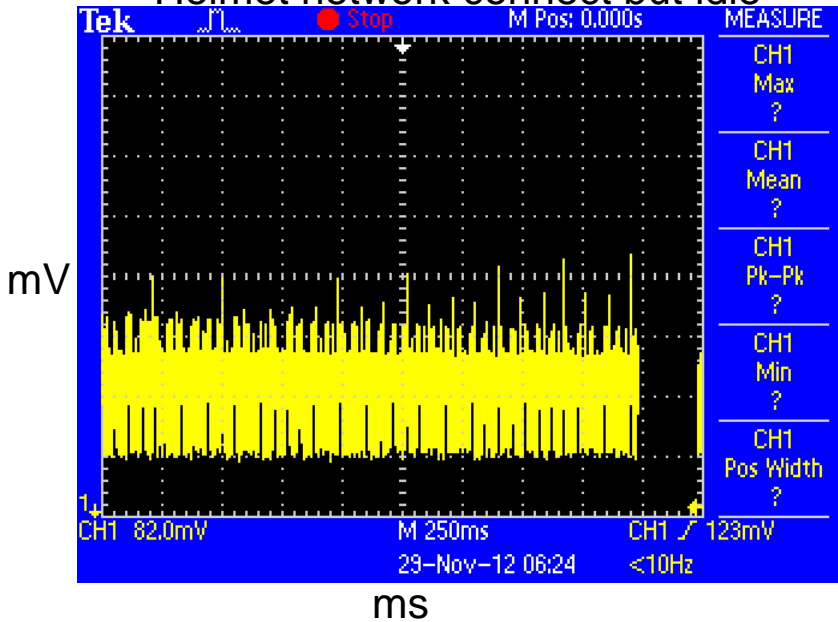
- Energy Consumption
 - Worst Case: 25.0 kJ per game
 - Typical: 5.8 kJ per game
 - 100 ms per hit and 100 hits per game

- Coin Cell Batteries
 - Weight & Size
 - Series or Parallel



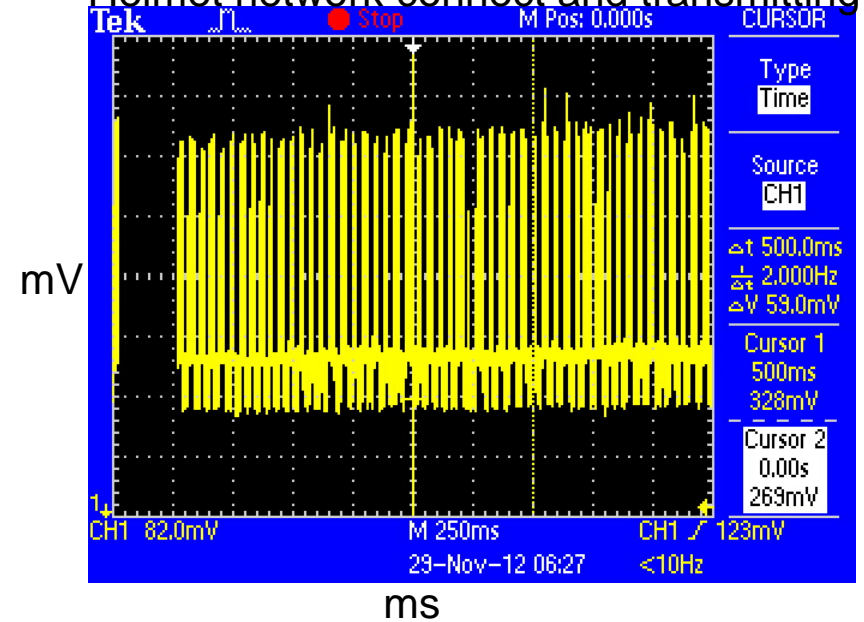
Measured System Energy Consumption

Helmet network connect but idle

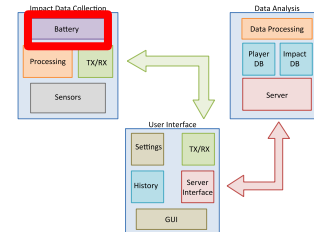


Mean Voltage: 255.8 mV

Helmet network connect and transmitting



Mean Voltage: 305.6 mV



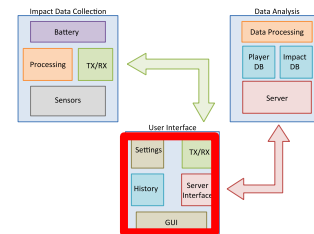
Application / User Interface and UI Communication

