



MDR & MDR Report

MDR Format

- Team Presentation (30 min)
 - ppt presentation
 - demos of MDR deliverables
- Evaluators Q&A (20 min)

UMass SDP15 MDR – Evaluation Sheet		Team Number/Name
Team Members:		
Evaluators:		
Presentation (10%) gpa range (4.0 - 2.0)	<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.	
System Requirements (10%) gpa range (4.0 - 2.0)	<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.	
System Block Diagram (15%) gpa range (4.0 - 2.0)	<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.	
Demonstration of Deliverables (50%) gpa range (4.0 - 0.0) Name: _____ (4.0 - 0.0) Name: _____ (4.0 - 0.0) Name: _____ (4.0 - 0.0) Name: _____ (4.0 - 0.0)	<input type="checkbox"/> (4.0) The team member has demonstrated that one subsystem is functioning. <input type="checkbox"/> (3.0) Most of the functionality has been demonstrated, but given past progress, about one week of work remains. <input type="checkbox"/> (2.0) About half the work to reach functionality has been performed, and given past progress, two weeks of work remain. <input type="checkbox"/> (1.0) Less than half of the progress to full functioning of one subsystem has been achieved. <input type="checkbox"/> (0.0) Little progress to full functioning of one subsystem has been achieved.	
Team Responsibilities and (2014-15) Schedule (15%) gpa range (4.0 - 2.0)	<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.	

