CHARGING ON THE MOVE

SHAFAYET SIDDIQUE
Mechanical Engineering

AFRIA SADIA
Mechanical Engineering

ANISUL KARIM
Chemical Engineering

ANINDITA GOLDER
Electrical Engineering

SITUATION

Nowadays, most electronic devices are equipped with sub-standard batteries that are not long lasting. According to statistics, a battery for a mobile lasts for around 17 hours with lower than average use [1]. This is very difficult for trekkers, cyclists, climbers and the army, who use such devices and are forced to treat batteries as importantly as food and water. However, one solution is to harvest motion and use it to produce power to charge these devices.

MOTION CAPTURE AND MATERIAL

Problem 1: Designing the Device

- The device should not cause discomfort to the user.
- The device should also withstand the harsh environmental conditions.

Solutions:

- The device can be designed as a knee brace.
- The device can be designed as a shoe.

Evaluation:

- Shoe is better since you do not have to wear something additional.
- Stress analysis show that a shoe is better than a knee brace.

Fig 1: The working model (Credits: http://www.etechmag.com/2011/12/06/energy-saving-shoe.html)

Problem 2: Selecting a Lightweight Material

- The device should be lightweight to make it more consumer-friendly.

Solutions:

- Reverse Electro-wetting: works on the movement of conducting droplets in dielectric plates.
- Piezoelectricity: works on the behavior of piezoelectric materials due to changes of pressure.
- Dielectric Elastomers: works on the behavior of elastomer materials.
- Electromagnetic Induction: works on Faraday's Law of Induction.

Evaluation:

- Electromagnetic Induction makes the device heavy.

ECONOMIC FEASABILITY

Problem 3: Selecting Material for the operation of the device

- The device should be made affordable for all classes of people.
- The material used should be commercially available and easily attainable to make the device cost effective.

Solutions:

- Reverse electro-wetting uses Galinstan droplets placed in dielectric sheets which can be made of an insulator easily available.
- Piezoelectricity uses piezoelectric materials such as Rochelle salts.
- Dielectric elastomer uses elastomer materials such as carbon nanotubes in dielectric plates.

Material	Unit price ($/g)	Amount (g)	Price ($)
Galinstan	38 [2]	0.045	1.71
Rochell Salt	0.0702 [3]	50	3.51
Carbon Nanotubes	150 [4]	0.05	7.5

Table 1: Costs of the materials

Evaluation:

- Table 1 shows the costs of the materials mentioned in the solutions.
- Carbon nanotubes are expensive and therefore not economically feasible.
- Based on table 1, dielectric elastomers will not be considered for our project.