■ Requirements

- Easy to use
- Displays Acceleration
- User Adaptable
 - Coach vs. Trainer
- Reliable

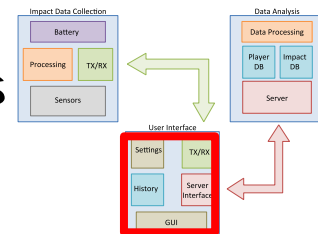
■ Challenges

- Unable to perform long processes on UI thread
- Uncaught process errors
- Working with Android Bluetooth protocol



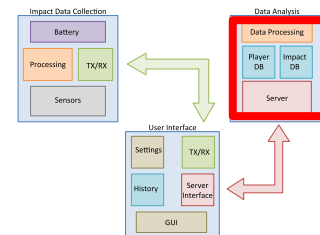
Application / User Interface and UI Communication

- Android AsyncTask
 - Allows multi-threading in Android applications
 - Performs tasks asynchronously in the background
- Android Debugging
 - Used to catch unseen errors
 - Found and fixed multiple runtime errors
- Android Bluetooth
 - Using Android Bluetooth package
 - Measured response time of transfer to be 16.8 ms

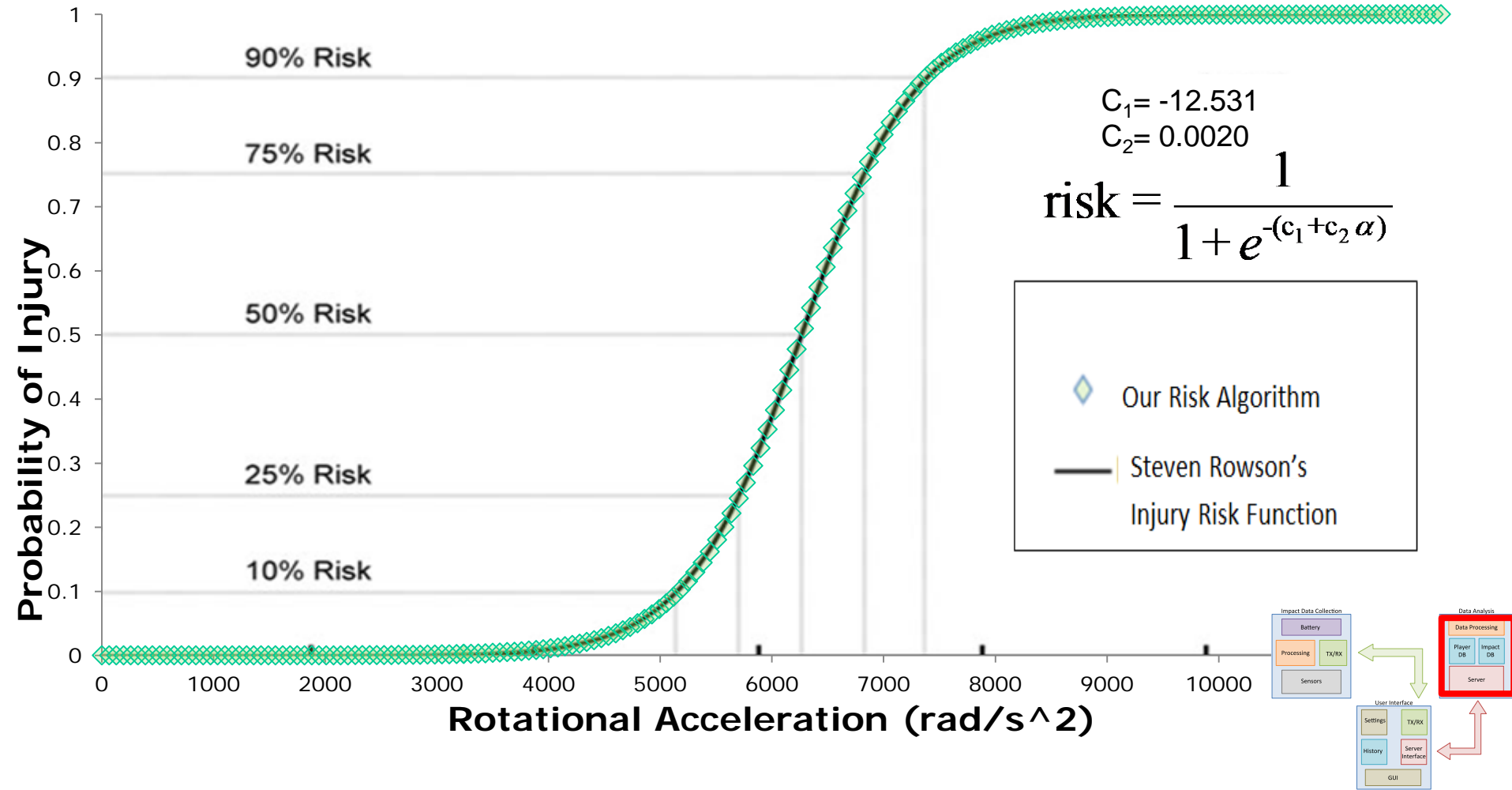


Data Processing and Storage

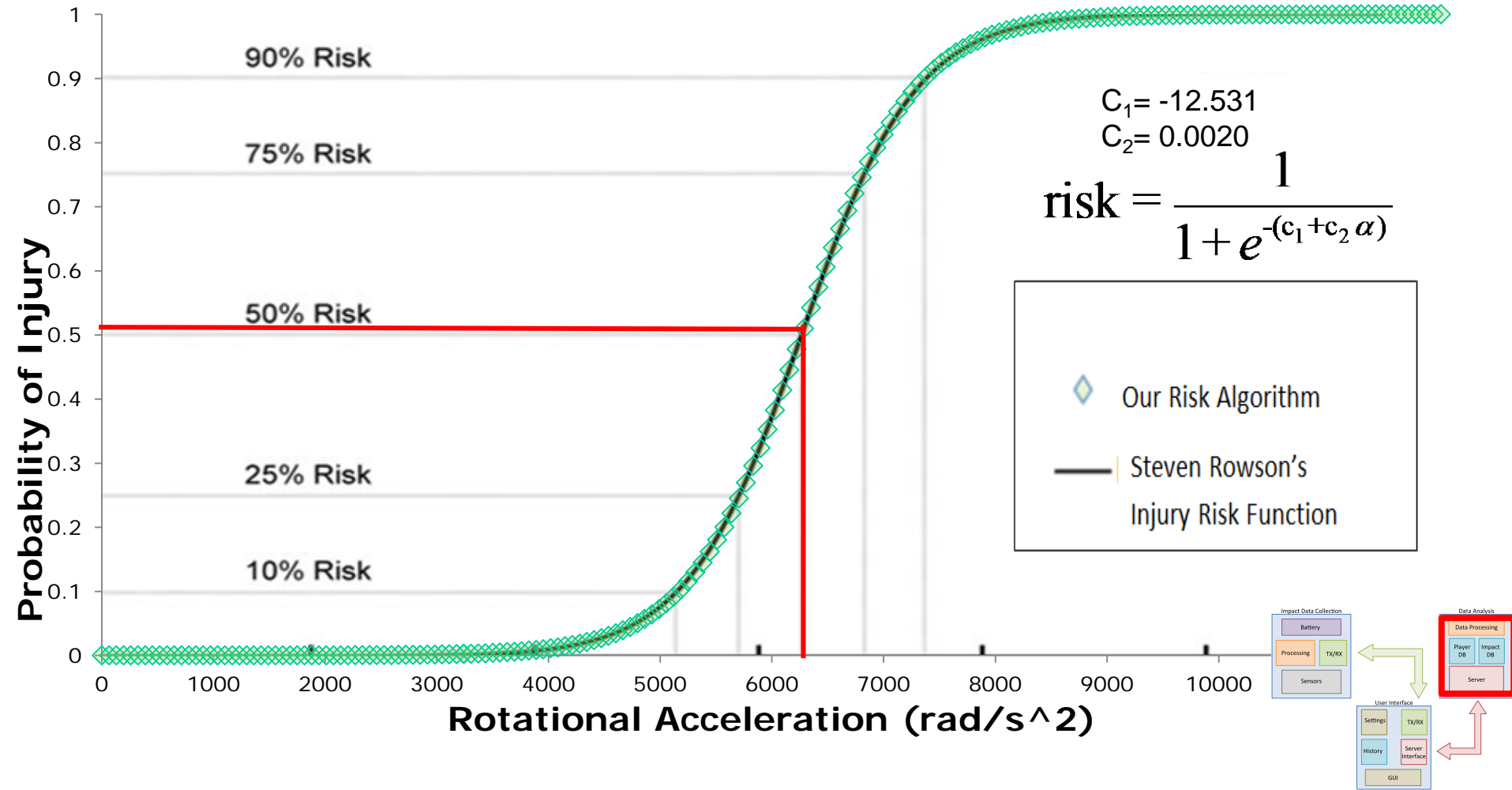
- Requirements
 - Calculates rotational acceleration
 - Determines probability of concussion
 - Output within 500 ms
 - Store all impact data efficiently
- Accomplished
 - Calculates rotational acceleration and probability of concussion in average of 411.6 ms
 - Computational analysis
 - Set up server with database to store data
 - Tested and graphed data



