EE595 Capstone Design

Project Presentations
EE595 Capstone Design Presentations

Wednesday, May 11

EMS-E250 Presentations

Team 1: 8:00 – 9:50AM → Solar Starter SOS
Mao Lee, Shangxing Sun, Roc Lloyd, Rebecca Tesch, Lisa Luo, Bopeng Zhao

Team 9: 10:00 – 11:50AM → Reflow Soldering Oven
Wentao Zou, Yuhao Chen, Rui Ma, Yanning Li, Zoran Milosavljevic

Best Project Award Fall 2015: 12:10 – 12:25PM → Power Line Induction Clamp Light
Denis Sterjo, Cassandra Appleton, Colin Hermann, David Messer, Evan Reichelt,

Team 10: 12:30 – 2:20PM → Portable Curve Tracer
Steven Blahnik, Songyu Huang, Colin Garvey, Wenyue Cai, Getu Ma, Cheng Zeng

Team 6: 2:30 – 4:20PM → Sustainable Aquarium System
Jacob Van Boxtel, David Boyce, Andrew Kovacich, Saleh Al-Gharrash, Evan Sinram

Team 7: 4:30 – 6:20PM → Automatic Pet Feeder
Xinye Xu, Jing Chen, Jacob Alward, Ruishuang Zhong, Timothy Sentz, Jingduo Fan
EE595 Capstone Design Presentations

Wednesday, May 11

EMS-E237 Presentations

Team 5: 8:00 – 9:50AM → Portable Single-Arm Heart Rate Monitor
Boris Bozic, Daniel Siudzinski, Luping Wang, Yarob Bahabri, Jingtao Yang, Edward Jen

Team 3: 10:00 – 11:50AM → Wireless Charging Table
Mark Halstrom, Chad Tarman, Muath Alhuthayl, Jordon Crowe, Zijian Cao, Danlei Hu

Best Project Award Fall 2015 - E250: 12:10 – 12:25PM → Power Line Induction Clamp Light
Denis Sterjo, Cassandra Appleton, Colin Hermann, David Messer, Evan Reichelt,

Team 4: 12:30 – 2:20PM → Aura Smart Fan
Luke Behling, Matt Kieckhafer, Caleb Romenesko, Max Nemer, Garry Jean-Pierre

Team 8: 2:30 – 4:20PM → Smart Window Shade
Yue Bei, Shibo Lu, Zhongyue Sun, Yutian Li, Haotian Hou

Team 2: 4:30 – 6:20PM → Cat Feeder
Chenghuab Vue, Ruoyu Chen, Jiaqi Li, Shuran Zhao, Shuaiyu Bu, Tuan Dong
Team 1
Solar Starter SOS (SSS)

Mao Lee
Shangxing Sun
Roc Lloyd
Rebecca Tesch
Lisa Luo
Bopeng Zhao

http://www.amazon.com/Chrome-Portable-Lithium-Battery-Starter/dp/B00H4FNXCQ
Solar Starter SOS (SSS)

Purpose of Product
- Portable battery pack
- Jump-start a car
- USB charger

Features
- Solar and 120VAC charging options
- Able to jump-start a car
- 5V Output
- Multi-mode flashlight (including SOS)

Market
- Intended for operation in the United States for use in indoor and outdoor settings
<table>
<thead>
<tr>
<th>Cost</th>
<th>Power Inputs</th>
</tr>
</thead>
</table>
| • Sales Price: $150  
  • Component Cost: $50  
  • $20 components  
  • $30 solar panel  
  • Assembly & Test Costs: $20 | • Residential AC Power:  
  100 – 240 VAC @ 50/60 Hz  
  • Solar Power: 25W, 12V, 2A  
  • Battery Power: 1 Sealed Lead Acid, 12V, 2A, 15 Ah |
| Environment | Major Functions |
| • Indoor / Outdoor  
  • Portable / Lightweight  
  • Operating Temp Range:  
  • 0°C to 60°C | • USB: 5V, 2A  
  • Jump Starter: 12V, 200A starting, 400A peak  
  • Flashlight: Multi-Mode  
  – Strobe  
  – SOS |
Description

* Weighs your cat
* Displays cat weight
* Adjustable food portions
* Adjustable timer
* Market: USA

