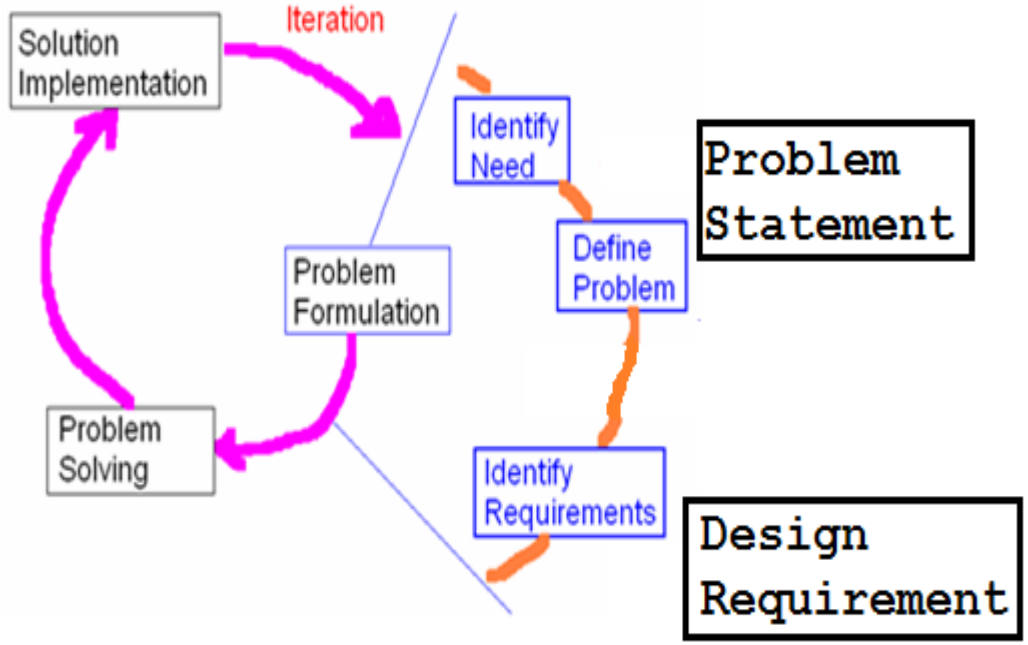
Design Requirements



EECE401 Senior Design I
for
Electrical and Computer Engineering Programs
Howard University

Recall: Problem Formulation Process

- Problem Statement:
  - NAB Value Proposition Approach (bullet items →1 sentence for each → Make out 3 sentences)
    1. Needs /Dissatisfied Situation/Problems
    2. Approach – Conceptual Solution
    3. Benefits or desired outcomes
       - How the proposition brings benefit
  - Combined 3-sentence problem statement

- Next Step ?

Your team's Problem Statement

A team's problem statement Process on Pager

- Subject: Pager/Beeper (as proposed in era of the Landline only phone system)
  - 1-sentence for each of the 3 elements
- Itemization
  - Need/problem/undesired situation
    - * to contact or notify someone
    - * no phone or source of contact nearby (undesired situation)
    - 1-sentence: Consumers aren't able to communicate effectively when not close to a landline
  - Conceptual Approach
    - * portable/mobile device
    - * ability to display message to user in a timely fashion without being near a landline
    - 1-sentence: Consumers will have a portable/mobile device that will allow them to send/recieve phone call notifications in a timely manner
  - Desired Outcomes or Benefit
    - * a more efficient way to communicate
    - * faster response time and increased mobility
    - 1-sentence: Consumers will be able to communicate with each other quickly and more efficiently without needing to be near a landline
- 3-setence Problem Statement:

The problem with a landline only phone system is that consumers aren't able to communicate efficiently when not close to a landline. A solution to this is having a portable/mobile device that will allow them to send/recieve notifications quickly. The benefits to this is that consumers can communicate quickly and more efficiently without being near a landline.

Group
Clarice Y
Trey N
Ryan H

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- Next Step ? Your team's Problem Statement

Another team's problem statement Process on Pager

- Subject: Pager/Beeper (as proposed in era of the

Antonio Jackson, Chima Nwughala, Lance Hinds, and Darnyieh Brewer

  - **1-sentence** for each of the 3 elements
- Itemization
  - Need/problem/undesired situation
    - * Not being able to be notified immediately for home calls
    - * Not being near your home or a landline, in case of emergency.
    - 1-sentence: There is an inability to be contacted when away from home or landline, in case of emergency.
  - Conceptual Approach
    - * Portable , to take anywhere you go.
    - *Being able to get paged through far distances for faster communication.
    - 1-sentence: A portable device that can bounce off cell towers and ping to different landlines through far distances for faster communication.
  - Desired Outcomes or Benefit
    - *More convenient for users to communicate .
    - *Faster response time in case of emergencies.
    - 1-sentence: This device is to help have a more convenient and efficient way of communicate and getting that faster response time in case of emergency.
- 3-setence Problem Statement:

There is an inability to be contacted when away from home or landline, in case of emergency. A portable device that can bounce off cell towers and ping to different landlines through far distances for faster communication. This device is to help have a more convenient and efficient way of communicating and getting that faster response time in case of emergency. 14

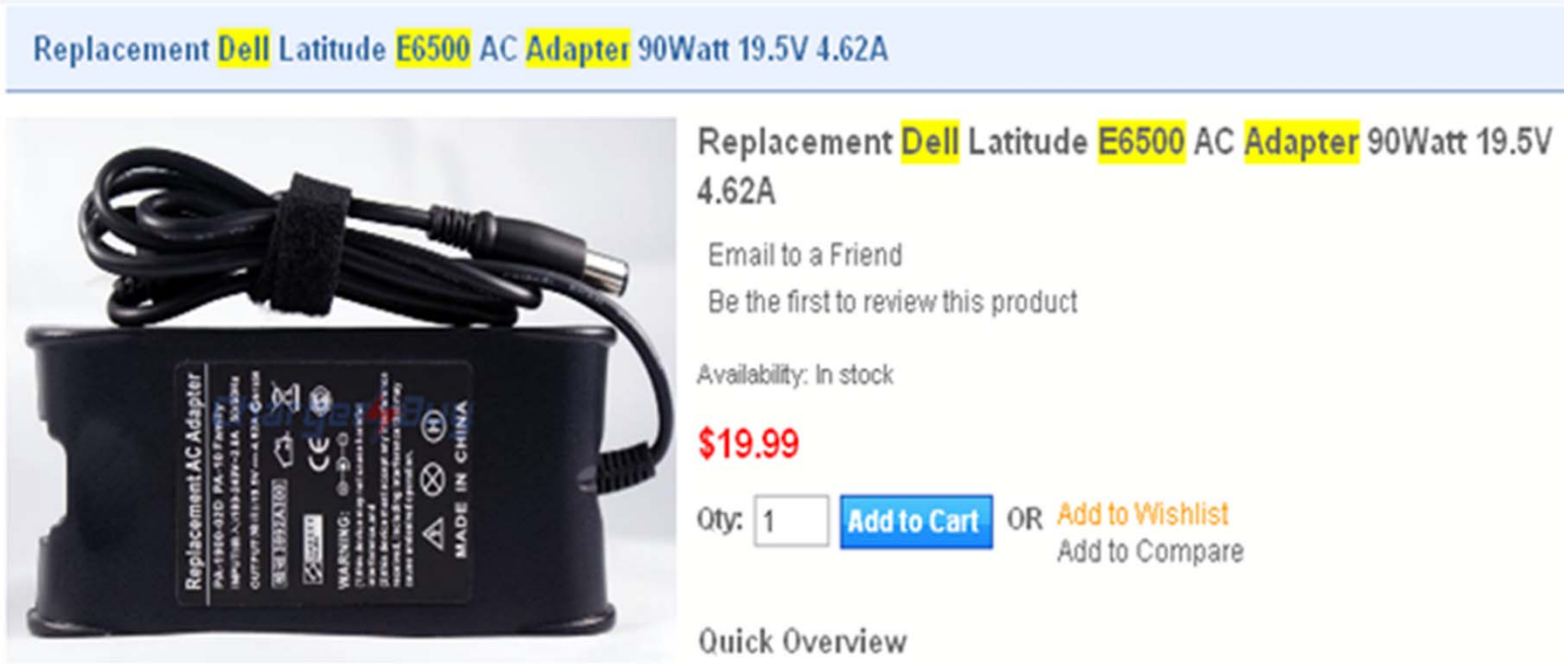
- Next Step ? Your team's Problem Statement

Design Requirement

- After the problem statement:
  - We have not proposed a specific solution here yet to convert the **needs or dissatisfied situations** to the benefits (or desired outcomes) , but we can **imagine/visualize the (final product)** which provides the promised benefits and its **features**
- **Design Requirements (for the features): 2 components**
  - A technical description of the features of the functionality of the final product
    - Technical specification
  - The ( ) under which the final product should be designed and implemented
    - Rules and regulations for the use of the final product
    - Environmental regulations on the materials used in the final product

Design Requirement

- Technical Specification:
  - Definition: A product specification is a document with a set of **requirements** that provides product teams with the information they need to build out the features of functionality.