Test Results



Test Results



Impact Processing & Communication

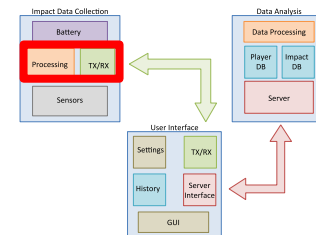
- ATmega32U4 8-bit AVR Microcontroller

- 16MHz Clock
- 10-bit ADC every 8us



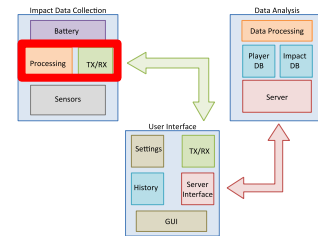
- Bluetooth: BlueSMiRF w/ RN-41

- Redesigned for scalability
- 25m Effective range
 - Proof of concept vs. XBee redesign



Impact Processing & Communication Experiments

- Experiments
 - Compared sensor to datasheet
 - Noise in system
 - Sample rate
 - Noise stabilized and found sample rate problem
 - System output vs direct sensor output
 - Confirmed sampling rate problem
 - Revised sample rate settings
 - Improved sampling rate and confirmed stable output
- Statistical analysis
 - Mean, Variance, Histograms
 - Confidence intervals of final system



Proposed MDR Deliverables

- Demonstration of Impact Data Collection
 - Accelerometer interfaced with processor
 - Helmet processor transmission

- Demonstration of Base Station/UI Interaction
 - Using test data
 - Receive from helmet
 - Run algorithm
 - UI able to receive and display test results

Proposed MDR Deliverables

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Proposed MDR Deliverables

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 - Helmet processor transmission

- Demonstration of Base Station/UI Interaction
 - Using test data
 - Receive from helmet
 - Run algorithm
 - UI able to receive and display test results

Proposed CDR Deliverables

- Demonstration of Complete System Functionality
 - Show implementation of battery management system
 - Impact the helmet with a known force
 - Transmit impact data with a specified sample rate from the sensor array to a mobile device
 - Display risk of injury, with confidence interval on Android device
 - Display impact history on Android device upon user request

GANTT CHART MISSING!

