



Recycled Vape Battery Pack

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Introduction

Need

- Vaping has become very popular in the past decade causing the waste of them to continue to grow at an unsustainable rate.
- Vape devices end up being disposed of once they have been fully depleted of e-liquid (a special mix of nicotine and other liquids) leading to the lithium-ion cells to end up in landfills.
- Lithium-ion batteries cells in landfills leads to fires, physical safety hazards, and environmental hazards

Alternatives

- There are currently no large-scale or fully developed products/services on the market that tackle the issue at hand.
- A drop box is something sellers offer so the devices can be properly disposed of, but this is far and few between.
- Hobbyist level projects and tutorials are available showing how to reuse batteries for other purposes yet fail to convey the associated risks or don't take the proper safety precautions involved with batteries.

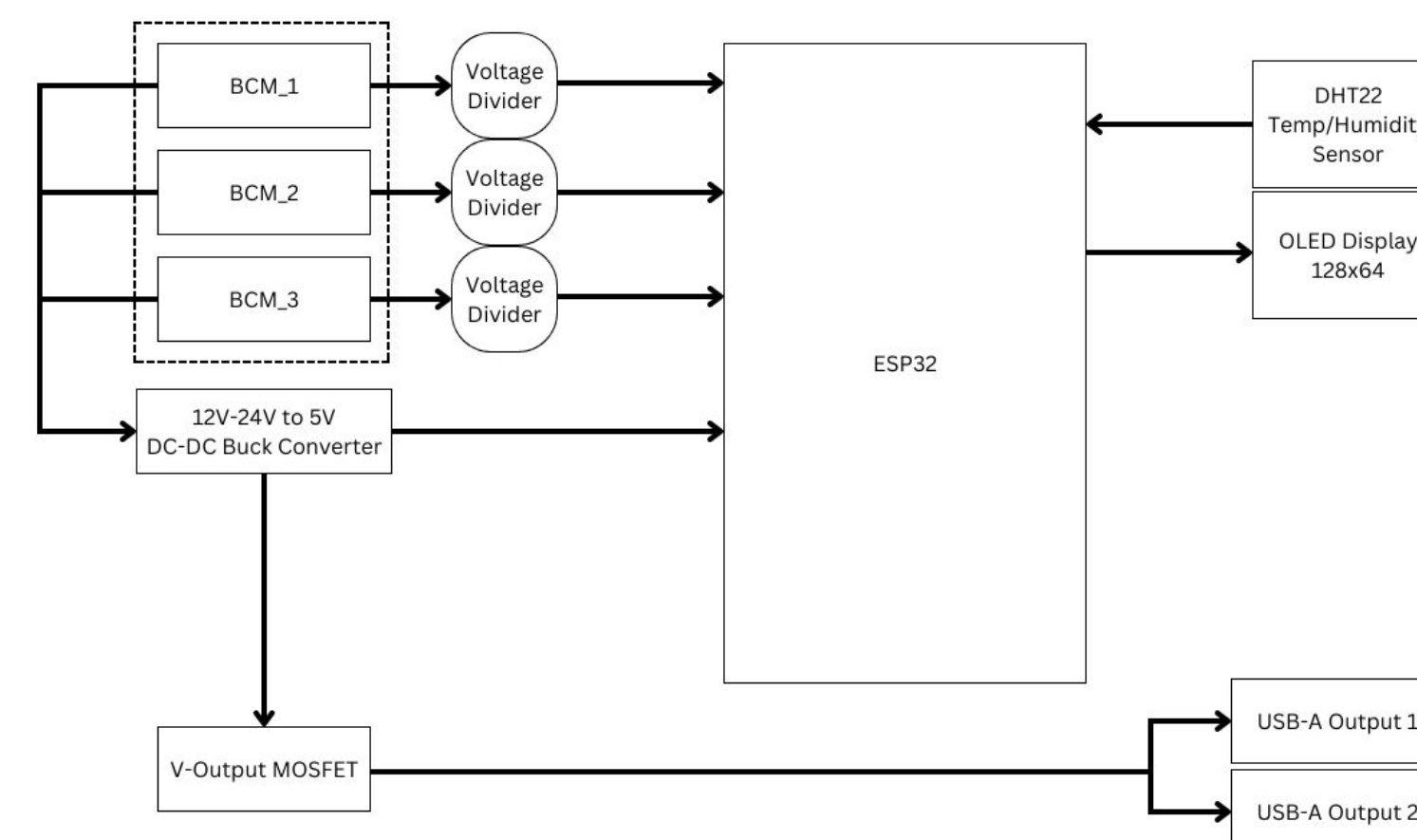


Solution

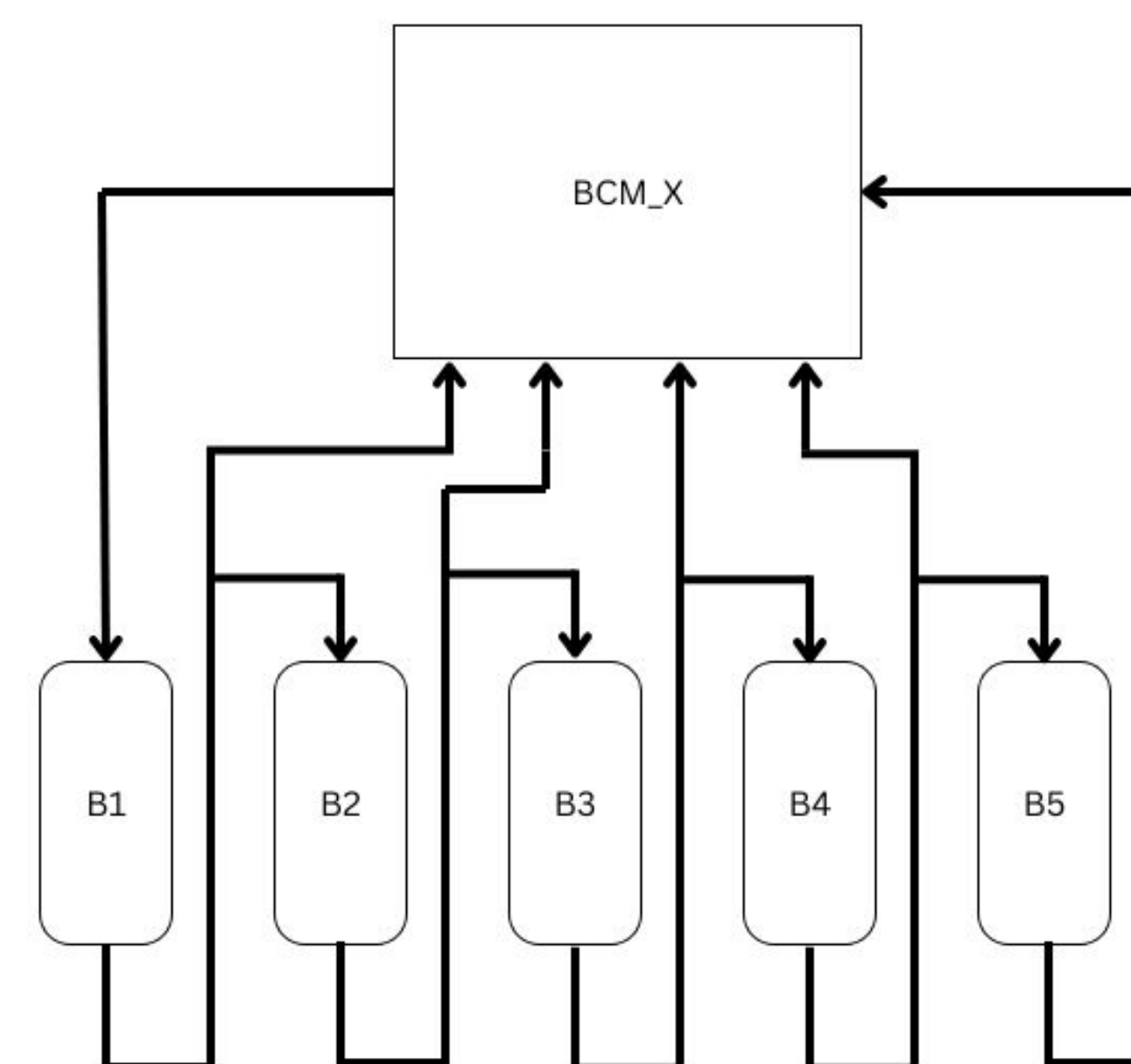
- An easy to construct battery pack platform in which the user can add recycled lithium-ion battery cells.
