Multi-Stage Power Conversion

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Three Stages of Power

- Adjustable Power Supply
  - David Yamnitsky
- Wireless Charger
  - Joseph Driscoll
- USB Converter
  - Paul Hemberger
Goals

Modular, useful power converters

Be able to charge and power everything
First Stage: Adjustable Power Supply

• Input: 120VAC to 16VAC @ 2A

• Output: Adjustable 2-12V DC @ 2A
Full Schematic
Power Stage
Feedback: Gain Stage
Triangle Generator
PWM Generator
Gate Drive
Adjustable Power Supply
Second Stage: Wireless Charger

- Colpitts Oscillator
- LC Receiver
- Bridge Rectifier
- Current Source
- Voltage Comparator
- Voltage Regulator
- Pot
- Battery
Wireless Charger: Power Transmitter

Specifications:
● Output Frequency around 700 kHz

Challenges:
● Efficient Power Transfer

Design:
● Colpitts Oscillator
Wireless Charger: Power Receiver

Specifications:
- Variable AC input
- 10 V DC output

Challenges:
- Efficient Power Transfer
- Maintaining Stable DC output

Design:
- LC -> Bridge Rectifier -> Voltage Regulator
Wireless Charger: Battery Charger

Specifications:
- 10 Volt DC Input
- Charge 1.5 to 9 V batteries

Challenges:
- Smart Charging

Design:
- Pot used to create reference
- Differentiator -> Current Source -> Battery
Third Stage: USB Converter

Specifications:
- 1.5V-14V input
- 5V output @ 500mA

Design:
- Buck-boost converter with PWM feedback

Challenges:
- Powering opamps / transistors from low-voltages

USB Converter Design

Battery → Buck-Boost Converter → Output Filter → 5V @ 500mA

Boost Converter IC → PWM → Error Amplifier

Voltage Reference
Timeline

Expected Completion Dates

Wireless Charger: Battery Charger          4/18
USB Converter V1:                                   4/20
Adjustable Power Supply V1:                   4/20
Wireless Charger: Power Transmitter      4/22
USB Converter V2:                                   4/25
Adjustable Power Supply V2:                   4/25
Wireless Charger: Power Receiver          4/25

Write Report
Conclusion

3 modular power converters
- Bench-top supply
- Wireless charger
- USB converter

Any questions?