



SolexPro

By

POWER WALKER

Team Members

- Tommy Lu
 - Chief Executive Officer
 - Duties Included:
 - Workflow Optimization
 - Conceptual Design
 - Energy Harvesting/Storage Unit
 - Prototyping
 - Testing



Team Members

- Pouya Aein
 - Chief Innovation Officer
 - Duties Included:
 - Innovation Enhancement
 - Procurement
 - Energy Harvesting Unit
 - CAD design and Fabrication
 - Website
 - Quality Assurance (QA)



Team Members

- Vani Choubey
 - Chief Financial Officer
 - Duties Included:
 - Budget and Finances
 - Energy Storage Unit
 - PCB Circuit Design and Implementation
 - Energy Storage Unit Testing and Experimentation



Team Members

- Shelvin Chandra
 - Chief Technology Officer I
 - Duties Included:
 - Technology Development
 - Energy Storage Unit
 - PCB Circuit Design and Implementation
 - Energy Storage Unit Testing and Experimentation



Team Members

- Shervin Mirsaeidi
 - Chief Technology Officer II
 - Duties Included:
 - Technology Improvement
 - Energy Harvesting Unit
 - CAD design and Fabrication
 - Testing and Experimentation
 - Acquiring Parts



Team Members

- Arshit Singh
 - Chief Operating Officer
 - Duties Included:
 - Scheduling
 - Energy Harvesting Unit
 - Shoe Fabrication
 - PSPICE Simulations
 - Prototype Testing



Outline

- Motivation, Purpose & Goals
- Market Analysis
- Schedule
- Design
- Background
- System Components
- Budget
- Challenges
- Recommendations



Goal, Motivation & Purpose

Goal

- To tap into a new source of sustainable energy

Motivation

- We want to change the way the world looks at energy

Purpose

- To create a self sustaining portable energy source



Motivation & Purpose

- The Motivation
 - We want to change the way the world looks at energy
- The Purpose
 - To create a self sustaining portable energy source
 - No need to worry about dead batteries ever again



Market Analysis



Current Competition

- Piezoelectric Alternative



Figure 1 : Harvesting Energy using Piezoelectric Energy Harvesters [1]

Market Analysis

- We estimate that the cost of a pair of SolexPRO's can be bought for under \$150
- Our product is unique
 - Higher Output
 - Non Invasive
 - Sustainability



Market Analysis (contd.)

- Target Market:
 - Hikers/Campers
 - This demographic is without power for a significant amount of time
 - Fitness Enthusiast
 - Monitor body health through sensors in a non invasive way
 - Third - World Countries (Buy One Donate One)
 - Provide a source of energy