Thank You

Questions

UMass SDP18 MDR – Evaluation Sheet

Team Number/Name

Team Members:

Evaluators:

<p>Presentation (10%) gpa range (4.0 - 2.0)</p>	<ul style="list-style-type: none"> <input type="checkbox"/> (4.0) A professional presentation that demonstrates knowledge and practice. <input type="checkbox"/> (3.5) The presentation should have been practiced more. <input type="checkbox"/> (3.0) The presentation was confusing at a few points. <input type="checkbox"/> (2.5) The presentation was confusing at more than a few points. <input type="checkbox"/> (2.0) The presentation was poorly organized or presented.
<p>System Requirements (10%) gpa range (4.0 - 2.0)</p>	<p style="text-align: center; font-size: 2em; color: red;">X</p> <ul style="list-style-type: none"> <input type="checkbox"/> (4.0) The system requirements are clear, complete, and appropriate. <input type="checkbox"/> (3.5) A few necessary system requirements are missing or unclear. <input type="checkbox"/> (3.0) More than a few system requirements are missing. <input type="checkbox"/> (2.5) System requirements are given, but they are either inappropriate or very incomplete. <input type="checkbox"/> (2.0) Minimal emphasis was placed on system requirements.
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<p>Demonstration of Deliverables (50%) gpa range (4.0 - 0.0)</p> <p>Name: _____ (4.0 - 0.0)</p> <p>Name: _____ (4.0 - 0.0)</p> <p>Name: _____ (4.0 - 0.0)</p> <p>Name: _____ (4.0 - 0.0)</p>	<ul style="list-style-type: none"> <input type="checkbox"/> (4.0) All deliverables demonstrated. <input type="checkbox"/> (3.0) Most deliverables demonstrated, but given past progress, about one week of work remains. <input type="checkbox"/> (2.0) About half the work to meet deliverables has been performed, and given past progress, two weeks of work remain. <input type="checkbox"/> (1.0) Less than half of the progress to meet deliverables has been achieved. <input type="checkbox"/> (0.0) Little progress towards meeting deliverables has been achieved.
<p>Team Responsibilities and (2017-18) Schedule (15%) gpa range (4.0 - 2.0)</p>	<p style="text-align: center; font-size: 2em; color: red;">X</p> <ul style="list-style-type: none"> <input type="checkbox"/> (4.0) The group clearly defined the responsibilities of each team member and the planned schedule of activities for each team member. <input type="checkbox"/> (3.5) A pattern of clear descriptions was established, but a few tasks were not clearly defined in terms of ownership or timeline. <input type="checkbox"/> (3.0) The pattern was mixed between clear descriptions and either omissions or poorly defined roles and deadlines. <input type="checkbox"/> (2.5) Only a few events had clearly defined owners and deadlines. <input type="checkbox"/> (2.0) The responsibilities and schedules for achieving the goals were not clearly defined

SDP Report

- draft due: 20th Dec'17
- coordinator feedback: 15th Jan'18
- final due: 30th Jan'18

StarTrack

Rebecca Baturin, EE, Christopher Boyle, CSE, Charles Urbanowski, EE, and Daniel Willmott, EE

Abstract — Even despite the banality of everyday life, the splendor of starlight and the space beyond continues to dazzle and inspire people of all kinds of origins. In order to aid the sense of discovery amongst astronomy enthusiasts and photography hobbyists alike, the StarTrack guided mount will allow users to track astronomical objects while maintaining the high standards of quality for a photograph. The system is composed of two joint accessories: a user-interfacing application, and a mount for the user's DSLR camera. The mobile application provides the user access to a database of celestial objects to track and will also be able to wirelessly send tracking directions to the corresponding mount. The mount itself incorporates three powered motors to adjust the exposure angle of the provided camera in order to ensure the celestial object remains in clear focus during the length of several extended exposures. At the conclusion of each session, the user will be presented with several images of their specified object. While the individual images may not be unique on their own, they form a distinctly focused photograph when the images are stacked together.

