A Novel Energy Harvesting System with a Piezo Element to Power a Visual Prosthesis

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The purpose of this project is to design an energy harvesting piezo electric solution to power an internal retinal prosthesis system using the natural eye movement. The best and most recent internal visual prosthesis systems allow patients with certain blindness to see their surroundings with limited clarity. These systems use electrodes to stimulate the optic nerve. The problem arises from the amount of power supplied by the implanted battery. These systems require invasive battery replacement surgeries. In addition, due to the limitation of power, the prosthesis can have only a minimal number of electrodes, hence limited vision. The solution here is to use a piezo fiber, a rectangular paper-like fiber that generates power when compressed or stretched. A small piezo fiber was attached along an eye model's lateral rectus muscle, one of the extra-ocular muscles that move the eyeball. A scale model was built where it simulated extra ocular muscle movement by using a servomotor controlled by a micro controller. The micro controller is programmed in PBasic language. A circuit and an extensive program to continuously measure the voltage produced by the piezo-fiber for a period of time, with various simulated eye movements, was built. In this experiment, the piezo-fiber is continuously generating voltage between 0.5 and 5 volts. It was proved that the piezo electricity can be harnessed to power a retinal visual prosthesis system. This will reduce and/or eliminate the battery replacement surgery, and it will open more pathways for advanced systems with more electrodes.

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