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

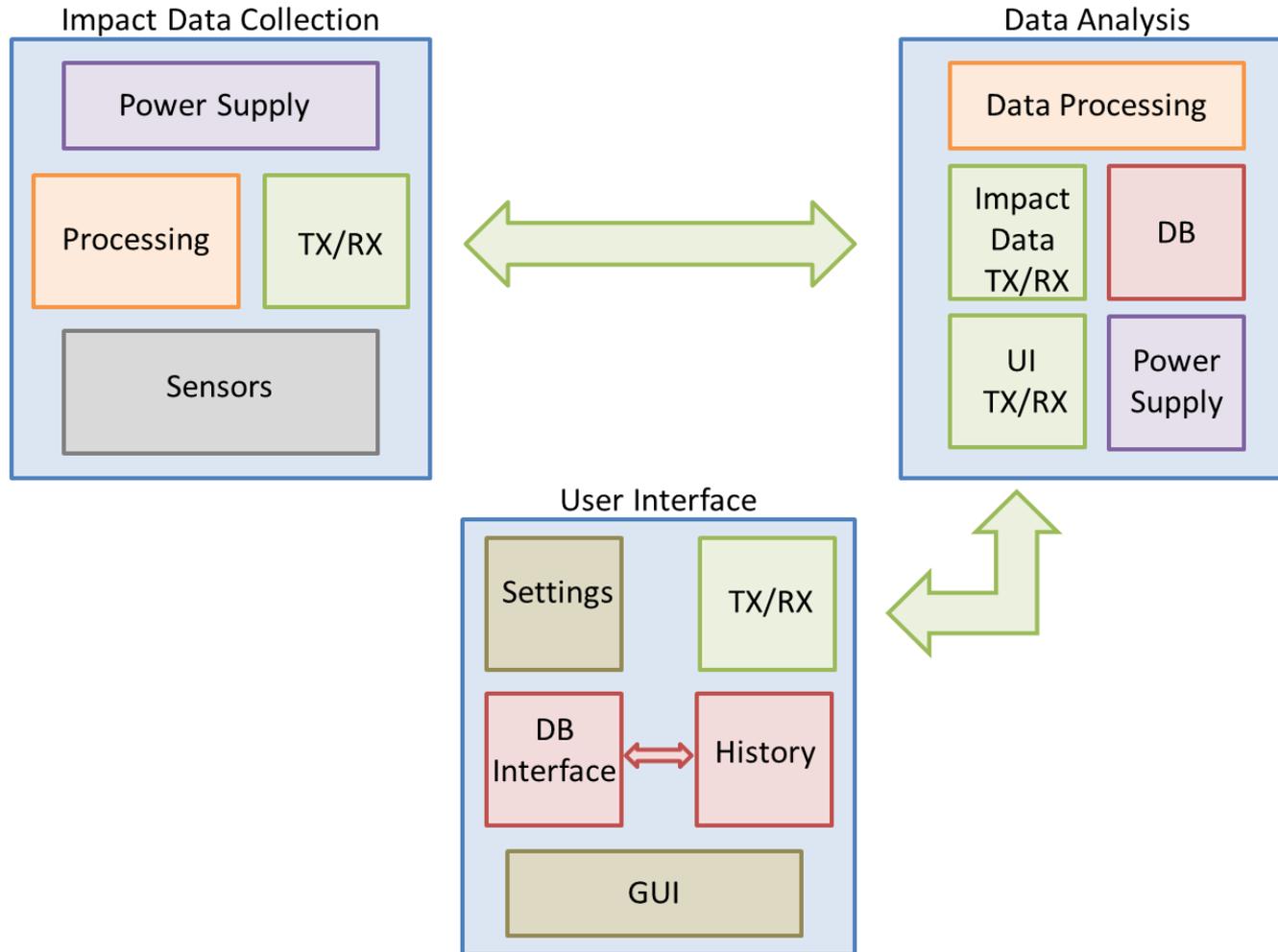


Justin Kober, EE
Sensor Network & Power

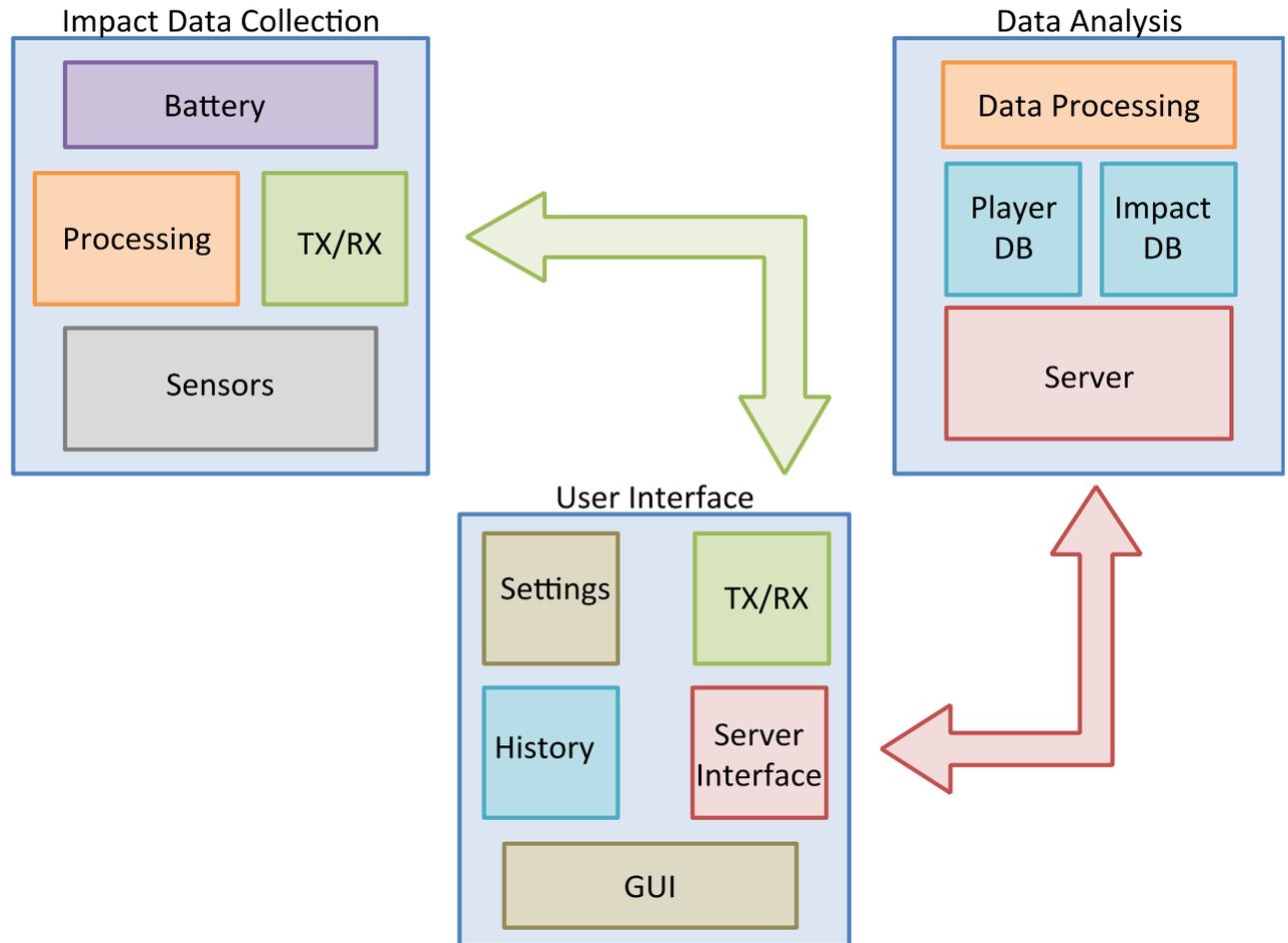
Concussion Detection in High School Football

