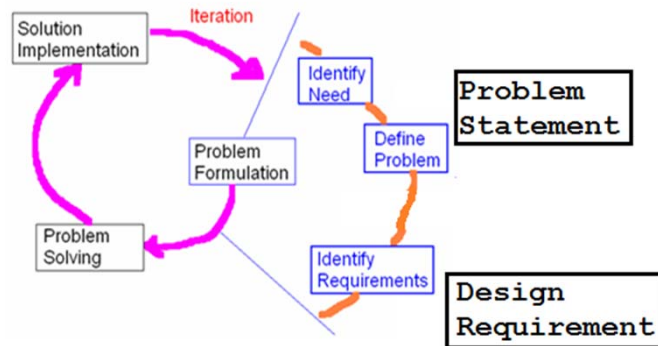


# Design Requirements



**EECE401 Senior Design I**

[www.mwftr.com/SD1920.html](http://www.mwftr.com/SD1920.html)

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## Recall: Problem Formulation Process

- Comprehensive Problem Statement:
  - Customer demands,
  - Undesirable situations
  - Specific Needs from the problems
  - Why they are not met/Solved,
  - Many different angles,
  - Cause, not symptoms

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# Recall: Problem Formulation Process

- Exercises



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# Your team's Problem Statement

- Discuss in your team's next weekly meeting
- Complete the activity for identifying the problem
- Submit the Problem Statement
- Word and PDF format

WWW.MWFTR.COM

## Problem Statement Form for VIP and Design Class

Date: \_\_\_\_\_

Team Name		
Team Project Title		
Team Faculty Advisor		
Team Graduate Assistant		
Team Members	Senior Design Class Students	
	Other Students	
Team Project's Long Term Goal		
Team Project's Academic Year Goal		
Problem Statement	Needs/Problems (i.e., Presently undesired situations)	Issue:
	Benefits	Issue:
	1-Sentence Problem Statement	A complete sentence:

www.mwfr.com/SD1920.html

**Senior Design Class of 2019-2020**

[Dr. Charles Kim](#)

**Lecture Notes:**

Syllabus+: [First Class](#)

Lecture 1: [Introduction](#)

Lecture 2: [VIP Project and Teamwork](#): (Link to [VIP at Howard](#) and [VIP Teams](#))

Lecture 3: Design Process and Problem Formulation  
Problem Statement Form ([docx format](#) and [pdf format](#))

## Next Step

- Next Step
  - From the problem statement: **Conversion** from the **Needs** to the Design **Requirement**
- Design Requirements
  - A **more precise (technical) description** of the Problem (Needs):
    - should not imply a particular solution;
    - provides **input (engineering term for “customer needs”)** to concept design/solution process.

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## Problem vs. Requirement (or “Spec”)

- Conversion from Problems (“Needs”) to Design Requirement (“Specification” or “Spec”)
  - Layman’s term → Technical terms → Specification

A **product specification** (also referred to as “**product specs**”) is a document with a set of requirements that provides **product** teams the information they need to build out new features or functionality. A good **product spec** doesn't micro-manage **product** development.

[What Are Product Specifications - ProdPad](https://www.prodpad.com/resources/guides/product-specifications/)  
[https://www.prodpad.com > resources > guides > product](https://www.prodpad.com/resources/guides/product-specifications/)

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## Problem vs. Requirement (or “Spec”)

- Conversion of **Description** → **Specification** (Example)
  - Customer: I need a replacement for Dell Latitude AC Adapter – Model # E6500
  - Custom adapter design engineer: What questions should be asked to design and manufacture an adapter for the customer?

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## Problem vs. Requirement (or “Spec”)

- **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](#)

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## Problem vs. Requirement (or “Spec”)

- **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

### 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.

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## Product Specs - Samples

- **Inputs:** 110 V AC via 3-wire connection
- **Outputs:** Position Location in GPS format via USB connection
- **Response Time:** Output should be available within 1 sec after input command entered
- **Dimensions:** “It must fit within 10”x6”X15”
- **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”
- **Operation Limit:** “The system should stand more than 4 hours in temperatures ranging from 40°F to 130°F.

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## Product Specs (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"
- **Performance:** "Car must reach 110 mph within 10 seconds"
- **Interface with other systems:** "all connectors must fit to industry audio cabling standard 3.5 mm TRS minijack"
- **Lifespan:** "The soda container must last for 2 years when filled with pressurized soda at 85°F"
- **Ergonomics:** "The system must be able to be lifted up with less than 10 pound force"

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## Product Specs - Practice

\* The need of the exercise is to resolve the Problem of dragging around wired Guitar while playing:

\* To Enable mobility while Performing

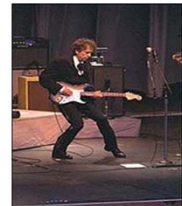
\* To resolve on stage wiring issues.

\* The Problem of dragging around while wires while Perform can be resolve by building wireless amps to Enable Musicians have unrestricted mobility on stage and also resolve the wiring issue that could cause safety hazards.

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## Product Specs - Practice

- Problem Statement: The problem of dragging wire around during performance can be resolved by wireless amps which enables performers to have unrestricted mobility on stage and eliminates safety hazard such as tripping by the wire.



