

Piezoelectricity with Photovoltaic (PV) Panels

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SITUATION

Solar energy is one of the most sustainable sources of energy, and one way to harness it is using solar panels. They are also known as photovoltaic panels (PV). Many countries such as Germany, Italy, China and the United States use PV panels extensively [1]. However, PV panels have their shortcomings. They are prone to natural events like wind, dust, and rain.

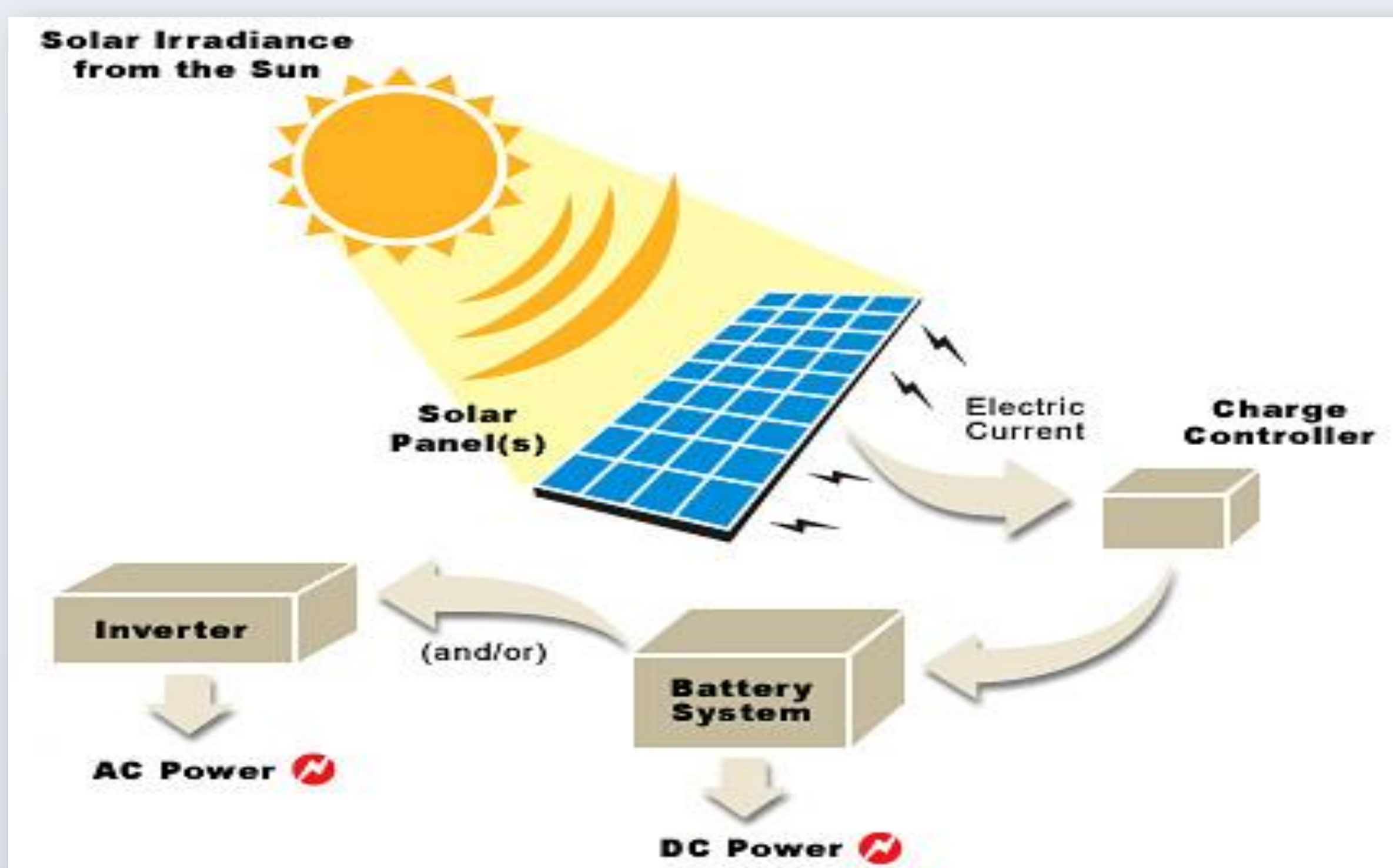


Figure 1. PV panels function [2]

