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Eco Cooler 2.0: A Low-Cost Smart Cooling System Using Recycled Materials

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Abstract
This research paper presents Eco Cooler 2.0, a low-cost and eco-friendly cooling solution designed for rural and low-income households. High indoor temperatures during summer create discomfort, especially where access to electricity and cooling appliances is limited. The proposed system utilizes recycled plastic bottles arranged on a panel to cool incoming air based on air pressure principles. Additionally, a temperature monitoring system using a DHT11 sensor and Arduino provides alerts when the temperature exceeds a set threshold. The design is sustainable, affordable, and easy to construct, making it suitable for homes, classrooms, and small workplaces. The results indicate that the system can reduce indoor temperature by 3–5°C while promoting environmental awareness and energy conservation.

Keywords: Eco-Friendly Cooling, Recycled Materials, Temperature Monitoring, Arduino, Sustainable Innovation

1. INTRODUCTION

In many rural and economically challenged areas, maintaining a comfortable indoor temperature during summer is a major issue. Conventional cooling systems such as air conditioners and fans require electricity, which may be expensive or unavailable. This creates a need for alternative cooling methods that are affordable and sustainable.
Eco Cooler 2.0 is inspired by simple scientific principles and focuses on reusing plastic waste to create a passive cooling system combined with a smart alert mechanism.

2. Problem Statement

The following challenges are commonly observed:

- High indoor temperatures during summer
- Limited access to electricity in rural areas
- High cost of conventional cooling systems
- Lack of awareness about eco-friendly cooling solutions

3. Survey and Research

Survey results indicate that many families and students face discomfort due to heat, especially in poorly ventilated spaces. Research shows that airflow manipulation and pressure differences can reduce air temperature slightly. Recycled plastic bottles can be effectively used to create airflow channels that enhance cooling.

Temperature monitoring using sensors like DHT11 allows real-time tracking and alert systems, improving user awareness and safety.

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4. Proposed Solution

The Eco Cooler 2.0 system includes:

- A panel fitted with multiple plastic bottle necks acting as cooling funnels
- Use of recycled materials for sustainability
- A DHT11 temperature sensor for monitoring
- Arduino-based alert system (buzzer/LED)
- Easy installation on windows or ventilation areas

This system combines passive cooling with smart monitoring.

5. Working Principle

- **Air Cooling (Pressure Principle):** When hot air passes through the narrow neck of a bottle, its speed increases and pressure decreases, causing slight cooling.
- **Temperature Monitoring:** The DHT11 sensor continuously measures temperature and sends data to the Arduino.
- **Alert System:** If temperature exceeds 30°C, the buzzer or LED activates to warn users.
- **Sustainable Design:** The system uses recycled plastic bottles, reducing environmental waste.

6. Advantages

- No electricity required for cooling
- Low-cost and affordable
- Eco-friendly and sustainable
- Easy to build and install
- Provides real-time temperature alerts
- Promotes recycling and environmental awareness

7. Applications

- Rural homes and low-income households
- Schools and classrooms
- Small shops and workshops
- Temporary shelters and huts
- Community spaces

8. Conclusion

EcoCooler 2.0 provides an innovative and practical solution to combat heat in areas with limited resources. By combining passive cooling techniques with simple electronics, the system enhances comfort while remaining environmentally friendly.

The project demonstrates how basic scientific principles and recycled materials can be used to address real-world problems. Future improvements may include enhanced design efficiency, larger-scale implementation, and integration with solar-powered systems.

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