Utilizing Soft Robotic Concepts To Achieve Passive Solar Tracking To Increase Efficiency of a Solar Panel

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Solar tracking is a technique used to increase the energy efficiency of a solar panel by orienting solar panels to face the sun as it travels across the sky. Challenges faced by solar tracking techniques include the energy usage of the necessary electronics outweighing the increase of energy production, resulting in a net-loss energy production. This project designed a solar tracker capable of orienting a solar panel to directly face the sun without the use of electricity, resulting in a net-gain energy production. The solar tracker was designed with the concept of soft robotics to passively orient the panel using air pressure rather than electricity. The prototype was created with a 3D printed mold, liquid silicone rubber, and a bike pump for air supply. As air pressure increases within the soft robot, the robot bends, orienting the solar panel tilt angle without the use of electricity. Testing consisted of measuring the solar panel tilt angle with a corresponding PSI to generate a correlation between the two variables. Further statistical analysis calculated a least squares regression line indicating a strong positive linear correlation between PSI and solar panel tilt angle. It was concluded that the soft robotic solar tracker prototype achieved all engineering goals. Potential design improvements can be made, specifically replacing the material with PETG plastic and more rigorous testing can be implemented. In closing, this project aimed to introduce the concept of soft robotics to the solar tracking industry and the benefits it brings to the ever-growing industry.