PROBLEMS

• Dust accumulation reduces efficiency

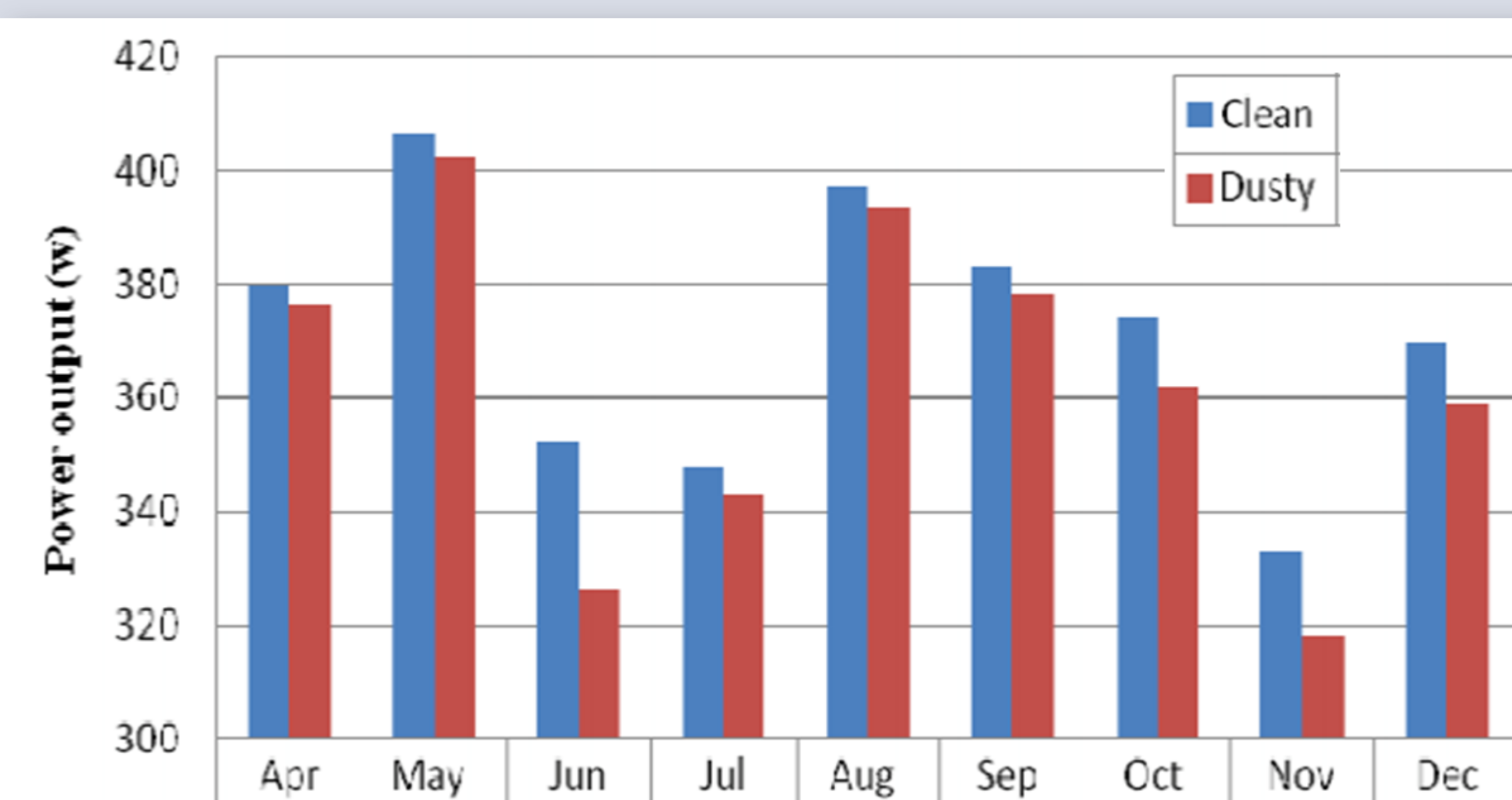


Figure 2: Total power output comparison [3]

• Existing cleaning methods are :

- Costly
- Time consuming (manually done)
- Harmful to the environment (waste water)
- Harmful to the PV panels (corrosive)

SOLUTION

The solution uses reverse piezoelectricity. In other words, Polyvinylidene fluoride (PVDF) films are used as piezoelectric materials. The process consists of polarizing PVDF films, mounting them on the PV panels, and then applying voltage to them. We start with high frequency voltage to shake the dust particles loose. Then, low frequency is used to push the dust particles away. Finally, dust slides down the PV panels.

