Hand-Cranked Charger

Team 14: Shreyasi Ray, Achyut Agarwal, Rubhav Nayak
Meet the Team

Achyut Agarwal
Computer Engineering, Senior

Shreyasi Ray
Computer Engineering, Senior

Rubhav Nayak
Electrical Engineering, Senior
Problem

- Reliance on technology and devices at all-time high, individuals dependent on devices for various aspects of their lifestyle
- Dependence on devices for emergencies and basic services is increasing
- Need for charging points not always available
Solution - Hand Cranked Charger

- Portable hand-cranked charger that generates electricity with the help of user’s kinetic energy
- Enables charging during times of emergency, when traditional charging options are not available
- Stores energy in an internal battery like a power bank
Electromechanical Subsystem

- Handles conversion of Kinetic to Electric Energy

- Key Components:
  - Motor
  - Linear Regulator
  - Relay
  - Power MUX
  - USB Output
Key Components

Motor
- Brushed 12VDC Motor → Pittman Motor
- Output at 60RPM: 12V ± 2V

Linear Regulator
- Linear Regulator → LM7805
- Stabilizes Voltage to 5V

Relay
- Relay → Panasonic HY1-5V
- One Input to Two Output Mechanical Relay
- Controlled by Microcontroller

Power MUX
- Power Multiplexer - TI TPS2115
- Two Input to One Output Power Mux
- Controlled by Microcontroller
Development of Electromechanical Subsystem

- Successes
  - Relay
  - Motor
  - USB Output

- Hurdles
  - Power MUX
  - Linear Regulator
Tests performed for Verification of the Electromechanical Subsystem
The Linear Regulator regulates all Voltage in the range 6V to 20V down to 5V
The Relay changes the output under 50ms
Hand Crank successfully powers the USB Output
Microcontroller Subsystem

- Handles Switching Logic
- Handles Battery and Display functionality
- Key Components:
  - Microcontroller
  - Battery and Battery Module
  - Display
  - Boost Converter
Key Components

- **Microcontroller →** AtMega328P
  - 23 GPIO Pins
- **Display →** AdaFruit 1002
  - I2C Backpack
- **Battery →** 1000mAh Li-ion
- **Battery Module →** TP4056
- **Boost Converter →** 2.5V-4.0V to 5V Boost
Development of Microcontroller Subsystem

- Successes
  - Battery
  - Boost Converter
  - Battery Module

- Hurdles
  - Display
  - Microcontroller
Tests performed for Verification of the Microcontroller Subsystem
The Battery Voltage is correctly measured and displayed
The display correctly outputs the recommended crank speed modification
The boost converter boosts the batteries $3.7 \pm 0.6$ VDC to $5 \pm 0.2$ VDC
Assembly of the Product

- Outer Casing - ABS Plastic
- Metal reinforcement for Motor Mount
- Safety Considerations for Battery
- Length of Hand Crank
- Display Orientation
Hurdles along the way, overcoming them

- Parts Reliability and Delivery
- Footprints
- PCB Issues
Hand Crank Charger
Team 14
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PCB Design
Size Comparison
Video of our Working Product
Conclusion

Learnings
- Experienced product development cycle
- Cheap and compact

Future Considerations
- More robust PCB design
Thank You!