Specification - Example

Description:

The PP-9000AW-2 Alphanumeric Pager, part of Cornell Communication's VersaPage medical paging system, is a true mini pager with large display and user friendly interface. It can be either selective PC or hand programmable. The pager device also has 16 memory slots, 10 personal slots, a full message indicator, and supports multiple languages (English, Spanish, Portuguese, Russian, German, and French).

Pocket Paging System Includes:

- 84 Alphanumeric or Chinese character
- Back lit display
- Long battery life, with Lithium battery back-up
- 4 beep alerts, 10 melody alerts, vibrate mode, 9 caller ID activated beep tones, reminder alert, and 5 daily alarm sets
- Duplicate message detection, unread message display, message time stamp, month/date/year/time display
- Extension compatible
- Up to 6 cap code capability
- Selective message lock/delete Frequency: 138\74MHz, 279\282MHz, 443\473MHz, 929\932\MHz
- Paging Sensitivity: 512bps – 5u V\M, 1200bps – 9u V\M
- Bit Rate: 512\1200\2400bps for POCSAG, 1600\3200\6400bps for FLEX
- Spurious Rejection: 40db below carrier
- Alert Tone Volume: 85db at 30cm (12")
- View Area: 45 x 14.43mm

Operation:

When used with Cornell System, this pager keeps you connected and available 24/7.

Engineering Specifications:

Contractor shall furnish, program and include Pocket Pagers Model PP-9000-AW-2 according to receive transmissions TR-9010-W2 or TR-9010-W5 according to specifications.

Technical Information:

- Dimensions: 64 x 43 x 20mm
- Power: 3.0V Lithium
- Battery Replacement: Duracell DL123A lithium battery
- Battery Life: Up to 2 years
- Operating Environment: 50-120°F Indoor Non-condensing

Can you guess the feature of this product?

Processor

Chipset Manufacturer	Intel
Cores	Deca-core (10 Core)
Processor Brand	Intel
Processor Generation	13th Gen
Processor Model	i7-1355U
Processor Speed	1.70 GHZ
Processor Type	Core i7

Memory

Available Memory Slots	1.0
Occupied Memory Slots	1.0
RAM Installed	16 GB

Storage

Display & Graphics

Display Screen Technology	In-plane Switching (IPS) Technology
Graphics Controller Model	UHD Graphics
Screen Mode	Full HD
Screen Resolution	1920 x 1080
Screen Size	15.6 inch
Touchscreen	No
V-Sync Rate at Max Res.	60 hertz

Network & Communication

Bluetooth	Yes
Data Link Protocols	Gigabit Ethernet
Wireless LAN	IEEE 802.11ax

Power

Battery Weight	6.35 ounce
Max Power Supply Wattage	45 watt
Plug Type	Type C
80 PLUS Certification	Electronic Product Environmental Assessment Tool Gold (EPEAT Gold)

Software

Operating System	Windows 11 Pro
Operating System Language	English
Operating System Platform	Windows

Technical Information

Certifications & Listings

Environmentally Friendly	Yes

Physical Characteristics

Color Category	Pike Silver Plastic

Dimensions & Weight

Height	0.78 inch
Weight	3.95 lb
Width	14.1 inch
Depth	9.2 inch

Service & Support

Product Spec Items – 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

Product Spec – for your own project

- 1. Start from the Problem Statement of your team project
- 2. Imagine the final product and its functional features which satisfies the dissatisfied situations, or meets the needs, and provides the promised benefits
- 3. Now specify/quantify the final product by
  - Size
  - Weight
  - Control and response speed
  - Response time
  - Material
  - -etc
- 4. Write (fill) the Product Specs for your project

Product 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**
- BUT, “Design Requirements” are NOT just “specification” – it is **just one component**
- There is **1 more component**

Component 2. **Constraints (3 types)**

- **1. Socio-Cultural Constraints**: Customer Cultural Preference-based requirements on material and design,
  - Example - Fengshui.