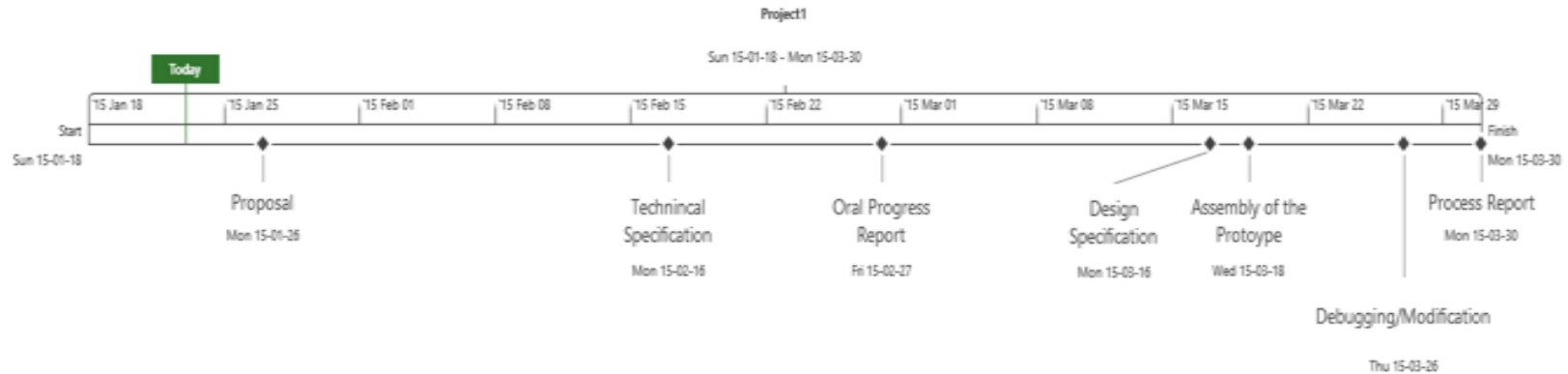


Schedule



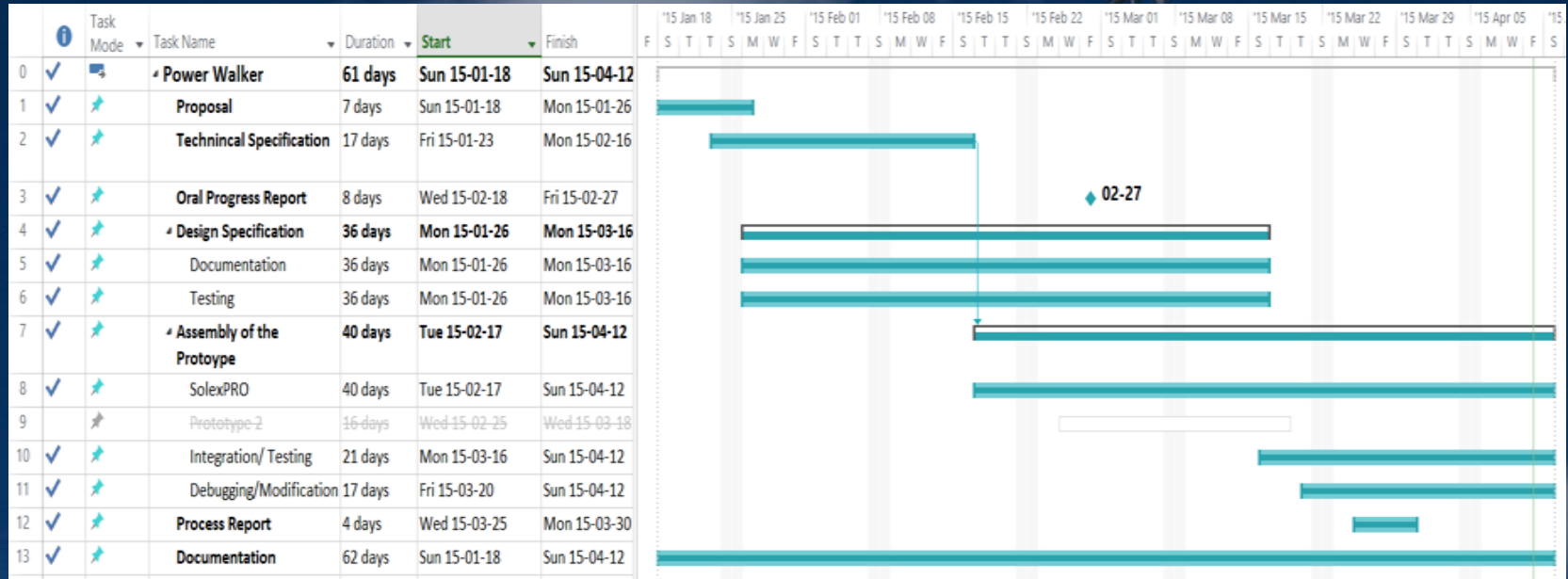
Schedule (estimated)

This was estimated at the beginning of the semester



Schedule (actual)

This is the actual schedule



Design



Design Stage

- Introduction of two prototypes
 - SolexPRO E
 - Based on Electromagnetic induction
 - SolexPRO F
 - Based on Fluid mechanics
- Feasibility Study



Solex PRO F

- Solex PRO F was abandoned due to low reliability and durability.