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

Our Previous Solution: Block Diagram



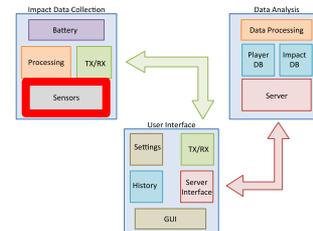
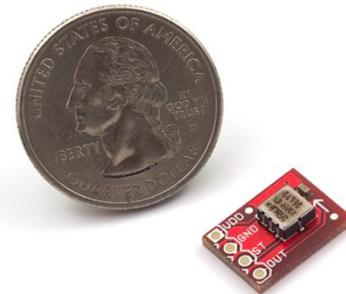
Our Redesigned Solution: Block Diagram



- Bluetooth
- Android
- Server

Sensors

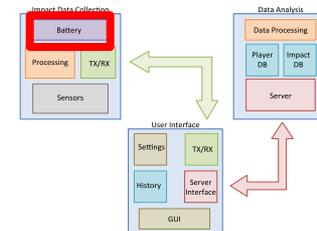
- ADXL 193 MEMS Accelerometer
 - Testing
 - Noise analysis
- PCB Design
 - ADXL 78
 - More sensitive



Battery Selection

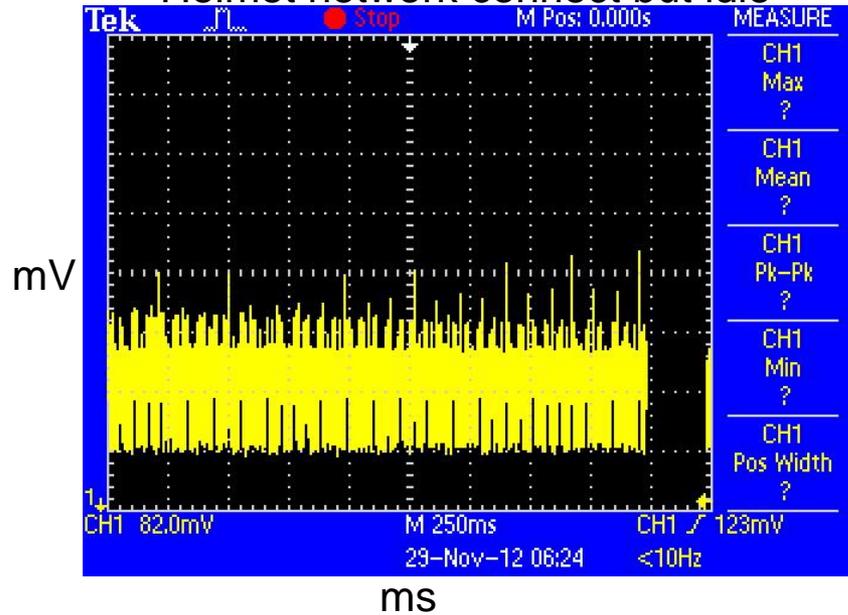
- Energy Consumption
 - Worst Case: 25.0 kJ per game
 - Typical: 5.8 kJ per game
 - 100 ms per hit and 100 hits per game

