

# Design Requirement

## EECE401 Senior Design I

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Dept of Electrical and Computer Engineering  
Howard University  
Washington, DC

Fall 2012

# Before We Proceed

- Problem Statement for Jimi Hendrix and Eric Clapton

Ellwood Lane

Tiffany Hall

Daley Gunter

Olusanya

Joseph Ignatius

To achieve mobility while maintaining the musical quality and being cost effective.

Adegboyega Akinsiku

Luan Watson

HENOK MAZENGEA

PIERRE CHARLES

Develop an efficient method to wirelessly send audio signals from a guitar to an audio amplifier in order to reduce mobility constraints.

# Before We Proceed

Jennifer Okafor  
Damel Goodard  
Kalorji Bankole  
Samuel Omosuyi

## Problem Statement:

We want to implement a wireless communication link between guitar and amp to increase mobility and reduce trip hazard.

We need to design a guitar system that eliminates restrictions on movement and connection issues associated with wired amp connections

Lamine Bassene

Eric Turner

Shaddy Abdelaal

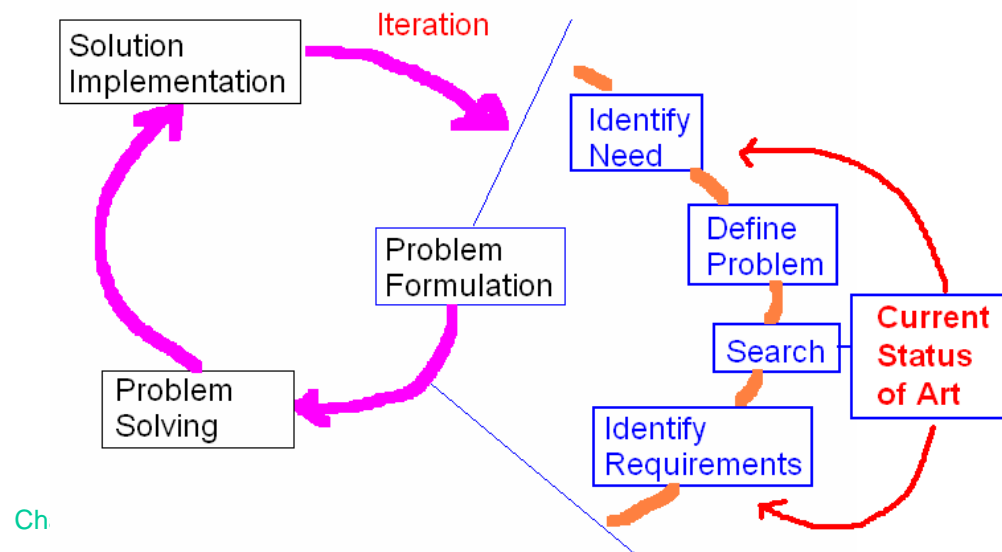
Paul Alade

# The Next Step in Design

- We are still in the PROBLEM FORMULATION
  - Clear understanding of the PROBLEM of the project
  - Practice with the problems of Jimmy Hendrix and Eric Clapton
- Next Steps
  - The **current status** of the solution (product) to the needs and problems
  - Establish **design requirements** for the needs and the problems
    - Conversion from the **Needs** to the Design **Requirement**
- **Team Specifics**
  - Cup 2013 Competition Teams
    - Topic and Title → Registration
    - Problem Formulation → Status of Art → Proposal Writing
  - Self-Healing Team
    - Group Meeting with Mr. Blue --- 10/5/2012 (F) 10 – 12
    - Problem Clarification and Current Status of Art
  - Grid-Eye team
    - NGC speaker will be invited for presentation and group meeting
    - Search and study the current status of art

# Current Status of Art

- Study and understanding of the **field knowledge** around the needs and problems – **core principle and technology, theory**, etc ← Basic Theory Focus
- The **current status** of the field related to the needs and problems -- **products, patents, research and development**, etc ← Product Focus
- Other issues specific to the needs and problems



# How to know the current status of art

- Three primary activities
  - Working with customers/users to get information
    - Interviews, Concept Maps, Observation
  - Discussing the problem with each other
    - Clarification within a group
  - Researching Information
    - Libraries and online sites
      - Be careful:
        - » Accuracy and Authority
        - » Objectivity
        - » Currency
    - Existing products
      - Benchmarking
    - Experts
      - Consulting Experts
      - Advisors

