

Flasher Powered by Photovoltaic Cells and Ultracapacitors

Characteristics include reliability, long life, and wide temperature range.

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A unique safety flasher powered by photovoltaic cells and ultracapacitors has been developed. Safety flashers are used wherever there are needs to mark actually or potentially hazardous locations. Examples of such locations include construction sites, highway work sites, and locations of hazardous operations.

Heretofore, safety flashers have been powered by batteries, the use of which entails several disadvantages: Batteries must be kept adequately charged, and must not be allowed to become completely discharged. Batteries have rather short cycle lives, and their internal constituents that react chemically to generate electricity deteriorate (and hence power-generating capacities decrease) over time. The performances of batteries are very poor at low temperatures, which often occur in the circumstances in which safety flashers are most needed. The disposal of batteries poses a threat to the environment. The development of the present photovoltaic/ultracapacitor-powered safety flasher, in which the ultracapacitors are used to

store energy, overcomes the aforementioned disadvantages of using batteries to store energy.

The ultracapacitors in this flasher are electrochemical units that have extremely high volumetric capacitances because they contain large-surface-area electrodes separated by very small gaps. Ultracapacitors have extremely long cycle lives, as compared to batteries; consequently, it will never be necessary to replace the ultracapacitors in the safety flasher. The reliability of the flasher is correspondingly increased, and the life-of-system cost and the adverse environmental effects of the flasher are correspondingly reduced. Moreover, ultracapacitors have excellent low-temperature characteristics, are maintenance-free, and provide consistent performance over time.

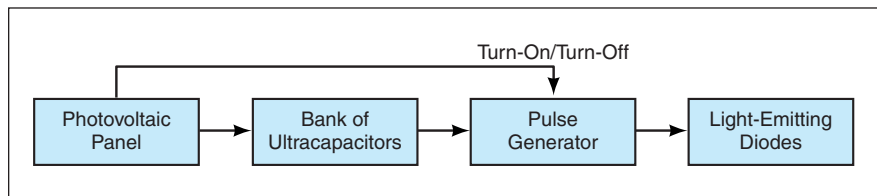
The flasher circuit (see figure) includes a 3-volt, 50-milliamper, all-weather photovoltaic panel connected in parallel with two 100-farad ultracapacitors, and with a pulse generator. The ultracapacitors can store enough

energy to sustain operation of the flasher for as long as 30 hours. Ultracapacitors are excellent for this application in that a complex voltage regulator is not required, as would be the case if batteries were used. The pulse generator puts out a pulse of 100-millisecond duration once per second. The pulses are fed to two high-efficiency light-emitting diodes. Light-emitting diodes are excellent for this application because they are characterized by low power demand, lack of inrush current, short response time, and long life. The light-emitting diodes are installed at the focus of a Fresnel lens to make them more visible from a distance. The voltage developed by the photovoltaic panel serves not only to charge the ultracapacitors but also as a signal to turn the pulse generator on at dusk and turn it off at dawn.

Because of the long lives of the photovoltaic panel, ultracapacitors, light-emitting diodes, and other electronic components, the minimum expected life of this flasher is 25 years.

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Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Commercial Technology Office, Attn: Steve Fedor, Mail Stop 4-8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-17246.



The **Photovoltaic Panel** generates electrical energy that is stored in ultracapacitors. The stored energy is used to power the pulse generator, which causes the light-emitting diodes to flash.

Improved Autoassociative Neural Networks

These networks could learn relatively complex tasks.

NASA's Jet Propulsion Laboratory, Pasadena, California

Improved autoassociative neural networks, denoted nexi, have been proposed for use in controlling autonomous robots, including mobile exploratory robots of the biomorphic type. In comparison with conventional autoassociative neural networks, nexi would be more complex but more capable in that they could be trained to do more complex tasks. A nexus would use bit weights and simple arithmetic in a manner that would enable training and operation without a central processing

unit, programs, weight registers, or large amounts of memory. Only a relatively small amount of memory (to hold the bit weights) and a simple logic application-specific integrated circuit would be needed.

A description of autoassociative neural networks is prerequisite to a meaningful description of a nexus. An autoassociative network is a set of neurons that are completely connected in the sense that each neuron receives input from, and sends output to, all the

other neurons. (In some instantiations, a neuron could also send output back to its own input terminal.) The state of a neuron is completely determined by the inner product of its inputs with weights associated with its input channel. Setting the weights sets the behavior of the network.

The neurons of an autoassociative network are usually regarded as comprising a row or vector. Time is a quantized phenomenon for most autoassociative networks in the sense that time proceeds in