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



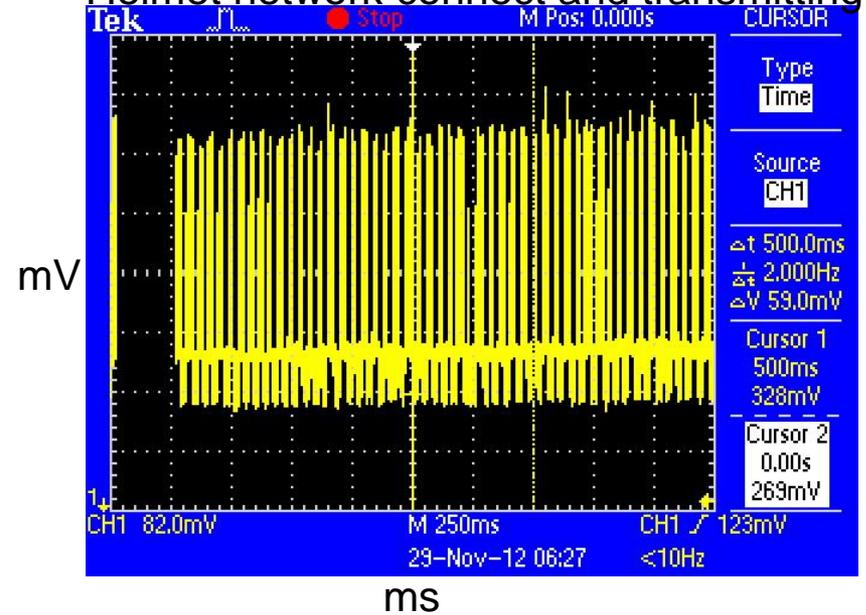
Measured System Energy Consumption

Helmet network connect but idle

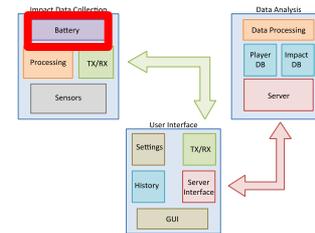


Mean Voltage: 255.8 mV

Helmet network connect and transmitting



Mean Voltage: 305.6 mV



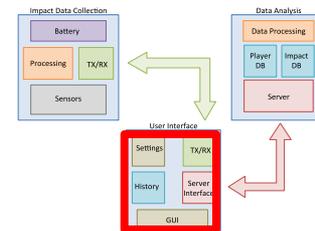
Application / User Interface and UI Communication

■ Requirements

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

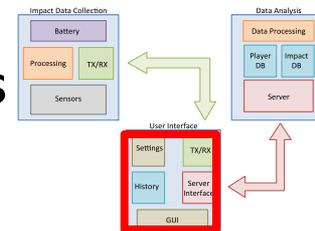
■ Challenges

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



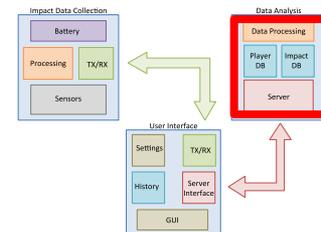
Application / User Interface and UI Communication

