

Exclusive Patent License Opportunity



Moje™.

*The first motion-powered
charger for mobile devices*



Efficient, Scalable and Wearable Energy Harvesting Technologies

Generate power with regular human motion

THE TECHNOLOGY

This patent portfolio¹ contains novel technologies used in the development of a dual mode energy harvester device, along with an efficient AC/DC converter and battery charging circuit. This circuit avoids the energy loss associated with traditional rectifier bridge circuits.

The combination energy harvester device can be incorporated to harvest, convert and store energy via low-frequency vibrations from a wide range of human and mechanical motions. The device converts motion into electrical energy that charges a battery or supercapacitor in the energy harvesting device, which can in turn be used to charge external devices. Smartphones, fitness bands, e-readers, tablets, cameras and wearable devices can all be charged with Moje™.

Additionally, this novel energy harvesting device can be incorporated and integrated directly in other portable devices.

The device is scalable, and can be tailored to specific applications. For example, a small version could be placed in an armband or pocket to generate power from human locomotion, and a large version could be adapted into a vehicle's shock absorbers to generate power directly from the vibrations created while driving. Several types of repetitive motion are easily harnessed by the technology.

¹Includes US patent 8,368,290 and application 14/933,507

A RAPIDLY EXPANDING MARKET

Harvesting energy from human movement provides solutions for low-power applications, such as ubiquitous wireless sensor nodes, portable electronics and monitoring devices. The number of smart devices linking everyday objects via the internet is estimated to grow to over 50 billion by 2020. Every one of them could be charged with Moje™, with no carbon footprint.

Most of the devices in the emerging "Internet of Things" will be small and in many cases embedded, seamlessly transmitting data to make our lives easier. The most sustainable way to power them is using energy harvesting technology.

KEY MARKET APPLICATIONS

The market sectors that can rapidly adopt these energy harvesting technologies are:

- Wearable Devices
- Smartphones
- Sporting equipment
- Recreational equipment
- Automotive

SPECIFICATIONS

Size: 5.1 x 7.6 x 1.5 cm
Power density: 0.02 mW/cm³ per step
Wearable location: pocket, armband, belt
Walking: 1Hz: Running/jogging: 2-3 Hz

A WEARABLE DEVICE FOR GENERATING AND STORING ENERGY FROM HUMAN MOVEMENT

Technology #1: HUMAN POWER GENERATION

This novel design for a dual-mode energy harvesting module uses a combination of piezoelectric and electromagnetic induction transducers, driven by the vibrations of human motion. The device can be scaled to any size, and overcomes the disadvantages of using a single transducer to generate higher power densities from low frequencies.

HOW IT WORKS

The design includes a combination spring-type piezoelectric and electromagnetic transducer. Two vertically positioned springs, separated and connected by a spherical, movable mass are contained within a tube. The springs are coated with a bi-layer of ferro-electric polymer and surface electrode materials to generate energy from both compression and surface shear stress. The electromagnetic transducer consists of a movable, spherical mass which is a rare earth permanent magnet, together with a set of insulated wire coils. The spherical magnet is suspended at equilibrium between the two springs, in the middle of the tube and in the middle of the set of coils. When external vibration is applied to the tube, the magnet oscillates, compressing and expanding the springs in turn and generating voltage from each transducer. Energy is harvested simultaneously from both methods.

ADVANTAGES

The device can efficiently capture energy from the low frequency (1-5 Hz) of human motion via common activities such as walking, hiking, running, jumping and dancing. The device can provide incremental charge to portable devices to sustain battery life.

Technology #2: POWER CONVERSION AND STORAGE

Traditional rectifier bridge circuits are generally used with energy harvesting devices. However, they exhibit energy loss in the AC to DC conversion. This novel circuit doesn't place a threshold limit imposed by diodes and/or the output voltage on mechanical vibrations, doesn't lose power across an additional stage (e.g., a rectifier), and doesn't limit how much the circuit dampens the transducer. All of these features cause the new technologies in this portfolio to harness power more efficiently.

HOW IT WORKS

The circuit captures electrical energy from a piezoelectric source, and can charge a capacitor and battery. The circuit includes an inductor that is configured to store electrical energy. A diode bridge-free switching network is configured to direct electrical energy from the piezoelectric source to the inductor during the first portion of a piezoelectric charge cycle, further directing electrical energy from the inductor to the battery in the second phase.

ADVANTAGES

The technology efficiently converts the energy generated by piezoelectric transducers from AC to DC, with a power cache that can be used to charge supercapacitors or batteries. The circuit design captures energy from short, non-periodic vibrations and can scale from microwatts to watts, depending on the power density of the energy harvester device. The circuit can be scaled and embedded to fit a number of practical applications.

When these technologies are used together, we have estimated you can completely recharge a smart watch or fitness band after 3000 steps and recharge an iPhone 6 to 10% after 5000 steps.

<u>Number of steps</u>	<u>Estimated Charge (mAh)</u>
1000	70
2000	140
3000	210
4000	280
5000	350

**WORKING WITH LEADING
UNIVERSITY SCIENTISTS
TO SELECT & COMMERCIALIZE
DISRUPTIVE TECHNOLOGIES**



The World's Largest Network for University Innovation

Tekcapital helps clients profit from new, university-developed intellectual property. Our proprietary Invention Discovery Network is linked to 4,000+ universities in 160 countries. When coupled with our expert scientific advisers, we make it easy for clients to find and acquire IP, assess the market potential of new technologies and recruit technology transfer professionals to create a competitive advantage. Tekcapital plc is listed on the AIM market of the London Stock Exchange (AIM: symbol TEK) and is headquartered in Oxford, UK.

Tekcapital plc
Oxford Center for Innovation
New Road, Oxford, OX1 1BY
United Kingdom
Tel: +44 (0) 1865 261445
info@tekcapital.com
www.tekcapital.com

**Available for license from Tekcapital plc.
For additional information please contact
Annette Reid-Antigua
Tel: +1 407-497-5551
areid@tekcapital.com**