I. INTRODUCTION

ASTROPHOTOGRAPHY is the term for pictures of space. The night sky contains a multitude of celestial objects unseen to the naked eye even in rural settings. With long exposures of the night sky, it's possible to capture images of stars, constellations, and galaxies. Taking long exposure pictures of moving objects presents an inherent problem: after a 5 minute exposure any light captured will have moved, creating streaks of light instead of sharp images. In order to cancel out the movement of the earth, the camera must rotate at the same rate. This approximation of the Earth's angular rotation proves difficult without a mechanical system to compensate.

The biggest influence in low cost astrophotography, and the most popular tool for newcomers to the field is the barn door mount. First introduced by George Haig in the April 1975 edition of *Sky & Telescope* magazine [1], this mount replaces the mechanical motion of an equatorial mechanical mount with a manual or hand crank system for rotating at the same rate of rotation as the earth. The results, while good, require constant attendance and are frequently much less accurate than expensive solutions due to human error.

The inspiration for automating a barn door mount came from our team member Rebecca Baturin's coworkers during her coop with NASA at the Kennedy Space Center. Unsurprisingly, many of the engineers there are both hobbyists and amateur

astrophotography enthusiasts. Many had built barn door trackers themselves, but were dissatisfied with the quality of the images being produced. Another issue they found with this manual process was the need to be continuously outside with the mosquitos and Florida heat for 45 minutes to take a succession of exposures. They envisioned an automated barn door tracker as portable, easy to use, and above all accurate, and from there StarTrack was born.

Our next step in the research and design phase was to investigate the specifications of currently available mounts. Options for automated mounts are often prohibitively expensive for hobbyists. They are frequently bundled with a telescope, and require advanced knowledge of star coordinates.

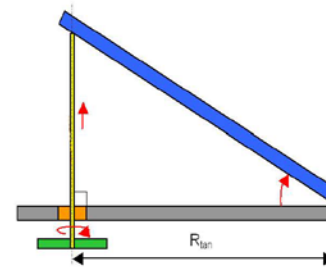


Figure 1: Barndoor Tracker Mount
(http://commons.wikimedia.org/wiki/File:Scotch_mount.png)

Having assessed the options, we came up with a set of goals for the project. The most important factor was clear: automation of as many aspects of the mount as possible is imperative. This accomplishes two of our goals; automation reduces the need for the user to be present for the entire exposure, and reduces the amount of error dramatically.

Additionally, we want a low cost final product. Expenses for cameras and high quality photography can become expensive quickly, and we want to provide comparable results for a fraction of the price of a professional mount.

We also want the final object to be approachable for newcomers. The system should be usable by individuals without much knowledge of the stars, as well as customizable and adaptable for those with prior experience.