Pet Bowl. Picture retrieved from: http://www.amazon.com/MidWest-Stainless-Steel-Snapy-Water/dp/B0012GS73S/ref=sr_1_2?ie=UTF8&qid=1458606860&sr=8-2&keywords=food+bowls

Key Requirements

✧ **Cost**
  * Sales Price: $300, Component Cost: $110

✧ **Environment:**
  * Indoor
  * Operating Temperature Range: 0~50°C
  * Operating Humidity Range: 0% to 75%

✧ **Power Input:**
  * Residential AC Power: 110~120VAC @ 15A

✧ **Major Functions, Quantities Measured, Displayed**
  * Functions: On, Off, pour food and weights pet
  * Pet Weight Range: 8lbs to at most 25lbs
  * Container size: 13 ounces of dry food
  * Display: 16 characters and 2 lines
  * Bowl: 4.7” x 4.7” x 1” & 12 ounces
EE-595
Wireless Charging Table
Team 3

- Mark Halstrom
- Chad Tarman
- Zijian Cao

- Muath Alhuthayl
- Jordan Crowe
- Danlei Hu

Wireless Charging Table

Description

• Device will provide both Qi* compliant wireless or wired charging for mobile devices.
• Feedback information including charger state (sleeping, sensing, charging) plus device information displayed on an LCD screen.
• Offers either wired (USB) or wireless (inductive) charging.
• Advanced power saving algorithms.
• North American market

• Qi Inductive Power Standard:  http://www.wirelesspowerconsortium.com/
EE-595
Key Requirements

• Cost
  • Sales Price: $100, Component Cost: $50, Assembly & Test Costs: $10

• Environment
  • Indoor environment
  • Operating Temp Range: 0 - 50 ºC
  • Operating Humidity Range: 0% - 100%

• Power Input(s)
  • Residential AC Power: 102 - 132 VAC @ 200 mA Max, 60 Hz

• Major Functions, Quantities Measured, Displayed
  • *Major Modes*: Sleep, charging, sensing modes
  • Battery charge percentage
  • 10 mV wireless charging resolution
  • DCP USB delivering 5 watts of power
  • Qi Compliance
AURA: TEAM 4

- Luke Behling
- Matt Kieckhafer
- Caleb Romenesko
- Max Nemer
- Garry Jean-Pierre
AURA: THE LAST WINDOW FAN... YOU'LL EVER NEED!

You get peace of mind knowing that wherever applied, your room will be just how you like it; breathing easy, comfortable, air year round.

• Smart Mode to monitor and maintain set point conditions automatically

• Two Reversible 100CFM PWM controlled DC fans provide automatic multilevel bi-directional room air flow control governed by aggregated zone humidity and temperature data

• 60dB of noise providing comfort no louder than a normal conversation

• Available in US and Canadian markets
AURA PRODUCT REQUIREMENTS

• Cost
  • Sale Price: $300
  • Component Cost: $100
  • Assembly & Test Costs:
    • Assembly: $50
    • Test: $25

• Environment
  • Commercial/Residential Indoor use
  • Operating Temp Range: 0 thru 60 degrees Celsius
  • Operating Humidity Range: 0 – 100 % Relative Humidity

• Power Input(s)
  • Residential AC Power: 102-132 VAC @ 5Amps Max

• Major Functions, Quantities Measured, Displayed
  • Programmable and ‘Smart Mode’ control options
  • Temperature
    • Displayed to user on HMI
    • Accuracy: within 2 degree Celsius
  • % Relative Humidity
    • Displayed to user on HMI
    • Accuracy: within 2% Relative Humidity
Portable Single-Arm Heart Rate Monitor

Team 5

- Boris Bozic
- Daniel Siudzinski

- Lushing Wang
- Yarob Bahabri

- Jingtao Yang
- Edward Jen

Portable Single-Arm Heart Rate Monitor

Purpose of Product:
• Portable heart rate monitoring and electrocardiogram

Features:
• Portable
• ECG data storage
• Single-arm monitoring
• Affordable
• Rechargeable—500 typical charging cycles
• Phone app—displays and analyzes ECG data
• Long-lasting battery—12 hours continuously
• 1 GB SD card included

