SeeStar II NiMH Battery Smart Charger

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Background

Rechargeable Nickel Metal Hydride (NiMH) batteries are used in multiple underwater experiments at the Monterey Bay Aquarium Research Institute (MBARI). These batteries are usually custom made with specific voltages and ampere-hour capacities for each experiment. The NiMH batteries are often recharged using a simple DC power supply. Based on the charge rate and method, the life cycle of the battery can be significantly reduced. Overcharging can lead to cell over pressurization and excess heat generation and eventual cell degradation. A smart charger can recharge the batteries without exceeding any of the rated specifications and extend the life cycle of the battery.

Proposed Work

The proposed senior project will be to design and build a smart battery charger for use with standard NiMH cells and multi-cell batteries. The final product will be a portable, water-proof (able to use on the deck of a deployed ship) charger that will accept standard (1.2V) NiMH single cells and batteries containing up to 16-cells.

Functionality

The charger will have two primary modes of operation: battery charger and battery tester. The Smart Charger will have a serial port which allows communication with the user via a hyperterminal window. A simple menu will allow the user to choose the mode of operation and to enter battery specific information.

Battery Charger Mode

The fast battery charger mode will allow a user to attach a single cell or multiple cell battery for safe recharging. The user will enter the number of cells and capacity and the Smart Charger will adjust the charge cycle parameters accordingly. The charge method will be determined by the students, but there will need to be safety checks in place due to the possibility of excess heat and gas generation in the event of accidental overcharging. The voltage and temperature of the battery will be logged and saved to an SD card during the charge cycle.

Battery Tester Mode

The battery tester mode will allow a user to test batteries by performing charge and discharge cycles. The voltage and temperature of the battery will be logged and saved to an SD card during both the charge and discharge cycles. The discharge cycle also allows the user to fully discharge a battery which is displaying voltage memory problems. The discharge cycle will be a constant current discharge method (instead of constant resistance). A separate trickle charge sub-function will allow users to top-off previously charged batteries which have been stored and suffered from self-discharge.

References

The Battery Handbook Third Edition, David Linden and Thomas B. Reddy. Chapter 29

Panasonic NiMH Battery Handbook (download)

Types of batteries:
http://industrial.panasonic.com/ww/products/batteries/secondary-batteries/nickel-metal/standard-type-ni-mh?reset=1