# First Team Homework

- Homework Subject: Current Status of Art (for your specific project)
- Before you start
  - Step 1: Your team needs a topic (subject) title
    - Proper project title which defines the subject matter.
    - The title must accurately describe what the project is all about.
    - Select a functional title rather than a creative, attention-grabbing title.
    - For example, **use** “Why ABC should build a factory in Whoseville”, **rather than** “Whoseville: A Town of Growth”.
  - Step 2: Your team needs a problem statement
- Now your start:
  - 1) Search, study, and discuss
  - 2) Find
    - what basic/core theory and principle are (to be) applied to the subject
    - Any existing similar product or prototype or product announcement
    - What are their features, characteristics, and drawbacks.
    - How you would improve and meet the needs
  - 3) Write
    - Page 1: Topic, team members, and 1-sentence problem statement
    - Page 2: 1-paragraph executive summary (with your own words)
    - Page 3 – 5: details of the finding, focused on the existing technology, products, ideas, and their drawbacks and disadvantaged that highlight the motive of your project. **And reference must be listed at the last.**
- For a team which is still seeking a topic (this may be a time-waste)
  - The topic for this HW is “Wireless Guitar Amp”

## Report Writing Instruction

- What is a good report? (Answer) A report that will be:
  - read without unnecessary delay;
  - understood without undue effort; and
  - accepted and, where applicable, acted upon.
- Grading Criteria
  - A good functional title
  - A good and comprehensive problem statement
  - A good executive summary
  - A good writing on the Current Status of Art which show good research
- Submission of the Report (**hardcopy only**) **Email submission not accepted**
  - 1 report per team
  - Letter size, 1" margin all sides, 11 pt. Times New Roman font. Single space. Left justified.
  - Submission Due: Wed, 10/10/2012 2:10pm



# Now, Design Requirement

- What is “Design Requirements” ?
  - **Technical** Guide
    - Plain English description → Technical terms
    - **Specifications**
      - Size
      - Weight
      - Current and Voltage and Power consumption
      - Reach
    - **Regulations**
      - FCC
      - FAA
      - Etc
  - It’s all down to **numbers**

# Problem vs. Requirement (or Spec)

- A **more precise (technical) description** of the Problem (Needs):
  - should not imply a particular architecture/solution;
  - provides input to design/solution process.
- Difference between Problems (Needs) and Specification
  - Layman's term → Technical terms
  - Aamco Commercials
  - Description → Specification (Example)



Replacement **Dell** Latitude **E6500** AC Adapter 90Watt 19.5V 4.62A



Replacement **Dell** Latitude **E6500** AC Adapter 90Watt 19.5V 4.62A

Email to a Friend  
Be the first to review this product

Availability: In stock

**\$19.99**

Qty:  [Add to Cart](#) OR [Add to Wishlist](#)  
[Add to Compare](#)

[Quick Overview](#)

## Specification:

Replacement **Dell** Latitude **E6500** AC Adapter 90Watt 19.5V 4.62A

Manufacturer: 3rd Party

Input: AC100-240V (worldwide use)

Output: DC19.5V 4.62A

Power: 90W Max

Outlet: 3-Prong

DC Connector (Barrel) size:

Internal Diameter: 5.0mm

External Diameter: 7.4mm

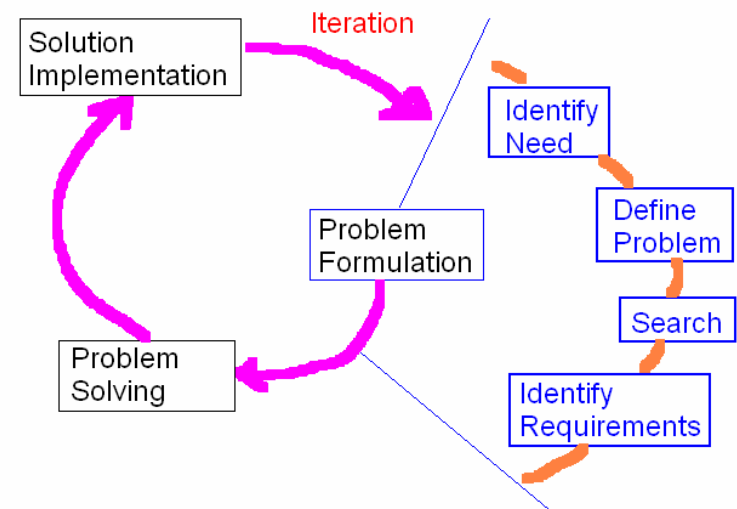
With central smart-pin

Item Includes: AC Adapter and Power Cord.