Market:
• Worldwide
Key Requirements

Cost
• Sales Price: $199, Component Cost: $70, Assembly & Test Costs: $40

Environment
• Indoor, Outdoor, Mobile, Wearable
• Operating Temp Range: -20 to 40 C
• Operating Humidity Range: non-condensing

Power Input(s)
• Battery Power: Qty 1 of Li-ion, 4.2 VDC, 1000 mAh
• USB (for charging): 5 V, 0.9 A
• Power Efficiency: 90%, Operational Hours: 12 hours continuous

Major Functions, Quantities Measured, Displayed
• Measuring heart rate and displaying it on a cell phone via application

Bluetooth (Data Transfer)
• Rate: 3 MBps, Range: 20 m

Heart Rate Accuracy
• HR: +/- 2 BPM, Range: 60 to 120 BPM
EE-595
Sustainable Aquarium System
Team 6

Jacob Van Boxtel
- Seeking B.S. in Electrical Engineering

David Boyce
- Seeking B.S. in Electrical Engineering

Andrew S. Kovacich
- Seeking B.S. in Electrical Engineering

Saleh Al-Gharrash
- Seeking B.S. in Electrical Engineering

Evan Sinram
- B.S. in Physics with minor in Mathematics
- Seeking B.S. in Electrical Engineering
Purpose of Product:
Electronic control system designed to stabilize the environment of an aquatic life-nourishing environment.

Features:
Through the use of a computer coupled with a user interface, this product will provide the consumer control over the following environmental concerns:

1. Temperature: Allows for automatic monitoring and adjusting of the aquatic temperature range.
2. Lighting: Programmable LED banked lighting offers the user control over the amount of light introduced to the environment as well as adjustable day and night settings.
3. Feeder: Motorized auto-feeder capable of programmable feeding frequency as well as an empty feeder alert.

Market:
This product has been designed for residential and light commercial usage within the United States and Canada.
EE-595
Key Requirements

Cost:
- Sales Price: $130.00
- Component Cost: $85.00
- Assembly & Test Cost: $15.00

Environment:
Designed for a stationary indoor environment only.
• Operating Temperature: 5°C-60°C
• Operating Humidity: 0%-95%

Power Input(s):
• Residential AC Voltage: 102-132 V_{AC} @ 3.5 A_{max}

Major Functions:
• On/Off
• Set Light Quantity and Schedule
• Set Temperature Range
• Set Feeder Frequency

Quantities Measured, Displayed:
• Temperature:
  Range: 0°C-60°C; Sensor Accuracy: +/-1°C;
  Control Accuracy: +/-3°C; Resolution: 1°C

• Lighting:
  Sensor Range: 0-6800 lux; Sensor Accuracy: 50 lux;
  LED Range: 0-200 LED Accuracy: 50 lux; Input Resolution: 50 lux

• Time:
  Range: 0-24 Hours; Accuracy: 1 Minute; Resolution: 1 Minute
EE-595
Auto Pet Feeder

- Purpose of Product: An automated meal dispenser to provide nourishment for your pets while away from home.
- Feature 1: Programmable
- Feature 2: Self Cleaning
- Feature 3: Monitors food levels
- Market: North America
EE-595

Key Requirements

• Cost
  – $99.99 (Sales Cost) Component Cost $50.00, Assembly& Test Costs: $30.00

• Environment: Indoors, Stationary
  – Operating Temperature (0 C to 50 C or 32 F to 122 F)
  – Operating Humidity Range (30 to 60 %)

• Power Inputs
  – Residential AC Power (120 V @ 60 Hz @ Max 20 Amps)

• Major Functions
  – Dispense Food Amount Determined By User @ 5% accuracy by weight
  – Dispense Water Amount Determined By User @ 5% accuracy by weight
  – Automatic Food Disposal After Eating Period (food is removed)
  – Program (Inputs are 5% accurate)
Block Diagram

Block Ownership

A. Power Supply: Jing Chen
B. Feed Circuit: Xinye Xu
C. Food Removal Cleaning System: Ruishuang Zhong
D. Sensor System: Jingduo Fan
E. User Interface System: Jacob
F. Microcontroller: Tim
EE 595
Smart Window Shade
Team 8