SDP Report Rules

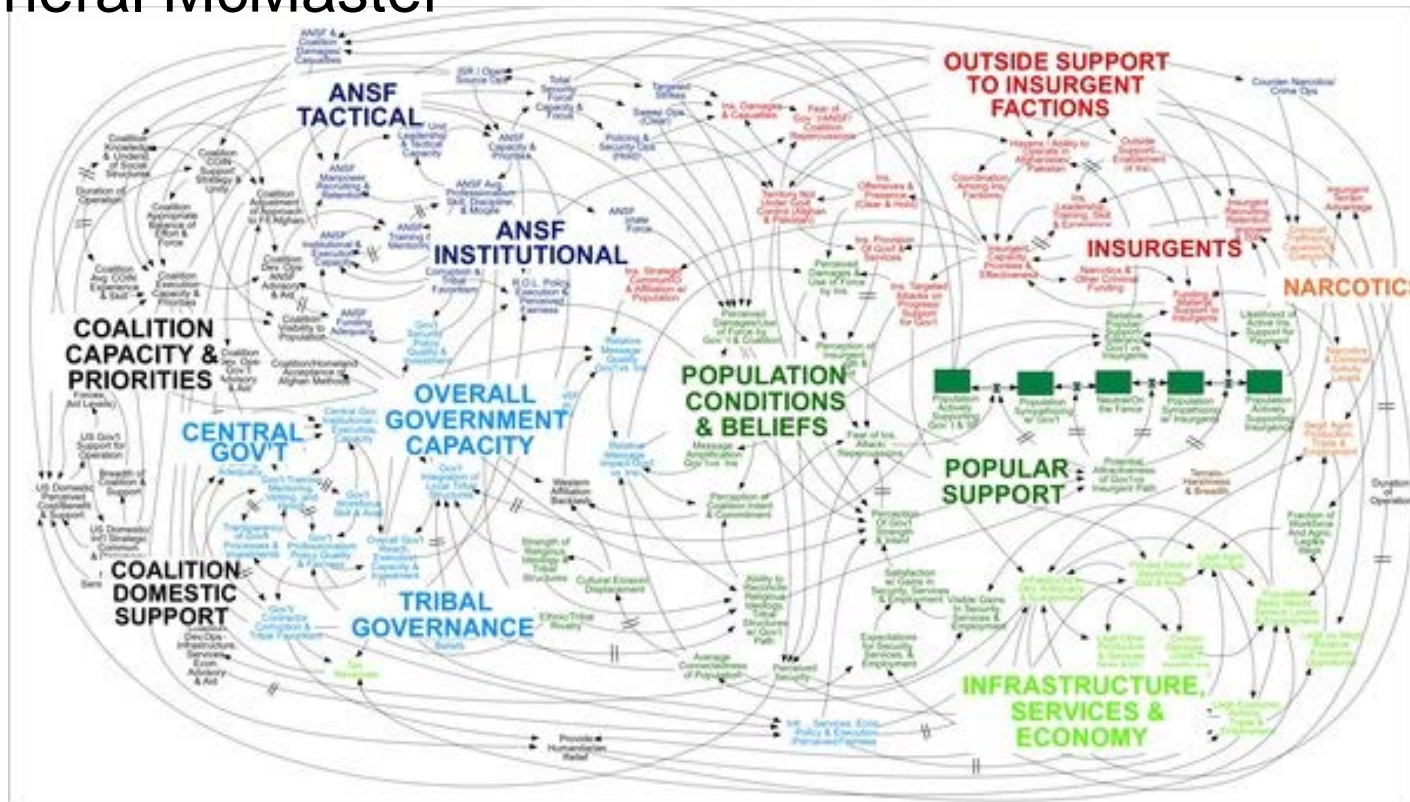
- IEEE Paper Format
- Cite all sources
- Grammar Counts
- Clear
- Content
 - 0. Abstract
 - I. Introduction
 - II. Design
 - III. Project Management
 - IV. Conclusion

Why

“We Have Met The Enemy and He is Powerpoint.”
--NY Times Article on Military Powerpoints 2010

Why

- “It is dangerous because it can create the illusion of understanding and the illusion of control.”
--General McMaster



IEEE Format

Download MDRformat.doc

Preparation of Senior Design Project Report

First A. Author, EE, Second B. Author, CSE, Third C. Author, EE, and Fourth D. Author, CSE

Abstract—This is an editable template. You should follow the format of this template in writing your SDP Midyear report. Your abstract that goes here should be one paragraph based on the abstract you wrote earlier.

I. INTRODUCTION

START with the statement of the problem. What is the problem that you are trying to solve? How big is this problem? Include citations that demonstrate that your problem is significant.

Put your problem in to context. How have people solved your problem in the past? Has the problem changed with time? What are the impacts on societal impacts of your problem? How does your problem affect individuals?

Summarize the requirements analysis that you performed. How big can your solution be? How much power can it use? How will someone use your solution? List the specifications in a Table as shown in Table 1.

TABLE I
SPECIFICATIONS

Specification	Value
Weight	<10kg
Height	<10cm
Length	<5cm
Width	<10cm
Battery Life	>5 hours

experiment you will perform to design or test this block. Explain how you will analyze the results of this test.

D. Block 3

Describe what this technical block will do. Explain what technology you will use to build this block. Detail which techniques from courses you will use to build this block. List what you need to learn in able to build this block. Explain an experiment you will perform to design or test this block. Explain how you will analyze the results of this test.

