Introduction: This portfolio is documentation of an engineering design project. The design process used is summarized below.

**Identify a Problem - By:**
- Summarizing the Problem with a Problem Statement and Solution Requirements
- Researching the Problem - What, Why, Who, Where, When
- Verifying the Lack of or Limitation(s) of Related Existing Solutions

**Propose a Design - From Many Possible Solutions, Choose a Design to Test By:**
- Generating a Large Volume and Wide Variety of Creative Solutions
- Proposing Workable Designs that Meet Solution Requirements
- Identifying a Design Based on Evaluation of Workable Designs
- Documenting the Design in Detail

**Test the Design - By:**
- Prototyping and Optimizing the Design
- Testing the Prototype

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Identify a Problem By:

☐ Summarizing the Problem with a Problem Statement and Solution Requirements

**Problem Statement:** The screen of a portable electronic device is difficult to see when it is face up on a desk or table.

**Name of Device:** iPhone 6 with a Tech21 Impactology case

**Criteria & Constraints:**

1. **Materials:** The design uses less than 1 cubic inch of 3D printer material.
2. **Simplicity:** The design is not too complicated to make or to use.
3. **Non-Interference:** The design does not interfere with the use of the charging port.
4. **Visibility:** The design allows for use in either portrait or landscape orientation.
5. **Functionality:** The design tilts the screen towards the user in a stable and easy to use way.
6. **Portability:** The design is easily transported everywhere the electronic device is used.

Identify a Problem By:

☐ Researching the Problem - What, Why, Who, Where, When

**Problem Research:**

1. **What is the problem?** The screen of a portable electronic device is difficult to see when it is face up on a desk or table.
2. **Why is it a problem?** This is a problem because the only other option is to have the user hold the electronic device in their hands while they watch something on the screen.
3. **For whom is it a problem?** This is a problem for anyone who uses an electronic device.
4. **Where is it a problem?** This is a problem wherever someone wants to watch something on their electronic device without having to hold it.
5. **When is it a problem?** This is a problem whenever someone wants to watch something on their electronic device without having to hold it.
Identify a Problem By:

- Verifying the Lack of or Limitation(s) of Related Existing Solutions

1. **Related Solution 1**
   
   a. Name: Google-Nexus One-Stand

   b. Form: This design is made from a thin sheet of metal that has been folded at angles. The device sits in a tray which is also folded into the metal. There is a section of the tray missing to allow for charging. The total height of the design is 4”.

   c. Function: This design holds a device in a tray about two inches off the table. It allows the device to sit either vertically or horizontally and the device can be charged while sitting in the tray.

   d. Limitations Meeting Criteria & Constraints:

   1. **Materials:** This design is made out of metal, not plastic.

   2. **Simplicity:** It would be difficult to measure and make the angles in this design.

   3. **Non-Interference:** This design does not interfere with the charging port.

   4. **Visibility:** This design allows for good visibility in either portrait or landscape orientations.

   5. **Functionality:** This design tilts the screen towards the user in a stable and easy to use way.

   6. **Portability:** This design is not easy to transport due to its large size and it doesn’t come apart to lie flat.
Identify a Problem By:

- Verifying the Lack of or Limitation(s) of Related Existing Solutions

2. Related Solution 2

   a. Name: WTB iPhone Stand

   b. Form: This design is a small white rectangular piece of plastic with a slot cut into it which is the exact size of an iPhone without its case.

   c. Function: This design stands an iPhone at one angle when it is inserted vertically into the slot.

   d. Limitations Meeting Criteria & Constraints:

      1. Materials: The design uses less than 1 cubic inch of 3D printer material.

      2. Simplicity: The design is not too complicated to make or to use.

      3. Non-Interference: The design interferes with the use of the charging port. It is not possible to charge the device while it is in this stand.