- 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

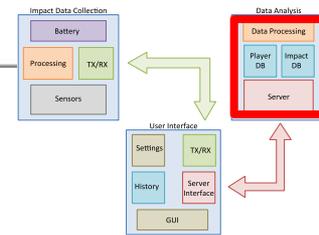
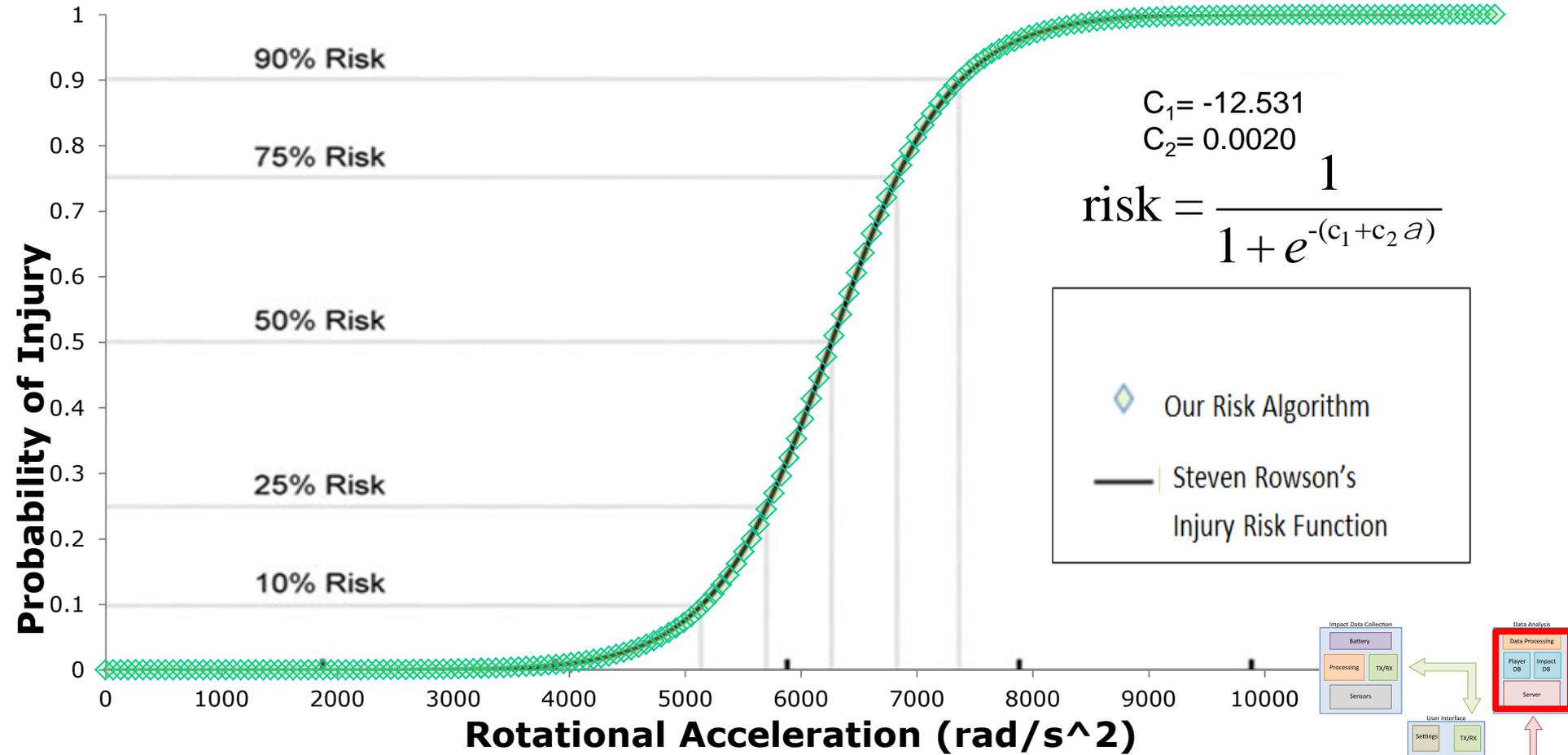


