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Electric Vehicle Battery Management System with Charge Monitor and Fire Protection

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Abstract: *The increasing demand for environmentally friendly and energy-efficient refrigeration systems has led to the exploration of alternative cooling technologies powered by renewable energy sources. This paper presents the design and development of a solar-powered refrigeration system using thermoelectric Peltier modules. The system operates based on the Peltier effect, where electrical energy is converted into a temperature difference across semiconductor junctions to produce cooling without the use of conventional compressors or refrigerants. Solar photovoltaic panels are used to generate electrical energy, which is stored in a battery and regulated through a digital temperature controller for precise temperature control. The proposed system is compact, portable, noiseless, and suitable for off-grid and remote areas. Experimental results demonstrate that the system can maintain temperatures in the range of 5 °C to 25 °C, making it suitable for food preservation and medical storage applications. Although the coefficient of performance of thermoelectric refrigeration is lower than conventional systems, the advantages of sustainability, low maintenance, and environmental safety make it a viable solution for small-scale cooling needs.*

Keywords: Lithium-ion Battery, Charge Monitoring, Fire Protection, Voltage Sensor, Current Sensor, Temperature Sensor, State of Charge (SoC), Battery Safety

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