Biomechanical Energy Harvesting

A Kinetech Vision

Alex Benson, Danny Conway, Tom Daily, Mike McBride, Ryan McVeigh, Carter Salz

KINETECH

Mission Statement

To provide a personal renewable energy source utilizing natural human motion.

Project Description: Biomechanical Energy Harvester – the device will be worn on the users leg and will utilize the natural walking motion to generate electricity. This will be stored in a removable battery and used to charge personal electronic devices, such as a cell phone, tablet, GPS signal, or radio.

Key Innovation: There will be a user feedback system in the form of an attached LCD screen which reports real-time performance metrics.

Global Focus: In parts of the developing world, electricity is not always so easily accessible. This device is meant to empower people in these parts of the world by giving them a renewable source of energy, even if only in low voltages.

Problem Definition

How do we generate and store energy using natural human motion?

76% of adults own a smartphone*

44% say they run out of battery at least once a day

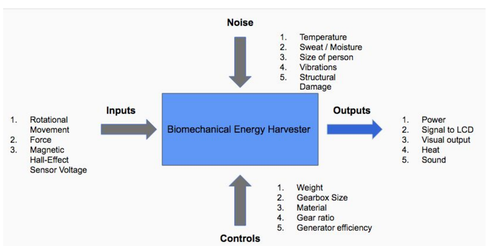
Target Customers:

- Hikers, city dwellers, urban commuters, children

Benchmarks:

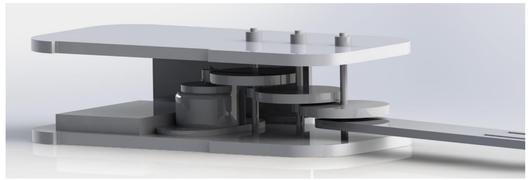
	Target	Prototype Specs
Weight	5 lbs <	1.75 lbs
Dimensions	10 in x 3 in x 3 in	8 in x 4 in x 4in
Average time to full charge	2.5 hrs	2.5 hrs
Battery % per mile	15%	19.4%

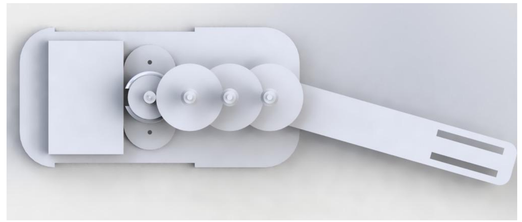
P Diagram:

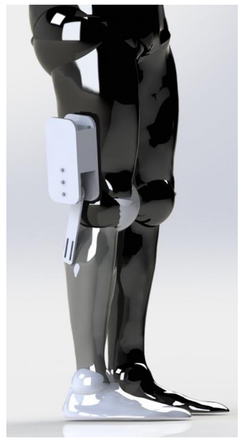


RUN. RECHARGE. REPEAT.

CAD Models







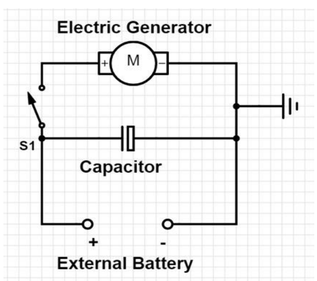
Mechanical & Electrical Design

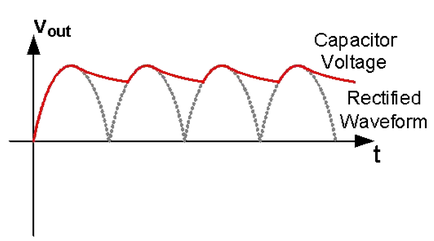
Mechanics:

- Gear overdrive ratio of 125:1
- Drivetrain only engages during the forward swing of the leg
- Bearings press fit into 3D printed housing

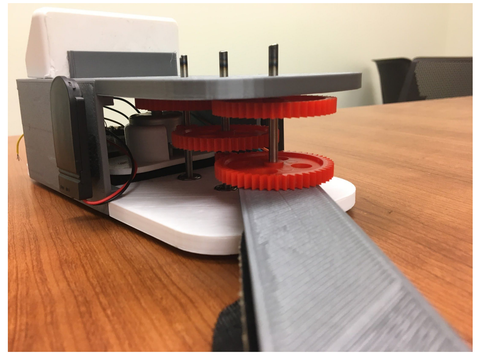
Electronics:

- Capacitive voltage smoothing into battery
- LCD screen to provide key performance feedback





Prototype



Overdrive Gear Train Factors of Safety:

	Gear 1 (input)	Gear 2	Gear 3	Gear 4	Gear 5	Gear 6 (Generator)
Number of Teeth	50	10	50	10	50	10
Pitch (teeth/ in)	25.4					
Tooth Quality	8					
Face Width (in)	0.225					
Material	ABS Plastic					
Static bending factor of safety	**3.88**	**2.03**	**19.75**	**10.04**	**94.90**	**47.76**
Fatigue factor of safety	**10.26**	**4.58**	**23.05**	**10.49**	**52.92**	**22.88**

Marketability and Future Development

Components	Abs housing and gears, external battery, knee sleeve with straps, LCD display with feedback system.
Cost	$35.00
MSRP	$200.00

Mechanics	Electronics

• Smaller, thinner
• Stagger gear system to reduce space
• Fully-enclosed for weather-proofing and safety
• Key roller clutch to avoid slipping
• Plastic molded casing
• Integrate crank arm with knee brace supports
	• New hall-effect sensor to reduce electronic components
	  ○ Allows 5V out
	  ○ Variable voltage out
	• Additional feedback on LCD screen
	• Higher efficiency generator
	  ○ Currently using a 1980s hand crank radio generator
	  ○ Increase voltage output

Kinetech would like to thank Professor Boregowda, Dr. Naumann, Professor Panchal, Mr. Florence, Professor Max Donelan, and J.D. for their inspiration and support in the development of this project.