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## Specification - Summary

- What is Specification ?
  - **Technical** Guide
  - Plain **English description** of problem statement → **Technical terms for design & implementation**
  - **Express in quantity and in number**
- BUT, “Design Requirements” are NOT just “specification”
- There are 2 more elements

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## 2. Environmental-Socio-Cultural Constraints

- “**Socially and Environmentally Responsible Design**”
- **Example: Recycling:** “Container must be made of at least 33% post-consumer materials and must be 100% recyclable”
- **Environmental-Socio-Cultural Constraints:** Customer Cultural Preference-based requirements on material, design, Fengshui, for example.

#BUSINESS NEWS JULY 19, 2017 / 7:14 PM /



### Ford's 'golden noses' seek edge in slowing China car market

- **Guess what Ford Seeks?**

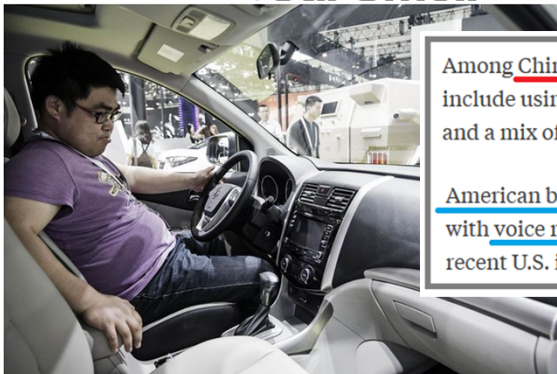


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## Example - Socio-Cultural Constraints



### Chinese Consumers Hate That New-Car Smell



Among China's motorists, popular ways of getting rid of that new car smell include using bags of activated carbon, lemon, grapefruit or orange peels, and a mix of water with vinegar.

American buyers, on the other hand, have been consistent in taking issue with voice recognition, Bluetooth and connectivity systems in J.D. Power's recent U.S. initial quality surveys,

A visitor sits in the driver's seat of a Dongfeng S500 electric car at the Beijing International Automotive Exhibition. New car smell is deemed unpleasant in China, where formaldehyde pollution of interior air have worried people. *Photographer: Qilai Shen/Bloomberg*

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## Environmental-Socio-Cultural Constraints - Practice

- Problem Statement: The problem of dragging wire around during performance can be resolved by wireless amps which enables performers to have unrestricted mobility on stage and eliminates safety hazard such as tripping by the wire.

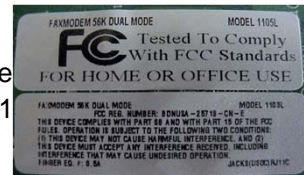


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## 3. Compliance

### 3. Compliance to Regulations

- FCC: Electronic devices
  - Part 15 of Title 47 “Low-power, non-licensed transmitter
  - (Ex) 47 CFR 15.103 “Digital devices oscillating below 1
  - FCC ID --- traceability to FCC compliance
- FAA: Aircraft devices
- FDA: Medical devices
  - (EX) 510(k) Clearance to Market [FDA 21 CFR Part 820]
  - (EX) ISO 13485 Medical Device Quality requirement in International market
- Others



## Compliance - Practice

- Problem Statement: The problem of dragging wire around during performance can be resolved by wireless amps which enables performers to have unrestricted mobility on stage and eliminates safety hazard such as tripping by the wire.



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## Summary - Good Design Requirements

- Conversion of customer needs into technical terms
- 3 Elements:
  - (a) Product Specifications,
  - (b) Constraints (Cost, Time, and Environmental-Socio-Cultural Constraints),
  - (c) Compliance (to Rules, Regulations, and Standards)
- Design Requirements should:
  - Be as **quantitative, measurable, and precise** as possible
  - Describe the **Need**, not the solution
  - Be **Comprehensive**

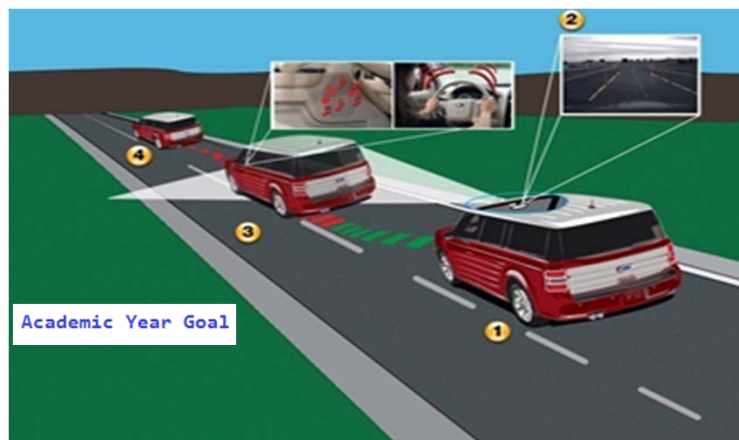
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## Sample Design Requirement

- Team **Summit**
- Log Term Goal: **Autopilot Car**
- Academic Year Goal: **Lane Departure Warning System Implementation**



Design\_Requirements\_SAMPLE.xls



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## Design Requirements – Team Assignment

- Project Design Requirements
- Team meeting/activity
- Use **Excel file format**
  - **Form:**
  - **Sample:**
- Be comprehensive
- Submission required
  - Due **M 10/14/2019**