Picture of Similar Product

- Yue Bei
- Shibo Lu
- Zhongyue Sun
- Yutian Li
- Haotian Hou

http://decorchick.com/simple-fit-custom-shade-giveaway/simplefit_light_filtering_white/
EE 595
Smart Window Shade

Purpose of product

- Control the light level indoor
- Protect individual privacy

Key features and/or operating modes

- Normal mode: To make shade up and down or change its angle by using remote control or buttons on the box which installs near the window
- Automatic mode: Window shade changes its angle automatically

Market

- USA (120V 60Hz)
EE 595

Key Requirements

- **Cost**
  - Sales Price: $150, Component Cost: $40, Assembly & Test Costs: $15

- **Environment**
  - Indoor
  - Operating Temp Range: Min: -10 °C  Max: 40 °C

- **Power Input(s)**
  - Battery Power: Qty 4 of 1.5V AAA Alkaline, Nom 6V, Min Life 300hrs
  - Other Power Input: N/A

- **Major Functions**
  - Function: Normal mode, automatic mode, on, off
Team 9
SPRING
2016

Wentao Zou
Yuhaoo Chen

Rui Ma
Yanning Li
Zoran Milosavljevic
Reflow Soldering Oven

Brief Overview
● A reflow oven for diy individuals and small businesses.
● Re-purposing a toaster oven with our own controller and heat insulation.
● The reflow oven would be capable of reflowing small to medium sized pcb’s with either a leaded or lead-free temperature profile.

What is it?
A reflow oven for small volume production by diy individuals or small businesses.

Why would I be interested?
A reflow oven of this quality and capability is only $200 - $300. This is a very reasonable price for a diy electronics enthusiast and very reasonable for small businesses. There are many benefits to using surface mount components in electrical design, and the ability to reflow for such a low price is very beneficial.
EE-595
Key Requirements

- **Cost**
  - Sales Price: $200-$300
  - Component Cost: $75
  - Assembly & Test Costs: $20

- **Environment**
  - Indoor or outdoor use with roof enclosure. Device will not be waterproof.
  - Operating Temp Range: -30°C - 50°C
  - Operating Humidity Range: 0 - 100

- **Power Input(s)**
  - Residential AC Power: 102 - 132 VAC @ 7 Amps Max
  - Battery Power: Qty 1, 3.7 Volts, 15 mAmps (for RTC)

- **Major Functions, Quantities Measured, Displayed**
  - Temperature Accuracy: 25°C - 260°C, +/- 5°C within profile
  - Temperature Reading Accuracy: 25°C - 260°C, +/- 4°C of actual temperature
  - Operating Frequency: 57Hz - 63Hz
  - Operating Voltage: 102VAC - 132VAC
  - Operating Current: 6Amps - 8Amps
  - Operating Altitude Range: -50 meters - 3000 meters
Block Diagram

- Heating Elements
- Power Switching
- AC Power 120Vac
- Temp Sensor
- Microcontroller
- Power Supply
- Display
- Audible Indicator
- Non-volatile memory
- RTC

20°C = 0V, 250°C = 5V

Heat

Yuhao

Rui

Wentao

Yanning

Zoran

SW1, SW2, SW3
Portable Curve Tracer
Team 10

Steven Blahnik – Lead Prototype Director
Songyu Huang – Lead Presentation Manager
Colin Garvey – Lead Project Integrator
Wenyue Cai – Lead Report Manager
Getu Ma – Lead Manufacturing Manager
Cheng Zeng – Lead System Designer
Product Description

Affordable, easy NPN device test system. This curve tracer is the perfect fit for any small lab or DIY electronic project.

- On board display & interface
- Small lab bench footprint allows portability
- Simple yet effective design at competitive cost
- Marketed in USA
Key Requirements

- $300 list price
  - $50 component cost
  - $150 maximum production cost
- Environment
  - Intended for indoor use
    - Temperature range: Min-0, Max-60, Norm-25 Celsius
    - Humidity: 0-100% non-condensing.
- (Power input)
  - 120 V 60 Hz input
  - Standard wall plug
- Functionality
  - Allows user to set transistor gate current step, Collector voltage.
  - Displays device characteristic curve, all test parameters
Block A: Getu Ma
Block B: Wenyue Cai
Block C: Songyu Huang
Block D: Colin Garvey
Block E: Cheng Zeng
Block F: Steven Blahnik