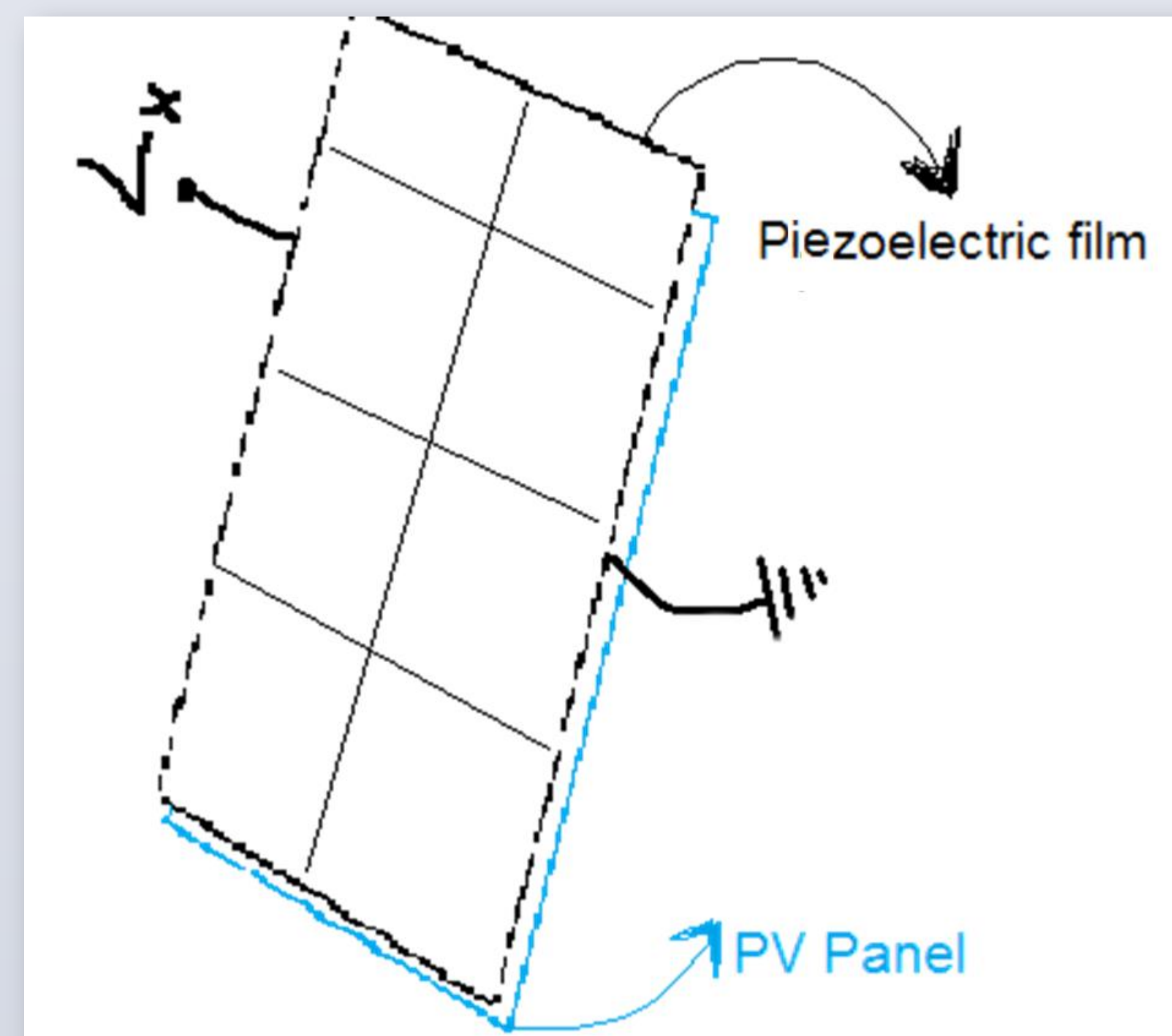


Figure 3. Piezoelectricity as a solution

• Possible areas of improvement:

- Hydrophobic materials are used to avoid the formation of mud in case of rainfall [4].
- A feedback system is used to inform the control unit of any drop in efficiency.

EVALUATION

	Capital Cost	Water Usage	Labor Usage	Cost Over Time
Manual Methods	Low	High	High	High
Mechanized Tools	High	Low	Low	Med
Hydraulic Systems	Med	High	Low	Med
Piezo-electricity	High	None	Low	Low

Table 1. Comparison of costs of different cleaning methods [5]

This solution is a brand new process that is still in its early development stage.

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