Data Processing and Storage

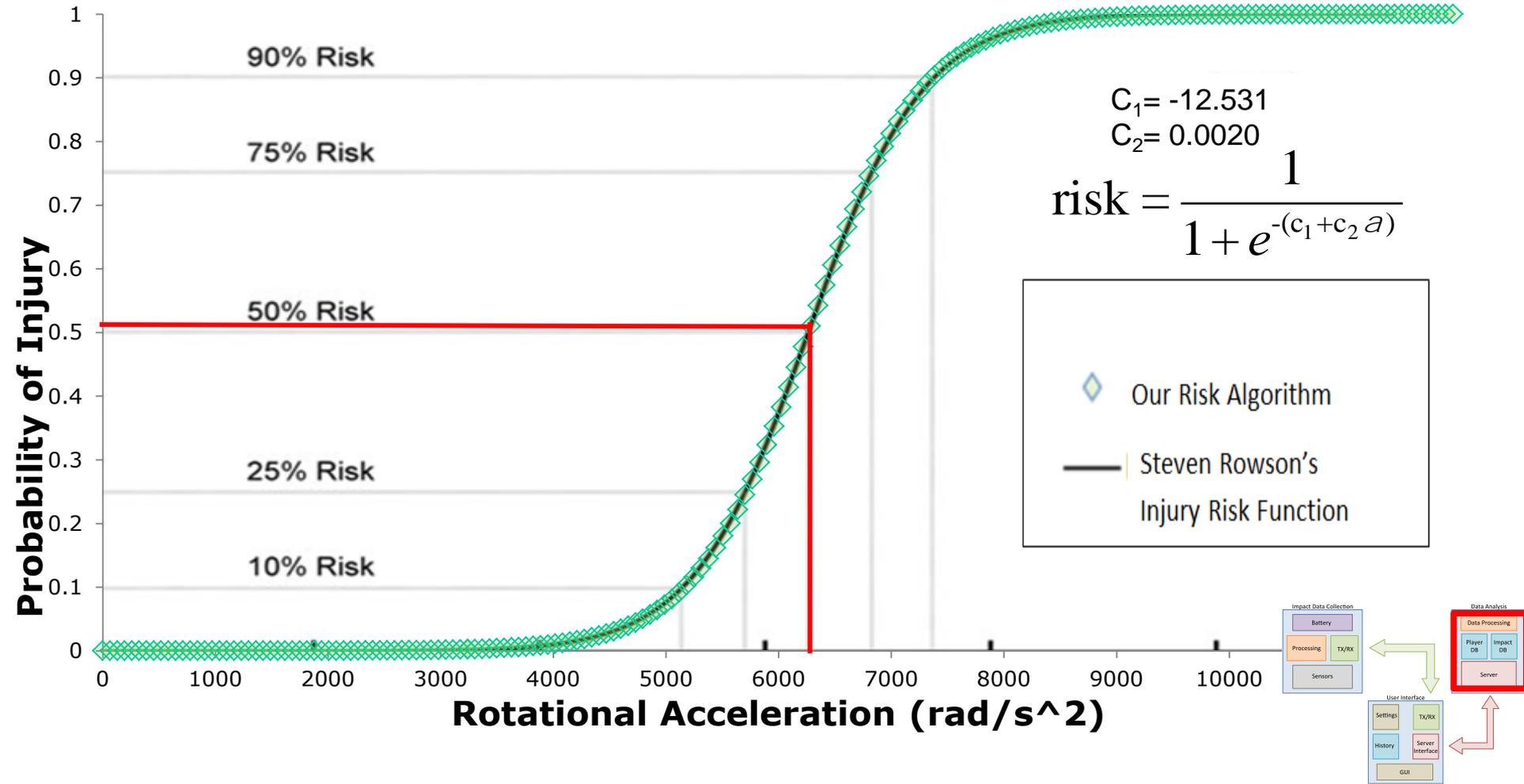
- Requirements
 - Calculates rotational acceleration
 - Determines probability of concussion
 - Output within 500 ms
 - Store all impact data efficiently
- Accomplished
 - Calculates rotational acceleration and probability of concussion in average of 411.6 ms
 - Computational analysis
 - Set up server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