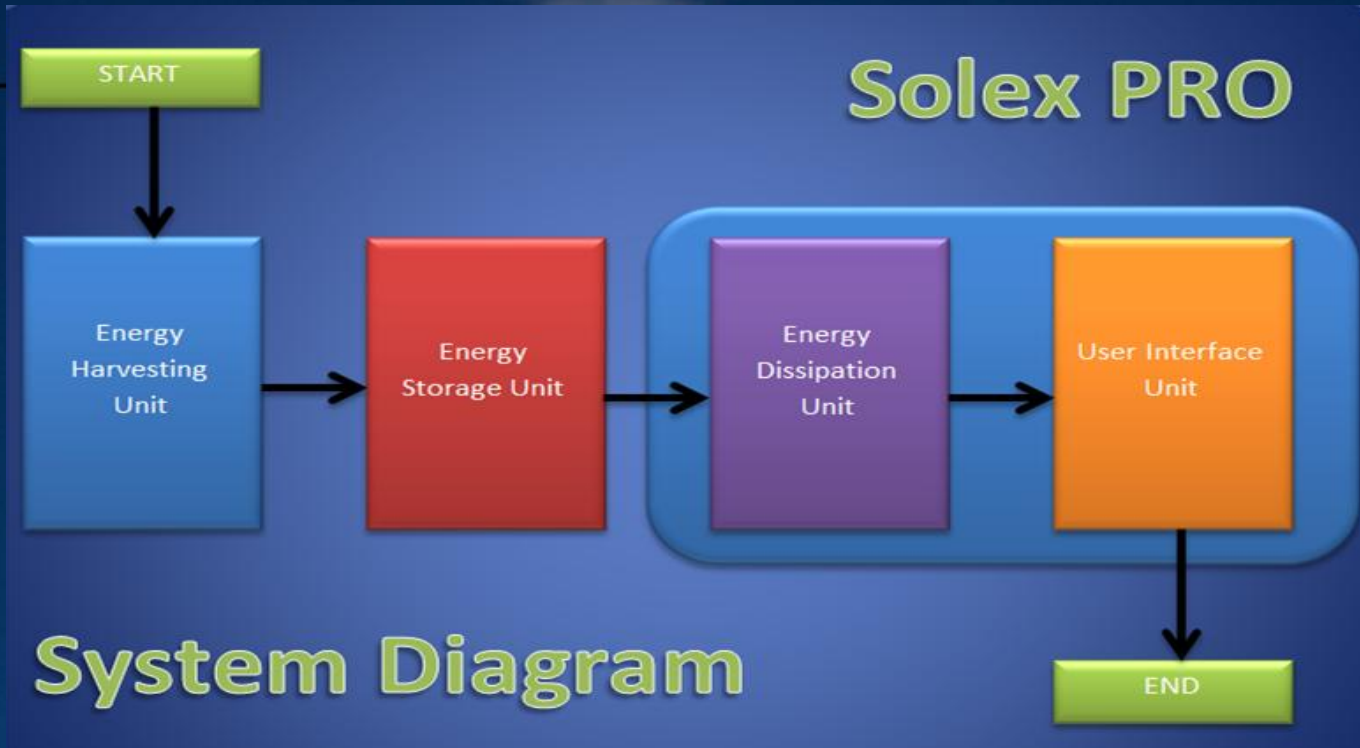


Rebranding

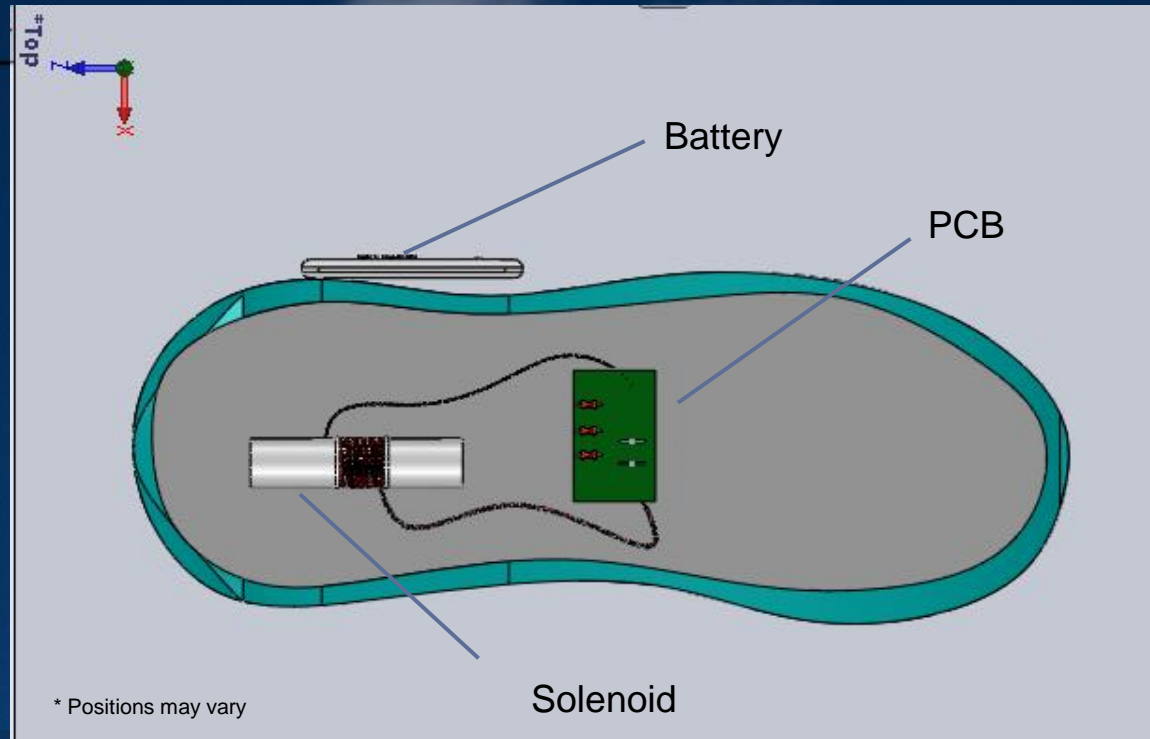
Solex PRO E → Solex PRO



System Overview



System Overview (contd.)