Charles Kim – Howard University

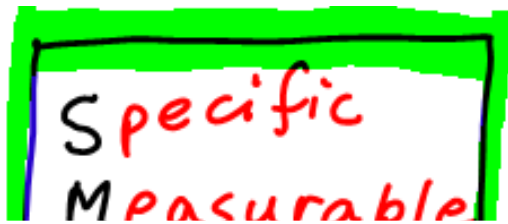
# Design Requirement Identification

- Step 1:
  - Clear, unambiguous description of the problem
- Step 2: **Focus of the class**
  - Establishment of clear set of Design Requirements



# Good Design Requirements

- Design Requirements should:
  - Be as **quantitative, measurable, and precise** as possible
  - Describe the **Need**, not the solution
  - Be **Comprehensive**
  - Be presented in an **easy to understand** format.



Specific  
Measurable

# Requirements – Be Measurable

- If you cannot test if a “requirement” is met, then it is not a requirement
- Testable → Measurable → Quantitative
- Example:
  - 2-liter soda container
    - Bad: “must be safe”
    - Good:
  - Wireless Guitar Amplification System
    - Bad: “lower power consumption”
    - Good:
    - Bad: “Sound quality should not be changed”
    - Good:
  - PV connection to Power Grid
    - Bad: “saving electricity bill”
    - Good:

# Requirements – Need is described

- Should not limit the range of solutions unnecessarily
- 2-liter soda container
  - Good: “container”
  - Bad: “bottle”
- Page turner for a quadriplegic
  - Bad: “Must be Bluetooth enabled”
  - Good:
- Wireless Guitar Amplification System
  - Bad: “Use Bluetooth technology”
  - Good:
  - Bad: “must have wheels to move around”
  - Good:
- Hybrid Vehicle
  - Bad: “Gasoline engine is minimally used”
  - Good:

# Requirements – Be Comprehensive

- How to be comprehensive?
  - Include a team in the formulation of requirement
  - Keep the customers (or stakeholders) in the loop
  - Checklist
    - Spur Ideas
    - Identify gaps

# Sample requirement items (1)

- **Aesthetics:** “70% of target guitarists indicate that the appearance of the system will encourage purchasing it” --- cf. iPad vs. Galaxy Tab
- **Cost:** “Each container must cost less than \$0.10 to manufacture given a production of 2 million per year”
- **Dimensions:** “It must fit within 10”x6”15”
- **Easy of use:** “must not require more than 1 minute to set up the system”
- **Energy Use:** “The maximum power demand must be less than 20W and lasts at least 2 hours with standard audio system emergency power source”
- **Environment:** “The system should stand more than 4 hours in temperatures ranging from 40F to 130F.
- **Ergonomics:** “The system must be able to be lifted up with less than 10 pound force”
- **Interface with other systems:** “all connectors must fit on audio industry terminals”
- **Lifespan:** “The soda container must last for 2 years when filled with pressurized soda at 85F”



## Sample requirement items (2)

- **Maintenance:** “Required annual maintenance should be minimized and must not exceed 10 minutes per 1 person”
- **Weight:** “The system must be less than 1 pound”
- **Noise Level:** “The noise level of the system should be less than 60dB at 2 feet from front of the device when operating”
- **Patents:** “Must not infringe on the following patents: (1), (2), etc”
- **Performance:** “Car must reach 110 mph”
- **Recycling:** “Container must be made of at least 33% post-consumer materials and must be 100% recyclable”
- **Safety:** “The system should not get in fire when dropped from 3 feet while in operation”
- **Standards:** “The EMC standards and FCC part 15 in particular must be complied”
- **Regulation:** Electric wiring must meet and satisfy 2010 NEC code

# Sample Design Requirement

- Lane Departure Warning System



Design Requirements Form F2010.xls  
Microsoft Excel Worksheet  
36 KB

# Summary of “Problem Formulation”

- The most important first step in design process
- Is focused on identifying the requirements of the needs and problems
- Involves activities of
  - gathering information about needs
  - know the current status of art
  - Formulate (quantify) Design Requirements
- Will be used throughout the design process as Guideline for
  - Concept development and exploration
  - Basis for testing