**Introduction**

As food security issues become more challenging around the world, alternative farming methods are being created. Shipping containers are being used to grow leafy greens and vegetables. These systems could become the future of urbanized agriculture.

**Objective**

Create a controlled environment growing system within a shipping container. Once completed, the Modified Hydroponic Shipping Container will be placed at The Imagination Station, Lafayette’s Children’s Museum with a virtual display of the process to educate children about alternative growing practices and used for continuous research by Purdue University staff and students.

**Criteria and Constraints**

- **Limited Space**
  - (40’X 8’X 9’) standard shipping container
- **Budget** (relaying heavily on sponsors)
- **Design new electrical schematics**
- **100 AMP power load**
- **Complete before May 2019**

**Impact and Sustainability**

- **Reduce transportation**
- **Increase shelf life**
- **Solution for food deserts**
- **Year-round production**
- **Eliminate use of pesticides**
- **Access to local and FRESH produce**
- **90-95% less water usage**

**Alternatives Considered**

- Hanging lights
- Ropes
- Ratchet hanger
- Reservoirs
- Metal tubs
- Storage containers
- Lights
- Fluorescent

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**Fabrication — Installation**

**Air Intake Holes**

The intake of outside air increases the carbon dioxide levels within the shipping container, required for plant growth. There are a total of 16 air intake holes in the MHSC.

**Plastic Paneling and Mylar Film**

The Mylar film prevents light from entering the shipping container. The plastic paneling offers support to the walls of the shipping container.

**PVC Grow Tubes**

Each growing tray consists of four 4” PVC pipes which are 15’ long. There are 88-2” holes in each growth tube, totaling 352 holes for each growing tray. Each growing system contains four sets of legs (eight total). The legs are adjustable, providing various heights and slopes of the growing tray during growth cycles. Each leg height ranges from 23.5” to 33.5.

**Reservoirs and Pumps**

There are four 55 gallon reservoirs installed in the MHSC. Each reservoir holds the nutrient solution required for optical plant growth and four ECOrate adjustable flow rate of 172 GPH water pumps.

**LED Lights**

- 6-10 lights per grow unit (24–40 total)
- 4-8 lights for the nursery
  - Nursery will have 2-3 shelves for plants/light
- 6 work lights between grow units

**Current Inventory:**

- (6) Lumi bars
- (1) Bar 30
- (2) F-grow Tri Proof
- (2) EcoSpeed
- (2) VQ-GLL060x202
- (3) Sfm sunntek

**Electrical Components**

- **Advantech I/O Module Analog**
  - APAX-5580 (12-ch Analog Input Module)
- **Advantech I/O Module Digital**
  - APAX-5504 (24-ch. Digital 12 input, 12 output)
- **100A Service circuit breaker box**
- **14 120V Circuit Breakers**
  - a. 1 Amp x2
  - b. 5 Amp x 4
  - c. 15 Amp x 4
  - d. 20 Amp x 4
  - e. 240V 4 Pole Contactors rated for 16 Amps
  - f. 120V 1 Pole Contactors rated for 25 Amps
  - g. 120V 1 Pole Contactors rated for 30 Amps
  - h. 104V 4 Pole Contactors rated for 15 Amps

**Computer**

- **This is a UNO with Codesys and visualization. Development software is free and the driver for Ethercat is included.**

**Future Plans**

- **Create a Sponsor board**
- **Secure remaining LED lights**
- **Secure florescent lights for alley way**
- **Install Nursery**
- **Fresh paint on exterior**
- **Install cameras/ visual output**
- **Secure small heater**
- **Secure humidity and temp. sensors**
- **Create educational boards for children**

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**2018-2019 Economic Analysis**

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Cost</th>
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</thead>
<tbody>
<tr>
<td>Water Pumps</td>
<td>16</td>
<td>$274.88</td>
</tr>
<tr>
<td>Reservoirs</td>
<td>4 Totes</td>
<td>$68.00</td>
</tr>
<tr>
<td>FRP</td>
<td>1 Pail</td>
<td>$57.00</td>
</tr>
<tr>
<td>Adhesive Paneling</td>
<td>12 Panels</td>
<td>$258.72</td>
</tr>
<tr>
<td>6 Mil Mylar</td>
<td>4’ X 100 ft</td>
<td>$86.95</td>
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<td>$745.55</td>
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**FACTORS**

- **Economically improves leafy green and Vegetable production.**
- **Environmentally friendly in agriculture due to reduced transportation.**
- **Society becomes involved in the growing process.**
- **Globally impacts where our food is grown and how it’s produced.**

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**Sponsors:**

- **Advantech (Computer)**
- **Grand Industrial (Transportation)**
- **EEL, Inc. (Shipping Container)**
- **Kundinger (Electrical Plans)**
- **Huston Electric (Electrical)**
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**Instructors:**

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- **John Evans**
- **Scott Brand**

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**Environmental Considerations**

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- **Ropes**
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- **Storage containers**
- **Lights**
- **Fluorescent**

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