

SMART PARKING: PIEZOELECTRIC APPLICATION

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SITUATION

Smart parking is an upgrade to the paid parking lot entrances in the American University of Sharjah. A piezoelectric energy harvester generates clean electricity, from the applied pressure of cars onto the pavement of the Smart Parking technology.

Piezoelectric Effect: Certain materials generate an electric charge in response to applied mechanical stress [1].

- Mechanical components: road cover, ceramic layer, piezoelectric tiles.
1. Road cover provides safety by absorbing impacts.
 2. Ceramic layer provides equal load distribution, and protection against harsh weather environments such as heat and rain [2].
 3. Piezoelectric tile translates the mechanical load into electrical energy [1].
- Electric components: barrier, sensor, RFID tag, battery.
1. The sensor will activate upon detecting the RFID sticker, permitting the barrier to open.
 2. Excess electrical power will be stored via battery.

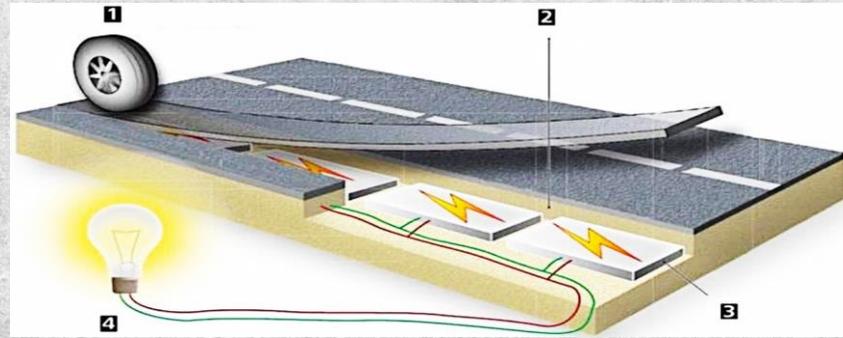


Figure 1: System Components [3]

PROBLEMS

1. As the temperature rises, performance decreases [4].
2. Piezoelectric material can be depolarized thus affecting material duration and operation [4].
3. Mechanical stress can demagnetize the product [4].
4. Asphalt is prone to raveling, load cracking, and rutting [5].

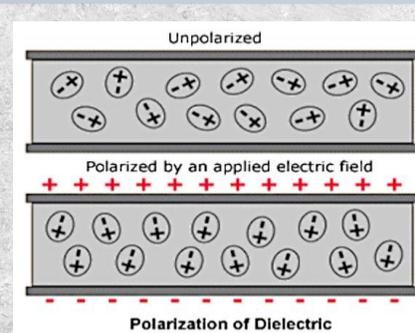


Figure 2: Depolarization Effect [4]

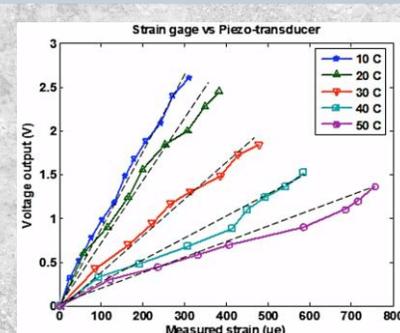


Figure 3: Temperature Variations [4]

SOLUTIONS

1. **Heat treat** piezoelectric materials to withstand high temperatures [6]
2. Use **actuators** to change polarity and control fluctuating electric field [7]
3. Use **ceramic** to reduce the amount of stress on the piezoelectric device [4].
4. Use **Polymer Modified Rubber** (bio-binder) to prevent wear out and carbon footprint [5].

EVALUATION

Smart parking is an exceptional product as it eases paid parking in AUS and is environmentally friendly.

One factor hindering the implementation however, is the **cost of the device**. A piezoelectric device costs approximately \$30 [3]. Another factor is the **high temperature** in the UAE [4].

REFERENCES

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