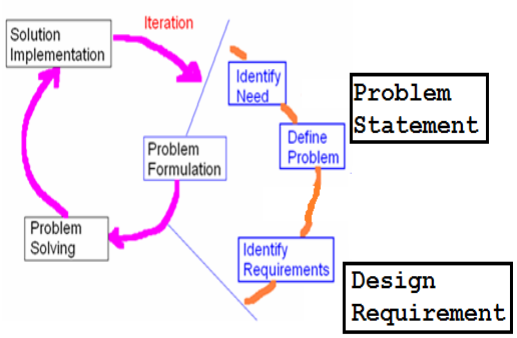
# Design Requirements




EECE401 Senior Design

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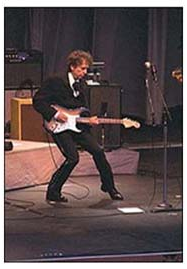
## **Recall:** Problem Formulation Process

- Problem Statement:
  - N-B Proposition
    1. Needs (Dissatisfied Condition/Situation)
       - Customer's undesirable situations
    2. Benefits
       - How the proposition brings benefit
    3. Combined 1-sentence problem statement



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# Your team's Problem Statement

- Team Assignment 2
  - Due: (M) Oct 3
- Discuss in your team's next weekly meeting
- Dissatisfied Situations & Benefits
  - Talk to your advisor
  - Talk to your customers
  - Brain storm in the meeting
- 1-sentence statement
- Submit the Problem Statement Form
- MS Word format

| | | | |
|---|---|---|---|
| wk4 - Sep12 | • **Lecture** - Problem Formulation | Problem Statement Form (download this Word file) | |
| wk5 - Sep19 | • **Lecture**- Team and Teamwork | Team Contract Form (download this Word file) | Team Assignment 1: Team Contract (due: (M) Oct 3). Team Assignment 2: Problem Statement (due: (M) Oct 3) |

- NEXT STEP

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# Design Requirement

- After the problem statement:
  - We have not proposed a specific solution here yet to convert the dissatisfied conditions to the benefits , but we can **imagine/visualize the (_____)** which provides the promised benefits and its features
- **Design Requirements**
  - A **technical description** of the final product
  - Conversion of "Layman's term" of the desire to "Technical terms and to Specification"
- Specification: Definition: A product specification is a document with a set of requirements that provides product teams the information they need to build out new features of functionality.

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## Image of Final Product → Requirement (or "Spec")

- Conversion of **Description → Specification** (Example)
  - Customer: "My AC Adapter for my old laptop is dead but I could not find replacement in the market."
  - Final Product: "An AC adapter which can replace the dead one for the old laptop"
  - **Design engineer: What questions** do we need ask to **design and manufacture the customized adapter** for the customer?
    - Quantification is essential


**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 Connecter (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 (Anything with numbers belongs to "spec")

- **Inputs:** 110 V AC via 3-wire connection
- **Outputs**: 12V DC with Max Current of 4Amps.
- **Response Time**: Output should be available within 1 sec after input command entered
- **Dimensions**: It must fit within 10"x6"X15"
- **Speed**: Max 10 mph and Min 1 mph
- **Energy Use**: The max power 50W
- **Battery**: 12V 12Ah Battery **Operation Limit**: The system should stand more than 4 hours in temperatures ranging from 40°F to 120°F.
- **Weight:** The system must be less than 5 lbs
- **Noise Level:** The noise level of the system should be less than 60dB at 2 feet from front of the device when operating
- **Performance:** Full battery gives minimum 10 hours of operation
- **Software Requirement**: Open source
- **Platform/Hardware**: minimum 64-bit process with 64MB RAM

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# Software Specs (SRS: Software Requirement Specifications)

## Overall description

- Product perspective
  - *System Interfaces*
  - *User Interfaces*
  - *Hardware Interfaces*
  - *Software Interfaces*
  - *Communication Interfaces*
  - *Memory Constraints*
- Design constraints
  - *Operations*
  - *Site Adaptation Requirements*
- Product functions
- User characteristics
- Constraints, assumptions and dependencies

## Specific requirements

- External interface requirements
- Functional requirements
- Performance requirements
- Logical database requirement
- Software System attributes
  - *Reliability*
  - *Availability*
  - *Security*
  - *Maintainability*
  - *Portability*
- Organizing Specific Requirements

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# Software Specs - Example

- Ex) – Digital Picture Frame
- -Ex) Wildlife camera

### 3.2 Hardware Interfaces

The minimum hardware requirements of Gephi are a 500 Megahertz CPU and 128 megabytes of RAM. Also, because Gephi uses an OpenGL 3D engine to speed up graph visualization, a compatible graphics card is required. A system with these specifications can handle a Network of approximately 1000 edges and nodes. For bigger networks, additional memory is required (https://gephi.org/users/requirements/).