Test Results



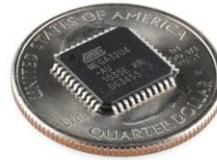
Test Results



Impact Processing & Communication

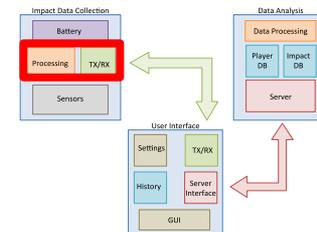
- ATmega32U4 8-bit AVR Microcontroller

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



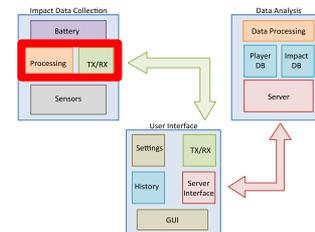
- Bluetooth: BlueSMiRF w/ RN-41

- 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

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Proposed CDR Deliverables

- **Demonstration of Complete System Functionality**
 - Show implementation of battery powered system
 - Impact the helmet with a known force
 - Transmit impact data with required sample rate from the sensor array to Android device
 - Display risk of concussion with confidence interval on Android device
 - Display player impact history on Android device upon user request

Thank You

Questions

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MDR Report

draft due: 3rd Dec'14

final due: 15th Dec'14

MDR Report Rules

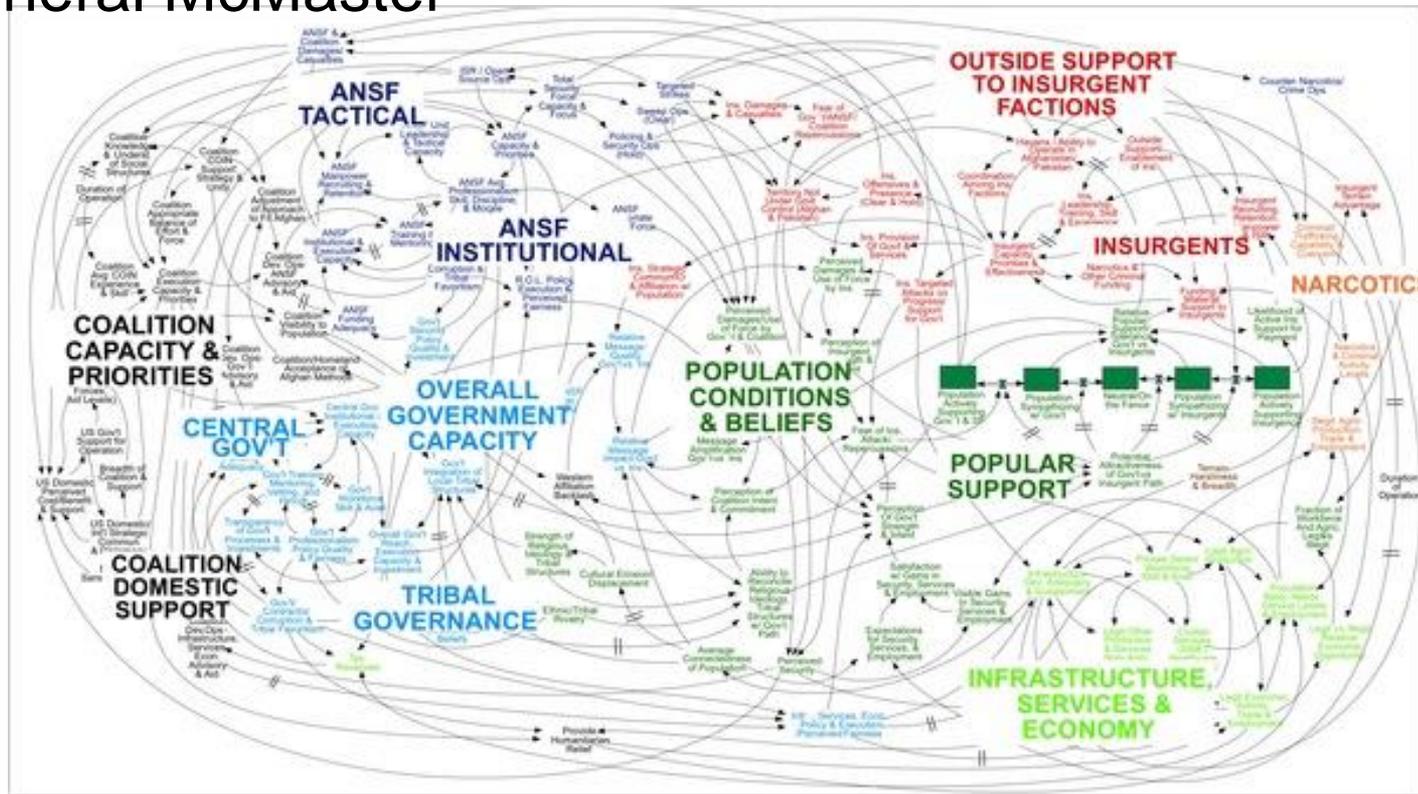
- IEEE Paper Format
- Cite all sources
- Grammar Counts
- Clear
- Content
 - 0. Abstract
 - I. Introduction
 - II. Design
 - III. Project Management
 - IV. Conclusion