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

REUTERS

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

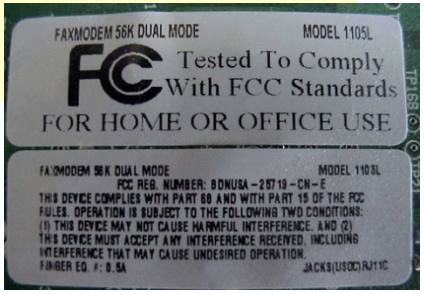
Component 2. **Constraints (3 types)**

- **2. Environmental Constraints**:
  - Environmental and Sustainability Issues of Electronic Product Development
    - Electronics are everywhere in our lives
    - Pose significant environmental and sustainability challenges
      - Production: materials and energy
      - Disposal: Waste and pollution

Component 2. **Constraints (3 types)**

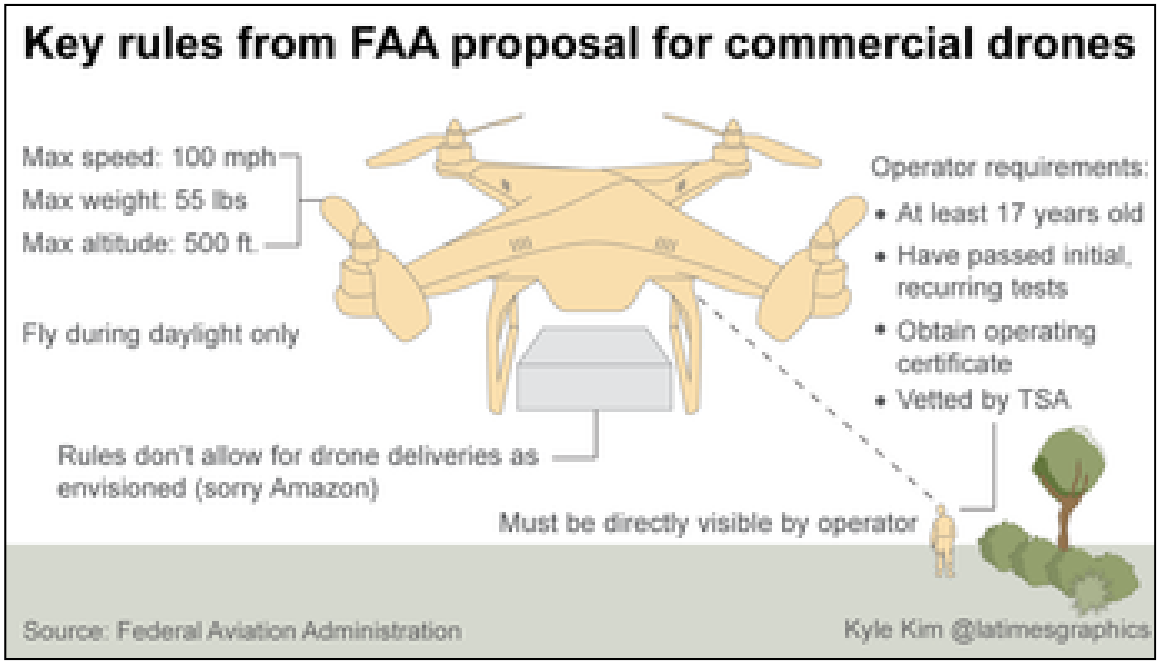
- **2. Environmental Constraints**:
  - How do we design and develop more eco-friendly and durable product?
    - (_____): Consider the whole life-cycle of the product – (a) sourcing the materials, (b) manufacturing process, (c) distribution process (weight); (d) use of the process (energy consumption); (e) End-of-life and disposal process. Minimizes the negative impacts
    - (_____): (a) Selection of materials that are renewable, recyclable, recycled, biodegradable, low environmental footprint. (b) avoid or reduce hazardous substances that can harm human health and the environment.
    - (_____): (a) Design a product so that it reduces energy consumption and emissions using low-power component, software for power management. (b) comply with energy efficiency standards and labels (ex. Eco Star)
    - (_____): (a) Increase durability and reliability of the product so that it can serve longer time and reduce the need of replacement. (b) Use of high-quality materials and components. (c) Design for modularity and upgradability (d) Provide reuse and refurbishment options for the product.

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

  - Others



Constraints – for your own project

1. Start from the image of the Final Product and its functional features
2. Consider any part/component/fuel which would harmfully impact environment → Find/Search corrective or mitigative approach (material, energy consumption, noise, etc)
3. Consider any part/component/fuel which would harmfully impact society/culture → Find/Search 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/Search those applied to the similar or same class products in the market.

Design Requirements - Recap

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

Design Requirement Form		
Date:		
Project Name/Title:		
Team Advisor		
Project's Goal/Scope		
Team Members		
3-sentence problem statement		
Requirements	**Items**	**Quantity**
1. Preoduct Specification		
2. Contraints	Environmental Constraints	
	Socio-Cultural Constraints	
	Compliance (Rules, Regulations, and Standards)	

Design Requirement Form

- Check the webpage for Assignment 3 for Design Requirement