

Title of the Innovation: Smart Heating and Cooling Water Bottle

Theme:

Low carbon footprint solution/Technology

Problem Statement : Access to clean and temperature-controlled drinking water is a growing concern, especially in outdoor, travel, and rural settings where refrigeration is unavailable. Traditional bottles lack the ability to maintain or adjust water temperature based on user preference or weather conditions. The Smart Heating and Cooling Water Bottle addresses this gap by providing a portable, rechargeable solution that can cool or heat water on demand without relying on external power. This innovation supports health, convenience, and sustainability—aligning with current market demands for smart, eco-friendly consumer products.

Solution / Proposed / Developed : The Smart Heating and Cooling Water Bottle is equipped with a Peltier module, rechargeable battery, fan with heat sink, temperature sensor, and a DPDT switch. This setup allows users to cool or heat 500ml of water on demand by simply flipping a switch to change polarity. The temperature sensor helps monitor water temperature, while the rechargeable battery and charging module ensure portability and eco-friendliness. Designed without microcontrollers for simplicity, the bottle is ideal for students, travelers, and people in remote areas, offering a convenient, electricity-free way to access temperature-controlled drinking water anytime, anywhere.

Uniqueness and Distinctive Features : The Smart Heating and Cooling Water Bottle stands out for its simplicity, portability, and dual-functionality. Unlike traditional thermos bottles or electric flasks, it uses a Peltier module and a DPDT switch to instantly switch between heating and cooling modes, without the need for a microcontroller or complex electronics. Powered by a rechargeable battery and equipped with a heat sink fan and temperature sensor, it provides real-time temperature control in a compact form. Its eco-friendly, electricity-independent design makes it ideal for on-the-go use in rural, travel, and emergency scenarios—bridging the gap between affordability, innovation, and everyday utility.

Concept & Objective : The Smart Heating and Cooling Water Bottle is a unique and innovative solution designed to address the growing demand for portable, energy-efficient, and dual-function temperature control for drinking water. In many parts of the world—particularly rural areas, outdoor work zones, travel situations, and during emergencies—there is limited or no access to refrigeration or electric kettles. At the same time, people often need cold water in hot weather or warm water in cold conditions. Conventional thermos flasks can only maintain the temperature of already-hot or cold water; they cannot actively heat or cool it.

The Smart Heating and Cooling Water Bottle fills this gap with a dual-function design that can heat or cool water on demand, powered entirely by a rechargeable battery, with no dependency on a continuous electricity supply.

The core concept revolves around the use of a Peltier module, a solid-state thermoelectric device that creates a temperature difference when powered. By applying current in one direction, one side of the module becomes cold while the other becomes hot. Reversing the current flips the effect. This unique property is harnessed using a DPDT (Double Pole Double Throw) switch, which allows the user to manually reverse the polarity of the current—switching between heating and cooling effortlessly. This eliminates the need for microcontrollers, complex circuits, or programming, making the system more reliable, cost-effective, and easy to assemble or maintain.

The bottle features a rechargeable 12V battery and charging module, enabling independent operation without external power. A fan and heat sink help dissipate heat from the Peltier module, ensuring efficient temperature control. A temperature sensor is included to monitor water temperature, giving users precise control over the heating/cooling process.

The primary objective of this innovation is to offer a simple, affordable, and portable solution for temperature-controlled drinking water anytime, anywhere. It targets students, travelers, outdoor workers, campers, and individuals in rural areas. Additionally, the bottle supports sustainability goals by reducing dependence on disposable plastic bottles and energy-heavy appliances.

A secondary objective is to show how real-world problems can be addressed using basic hardware without relying on expensive or complex systems. By avoiding software-based automation, this innovation remains accessible, replicable, and scalable for low-resource environments.

In summary, the Smart Heating and Cooling Water Bottle delivers a practical, eco-friendly, and affordable innovation that redefines portable hydration through clever engineering and smart integration of simple components.

Market Potential: The Smart Heating and Cooling Water Bottle has strong market potential across multiple user segments. With increasing demand for portable, smart, and eco-friendly hydration solutions, this product appeals to travelers, students, fitness enthusiasts, rural populations, outdoor workers, and emergency responders. Unlike conventional flasks or electric bottles, it actively cools or heats water using a rechargeable battery, making it suitable for both urban and off-grid environments. Its simplicity, affordability, and energy-efficient design make it highly scalable for mass production and retail. Additionally, it aligns with growing consumer trends focused on health, sustainability, and smart living.

IP or Patentable Aspects: Yes, the solution has strong IP and patent potential due to its unique configuration. It combines simplicity, portability, and dual-mode operation using a Peltier module and DPDT switch in a compact, battery-powered bottle. The design avoids complex electronics, making it cost-effective and easy to use. The integration of manual polarity control, temperature monitoring, and charging functionality into one reusable bottle presents a novel approach to hydration. A patent could be pursued on the system design, use-case application, or integration layout.

Stage of Innovation:\ Prototype / Working Model

Target Beneficiaries:\ Students, Travelers, Rural Communities, Outdoor Workers, Health-Conscious Individuals