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.

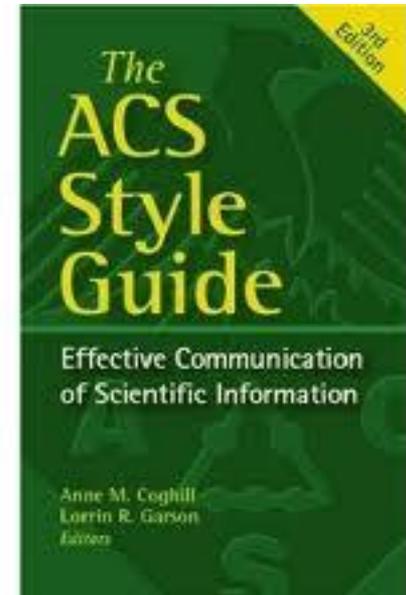
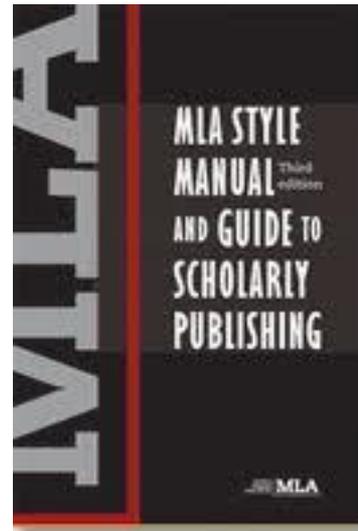
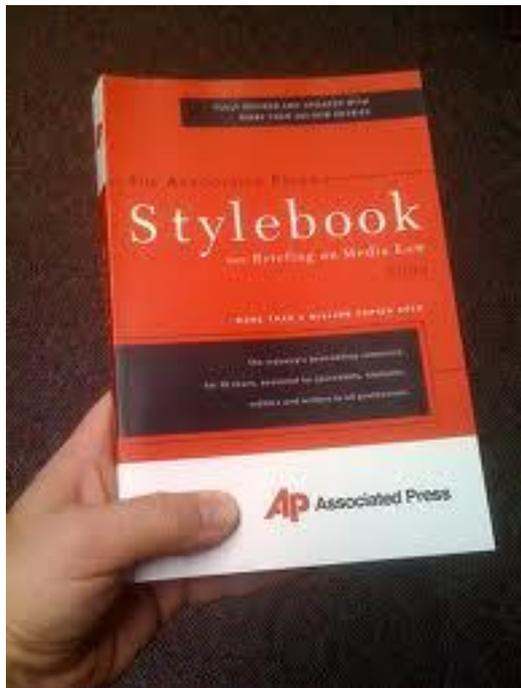
D. Block 3

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.

<http://www.ieee.org/documents/stylemanual.pdf>

How do you know the format?

Different Organizations Use Different Style Guides.



Cite All Sources

- Course Coordinators will Weight This Heavily in Grade.
- 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.
- Formats can be found in style guide or sample document.

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

MDR 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.

MDR Report Content

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

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	Value
Weight	<5% increase (typically 102 grams)
Range	25 m
Response Time	<2 s
Battery Life	>5 hours
Cost	<\$5000 for full team of 52 players
Power Consumption	<2 W
Acceleration Range	+/- 70 g
Sensitivity	Only measure actual collisions
Durable Packaging	Stable and waterproof

II. Design

- A. Overview (Block Diagram) (e)(f)
- B. 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