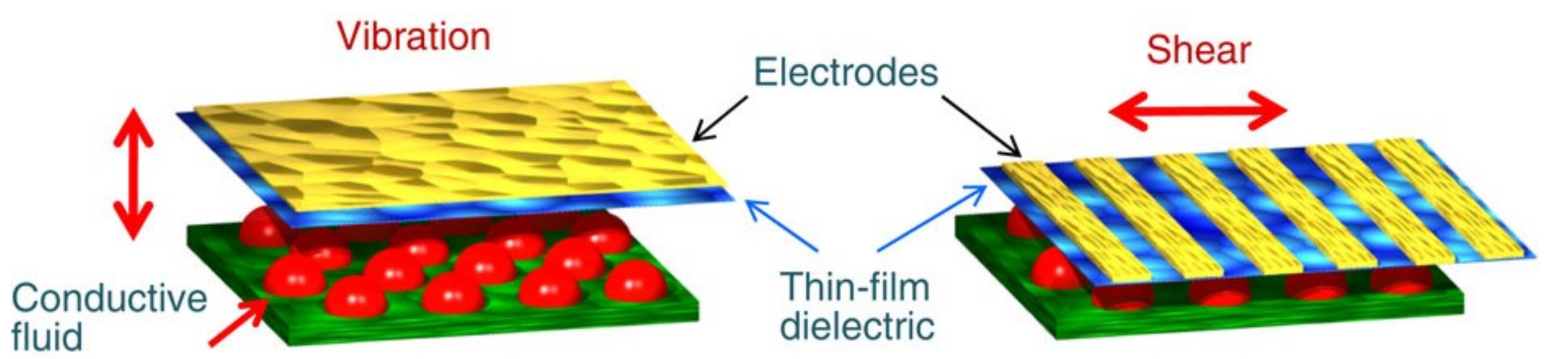

Fig 2: Reverse Electro-wetting Operation (Credits: http://www.etechmag.com/2011/12/06/energy-saving-shoe.html)

EFFICIENCY

Problem 4: Choosing an efficient device

- The device should produce the required output to power today's electronic devices. The device would be more useful if it could be made more versatile.
- The device should have low power wastage at the same time giving the required output to make it highly efficient.

Solutions:

- Reverse Electro-wetting which requires a smaller area.
- Piezoelectricity.

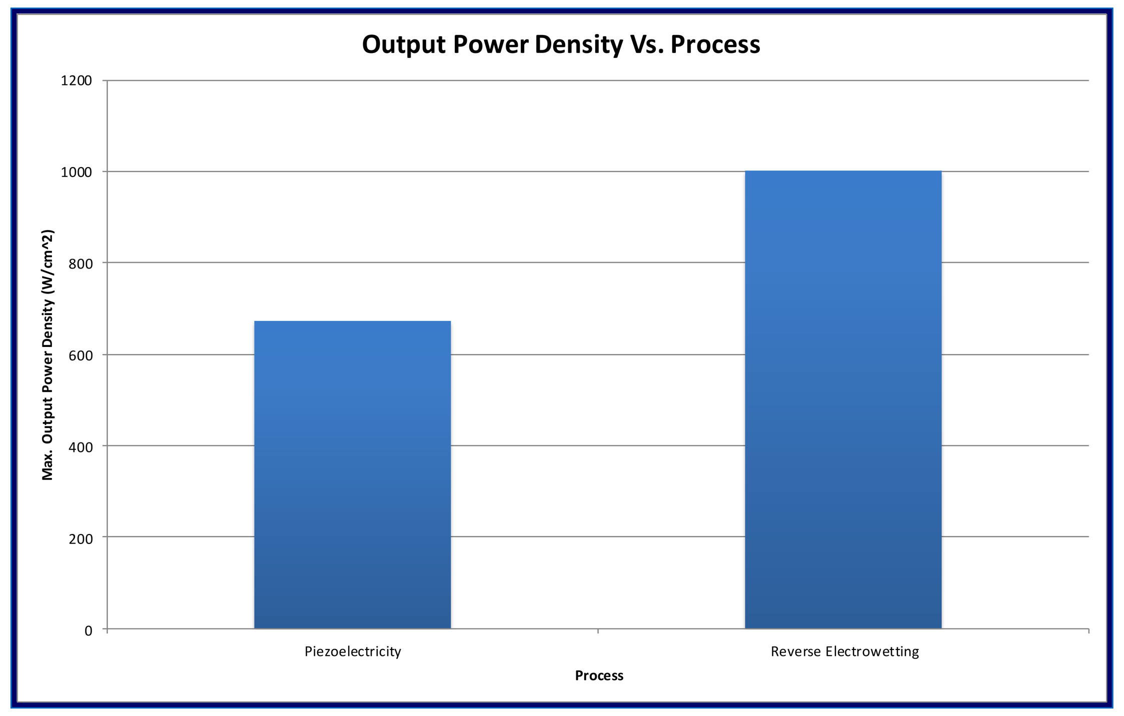

Fig. 3: Power output graph [5] and [6]

Evaluation:

- Fig. 3 shows the output power of reverse electro-wetting and piezoelectric materials.
- Our project will now focus on reverse electro-wetting.

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