      4. Visibility: The design allows for use in only portrait orientation.

      5. Functionality: The design tilts the screen towards the user in a stable and easy to use way.

      6. Portability: The design is easily transported everywhere the electronic device is used.
Propose a Design By:

- Generating a Large Volume and Wide Variety of Creative Solutions: 5 Creative Solution Ideas and Annotated Thumbnail Sketches
Propose a Design By:

☐ Proposing Workable Designs that Meet Solution Requirements: Workable Design 1: Multiview Hand Sketch on Class Dotty Paper
Propose a Design By:

☐ Proposing Workable Designs that Meet Solution Requirements: Workable Design 2: Multiview Hand Sketch on Class Dotty Paper
Propose a Design By:

- Proposing Workable Designs that Meet Solution Requirements: Workable Design 3: Multiview Hand Sketch on Class Dotty Paper
Propose a Design By:

☐ Proposing Workable Designs that Meet Solution Requirements: Digital Photos of Mockups of Workable Designs

Workable Design #1
“H Step” with and without iPhone:

Workable Design #2
“Slots” with and without iPhone:

Workable Design #3
“NFW” with and without iPhone:
Propose a Design By:

- Identifying a Design Based on Evaluation of Workable Designs: Decision Matrix

<table>
<thead>
<tr>
<th>Design Criteria</th>
<th>H Step</th>
<th>Slot</th>
<th>NFW</th>
<th>Rating Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>H Step would use 1.079 cubic inches of material, Slot .668 cubic inches and NFW only .281 cubic inches.</td>
</tr>
<tr>
<td>Simplicity</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>NFW is by far the easiest design to make.</td>
</tr>
<tr>
<td>Non-Interference</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>H Step will be the easiest to set up to charge without interfering with the charging port.</td>
</tr>
<tr>
<td>Visibility</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>All allow you to view the screen in both portrait and landscape orientation.</td>
</tr>
<tr>
<td>Functionality</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>Slot is limited to what angles the screen can be viewed from but the other two allow greater flexibility.</td>
</tr>
<tr>
<td>Portability</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>H Step will take up a lot of room in a bag and won’t fit in your pocket. NFW would easily fit in your pocket!!</td>
</tr>
</tbody>
</table>

| Total # (+)          | 2      | 3    | 4   |
| Total # (S)          | 1      | 1    | 1   |
| Total # (–)          | 3      | 2    | 1   |
| Score (#+ - #-)      | -1     | 1    | 3   |
| Rank                 | 3rd    | 2nd  | 1st |

Scoring Key:
- choice is better than at least one other workable design
- choice is worse than at least one other design
S choice is no better or worse than another design
Propose a Design By:

☐ Documenting the Design in Detail: Dimensioned Drawing of Device Stand
Propose a Design By:

- Documenting the Design in Detail: Dimensioned Drawing of Device
Propose a Design By:

- Documenting the Design in Detail: Parts List

### PARTS LIST

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
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<tr>
<td>1</td>
<td>1</td>
<td></td>
<td>Phone it with cone</td>
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<tr>
<td>2</td>
<td>1</td>
<td></td>
<td>student design device stand</td>
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**Design:**

Marcel Duhaime

**Date:**

13/28/2015

**Title:**

Parts List

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**Approved:**

B

**Phone with F Parts List**

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Propose a Design By:

- Documenting the Design in Detail: Exploded Parts List

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Test the Design By:

- Prototyping and Optimizing the Design: Digital Photos of Prototype - Apart and Assembled

NFW Stand

NFW Stand with iPhone
Test the Design By:

- Testing the Prototype: Extent to Which the Design Meets the Criteria & Constraints.

Requirements:

1. **Materials**: The design uses less than 1 cubic inch of 3D printer material.
   
   This stand used only 0.281 cubic inches of material.

2. **Simplicity**: The design is not too complicated to make or to use.
   
   As seen in the pictures, this stand is very easy to use. Just slide the device into the slot in either the portrait or landscape orientation and it works beautifully!

3. **Non-Interference**: The design does not interfere with the use of the charging port.
   
   You have complete access to the charging port while in the landscape orientation.

4. **Visibility**: The design allows for use in either portrait or landscape orientation.
   
   This stand works the same in either orientation.

5. **Functionality**: The design tilts the screen towards the user in a stable and easy to use way.
   
   This stand allows for several different angles based on where you put it on your phone.

6. **Portability**: The design is easily transported everywhere the electronic device is.
   
   This device fits well in a pant pocket or into any bag.
Project Reflection: Opinion about this activity’s effectiveness as a way of learning this unit’s content. What activities helped learn unit content and what didn’t? Be specific including supporting details.

This project allowed me to follow a thoughtful process while solving a problem. Even though the problem was given to me by the teacher, I still found this project interesting and useful. It taught me how to put my ideas down on paper, build a mock up, decide which design is best and to document the entire process through a portfolio. I’m happy and proud of my finished product and think it does a great job of solving the problem. I learned a lot and am ready to use this process to solve even more complicated problems.