Cite All Sources

- You Can Site a Web Page
 - Don't just type the URL
- Even if you didn't have to look it up you should cite it.
- Describe what the cited work did and what you added to it.

Grammar Counts

- Use complete sentences.
- Check your spelling.
- Avoid comma splices.
- Proofread, proofread, proofread.

Write Clearly

- Strunk and White said: “Write Tight”
- Start with an outline
- Start over

SDP Report Content

- Aside & Context (ABET)

- Content
 - I. Introduction
 - II. Design
 - III. Project Management
 - IV. Conclusion

ABET

- Accrediting Board for Engineering Degrees
- UMass EE and CSE programs evaluated every 6 years

ABET Student Outcomes (a-k)

- a) an ability to apply knowledge of mathematics, science, and engineering.
- b) an ability to design and conduct experiments, as well as to analyze and interpret data.
- c) an ability to design a system, component, or process, to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- d) an ability to function on multidisciplinary teams.

ABET Student Outcomes

- e) an ability to identify, formulate, and solve engineering problems.
- f) an understanding of professional and ethical responsibility.
- g) an ability to communicate effectively.
- h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- i) a recognition of the need for, and an ability to engage in life-long learning.

ABET Student Outcomes

j) a knowledge of contemporary issues.

k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

SDP Report Content

- I. Introduction
- II. Design
- III. Project Management
- IV. Conclusion

I. Introduction

- State the problem (e)
- How big is the problem (needs citation)
- How have people solved this problem? (c)
- What impact(s) does your problem have on individuals, society, and the environment? (c) (f) (h) (j)
- System specifications table (e)

Specification Table

TABLE I
SPECIFICATIONS

Specification	
Weight	
Range	
Response Time	
Battery Life	
Cost	for a full team of 52 players
Power Consumption	
Acceleration Range	+/- 70 g
Sensitivity	Only measure actual collisions
Durable Packaging	Stable and waterproof

Warning!
Do Not Use This Table Verbatim

II. Design

- Overview (Block Diagram) (e)(f)
- Block 1
 - What will it do? (c)
 - What technology will you use to build it? (a) (i) (k)
 - How will you test it? (b)

III. Project Management

- Table of MDR Deliverables
 - What have you done
 - What is left to do
- What is each member's expertise? (d)
- How do you help each other? (d)
- How does your team communicate? (d)(g)

IV. Conclusion

- What is the current state of the project?
- What are you working on now?

Sample MDR Report

SDP18 Team websites

Up and running - no later than Thursday 20th Dec'18

Minimal content

- Team pics
- Problem Statement
- System Specifications
- Block Diagram
- PDR/MDR slide decks
- Draft report

SDP Team website examples

Team 16 - Viano



Viano

The Viano, or virtual piano, allows music enthusiasts to play and record via GarageBand on the go without the hassle of having to carry a full-size midi keyboard around. The Viano is a portable, two-octave, life-size projected keyboard that gives the user the most optimal playing ability and alleviates the struggles of trying to play/record on too small of keys, which is unlike other portable alternatives.



© 2015

November 2017						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
		31 Benchside Meetings	1	2 Benchside Meetings	3	4
5	6	7	8	9	10	11
12	13	14	15	16 Lecture 3	17	18
19	20 Thanksgiving Recess	21 Thanksgiving Recess	22 Thanksgiving Recess	23 Thanksgiving	24 Thanksgiving Recess	25
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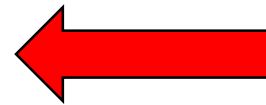


11 days to MDR

December 2017						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
3	4 MDR	5 MDR	6 MDR	7 MDR	8 MDR	9
10	11 Websites due	12 Last day of classes	13	14	15	16
17	18	19	20 Last day of exams Draft report due	21	22	23
24	25	26	27	28	29	30



25 days to website



34 days to draft report

Must Do!

- ~24hr email reminder of day/time/location
- Hard copy handouts of slides (multiple slides/page)
- Separate hard copies of:
 - block diagram
 - MDR deliverables (with individual responsibilities)