### 3.3 Software Interfaces

Gephi requires Java to be installed on the system, more specifically Java version 7 or 8 for its latest release. Additional information can be found on section 2.7 of this document.

Gephi can be connected with a MySQL, SQLite or PostgreSQL database to import a graph edge list.

### 3.4 Communications Interfaces

Gephi requires an internet connection to install new plugins, update already installed ones and update some of its components (APIs, modules etc.).

Source: Software Requirements Specification of Gephi, v.0.92, Prepared by Konstantinos Varvoutas, Aristotle University of Thessaloniki. Feb 2017. [online] https://gephi.org/users/gephi_srs_document.pdf

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## Product/Software Specs – (Team Work part 1)

- 1. Start from the Problem Statement of your team project
- 2. Imagine the final product which satisfies the dissatisfied situations and provides the promised benefits
- 3. Now specify/quantify the final product by
  - Size
  - Weight
  - Speed
  - Response time
  - Material
  - -etc
- 4. Write the Product Specs for your project

Work on either (a) Product or (b) Software Spec

- **Software Specs** (if the problem can be resolved primarily by software)

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## Product/Software Specification - **Summary**

- What is Specification ?
  - Technical Guide for **Development**
  - Conversion **from** Plain **English description** of problem statement **to** **Technical Terms for Design & Development**
  - **Product Specs ( or Software Specs)**
- BUT, "Design Requirements" are NOT just "specification" – it is **just one component**
- There is **1 more component**

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## Component 2. **Constraints**

- **1. Environmental Constraints:** Environmentally concerned/friendly material and design
  - "Container must be made of at least 33% post-consumer materials and must be 100% recyclable"
- **2. Socio-Cultural Constraints**: Customer Cultural Preference-based requirements on material and design,
  - Example - Fengshui.

- **Guess what Ford Seeks?**

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

REUTERS

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

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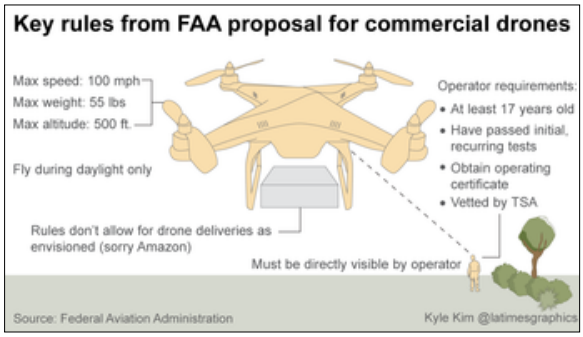
## **Component 2**. Constraints


- **3. Compliance to Regulations**
  - FCC: Electronic devices
    - Part 15 of Title 47 "Low-power, non-licensed transmitters"
    - (Ex) 47 CFR 15.103 "Digital devices oscillating below 1.705 MHz) etc etc"
    - 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

FDA 510(k)

  - Others

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## Constraints – (Team work part 2)

1. Start from the image of the Final Product
2. Consider any part/component/fuel which would harmfully impact environment → Find corrective or mitigative approach (material, design, noise, etc)
3. Consider any part/component/fuel which would harmfully impact society/culture → Find corrective or mitigative approach (design, smell, etc)
4. Consider what rules, regulations, or codes the final product should comply with to be cleared for sale. → Find those applied to the similar or same class products in the market.

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## Design Requirements - Recap

- **Conversion** from customer needs to the final product to technical terms for guiding development effort
- **2 Components**:
  - (a) Product (or Software Requirement) Specifications,
  - (b) Constraints (Environmental & Socio-Cultural & Compliance)
- Design Requirements should:
  - Be quantitative, measurable, and precise
  - Do not describe specific solution approach
  - Be comprehensive

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| Design Requirement | | |
|---|---|---|
| Date: | | |
| Project Name/Title: | | |
| Team Advisor | | |
| Project's Goal/Scope | | |
| Team Members | | |
| 1-sentence problem statement | | |
| **Requirements** | **Items** | **Quantity** |
| 1. Preoduct (or Software) Specification | AC Input Voltage | 110 - 230 V |
| | Weight of the final product | < 5 lbs |
| | | |
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| | | |
| | | |
| 2. Contraints | Environmental Constraints | |
| | Socio-Cultural Constraints | |
| | Compliance (Rules, Regulations, and Standards) | |

Design Requirement Form

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## Design Requirements – Team Assignment #3

- Design requirements of your own project
- Format: Design Requirement Form (available in the web page)
- File Name: **GroupName_DesignReq.xxx** (xxx being the file type)
- Submission Due: (M) Oct 17

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