Reliability



Reliability

- The ability of a system or component to perform under stated conditions for a specified period of time:

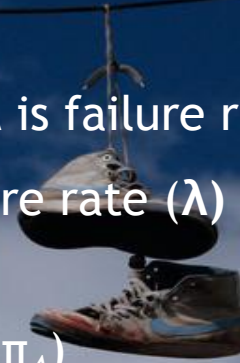
$R(t) = e^{(-\lambda t)}$, where t is in year and λ is failure rate

- For parts under specific operating conditions failure rate (λ) can be calculated as:

$$\lambda = \sum_i (\lambda_{ref,i} \times \pi_S \times \pi_T \times \pi_E \times \pi_Q \times \pi_A)$$

- Series System:

$\lambda_{total} = \sum$ all individual components (assuming an exponential distribution, where λ is constant)



Reliability Testing and Improvement

Accelerated testing

- Compressed-time Testing
- Advanced-stress Testing

Ways to improve reliability

- Redundancy
- Better quality parts



Background

- Electromagnetic Induction
 - Faraday's Law of Induction
 - Electromotive Force
 - Primary Components
 - Solenoids
 - Magnets

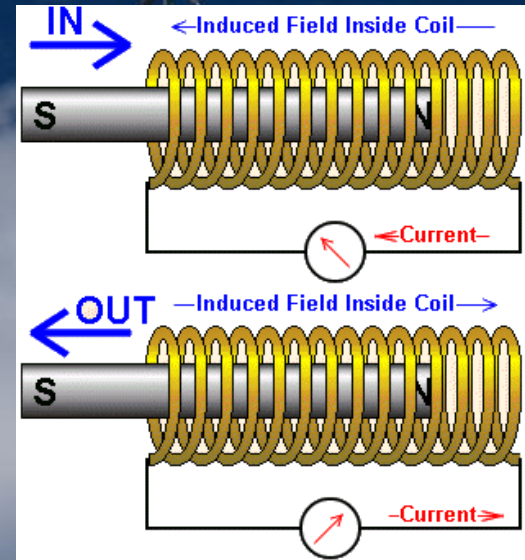


Figure 3 : Process of Inducing AC Current [2]

Energy Harvesting Unit



Energy Harvesting Unit

- This component generates AC current from the solenoid
- Input : Walking motion displaces magnet
- Output : Displaced magnet produces AC current
- Handoff : The AC current produced acts as the input to the full wave rectifier



Energy Storage/Dissipation Unit



Energy Storage Unit

- This component converts AC current into DC in order to charge an AA battery
- Input : AC current from EHU passing through a rectifier circuit
- Output : DC current produced from the rectifier
- Handoff : The DC current produced is used to charge the battery



Energy Storage Unit (contd.)

- Full Wave Rectifier
 - Purpose
 - Converts AC to DC
 - Primary Components
 - Diodes
 - Capacitor



Energy Dissipation Unit

- This component simply provides access to the stored energy
- Input : DC Current to charge the battery
- Output : Stored energy providing clean and constant current
- Handoff : End - User

Budget & Challenges

A pair of colorful sneakers is hanging from a clothesline against a bright blue sky with scattered white clouds. The shoes are positioned to the right of the main title text.

Budget

Till to date, we have spent around \$1245.26

Items	Costs
Solex Pro E	\$525.24
Solex Pro F	\$83.55
Shipping	\$16
Miscellaneous	\$620.47
Total	\$1245.26

Funding

- Received Engineering Student Society Endowment Fund
- \$500 for funding
- Exceeded by \$745.26
- Apply for Wighton Fund



Challenges

- Safety
- Size Restriction
- Noise
- Durability
- Procurement



Recommendations

- Reduce Noise
- Enhance ESU Capabilities
- Reduce Size
- Improve durability
- Add More Features (i.e health monitoring, gps tracking system.....)



References

[1] "Energy Harvesting Journal," 06 June 2013. [Online]. Available: <http://www.energyharvestingjournal.com/articles/5504/power-generating-shoe-insert>. [Accessed 19 January 2015].

[2] *Solenoid Actuator, Linear Actuators, Push Pull Actuator Solenoid Driven Actuator*. (n.d.). Retrieved April 2015, from Solenoid China: http://solenoidschina.com/images/actuators_solonoid_magnetic_field.gif

Acknowledgement

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Questions?



Lets proceed with the
DEMO!!