- An easily accessible base device that can be easily assembled and disassembled with little to no prior electronics experience.
- Multiple safety features including, website with active temperature and humidity readouts to ensure battery cell health.

Block Design

- ESP32-DEVKITC-32D Microcontroller
- TPS22990DMLR - Power Switch/Driver IC
- DHT22 Temperature/Humidity Sensor
- 128x64 I2C OLED Display
- 2 x USB-A 5V Outputs
- 21V@1A Integrated Charging Circuit



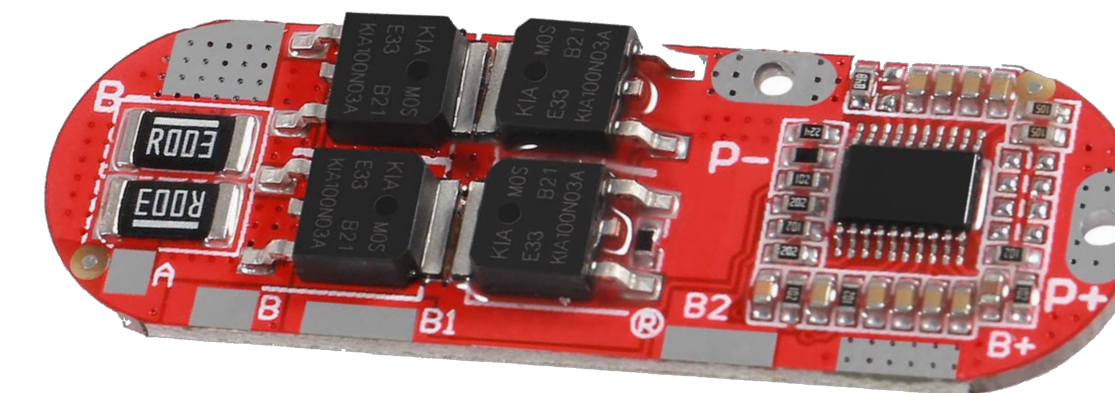
Complete system diagram (charging excluded)



Block diagram of 13450 lithium-ion battery cells and their corresponding connections to the battery control module (BCM).

Assembly and Testing

- 13450 Lithium-ion battery cells will be used
- Each cell has a rating of ~650mAh
- Voltage Ranges: 2.75V-4.2V. Nominal of 3.7V
- Using 5 cells would provide a total of 21V
- Using 3 strings of 5 cells would provide a maximum current rating of 1.95A



BCM board for 18650 Lithium-Ion cells. 5S (5 Cell) lithium-ion configuration. Integrated cell balancer ensures safety and functionality while collecting data

Web Interface

Vape Battery Pack Dashboard

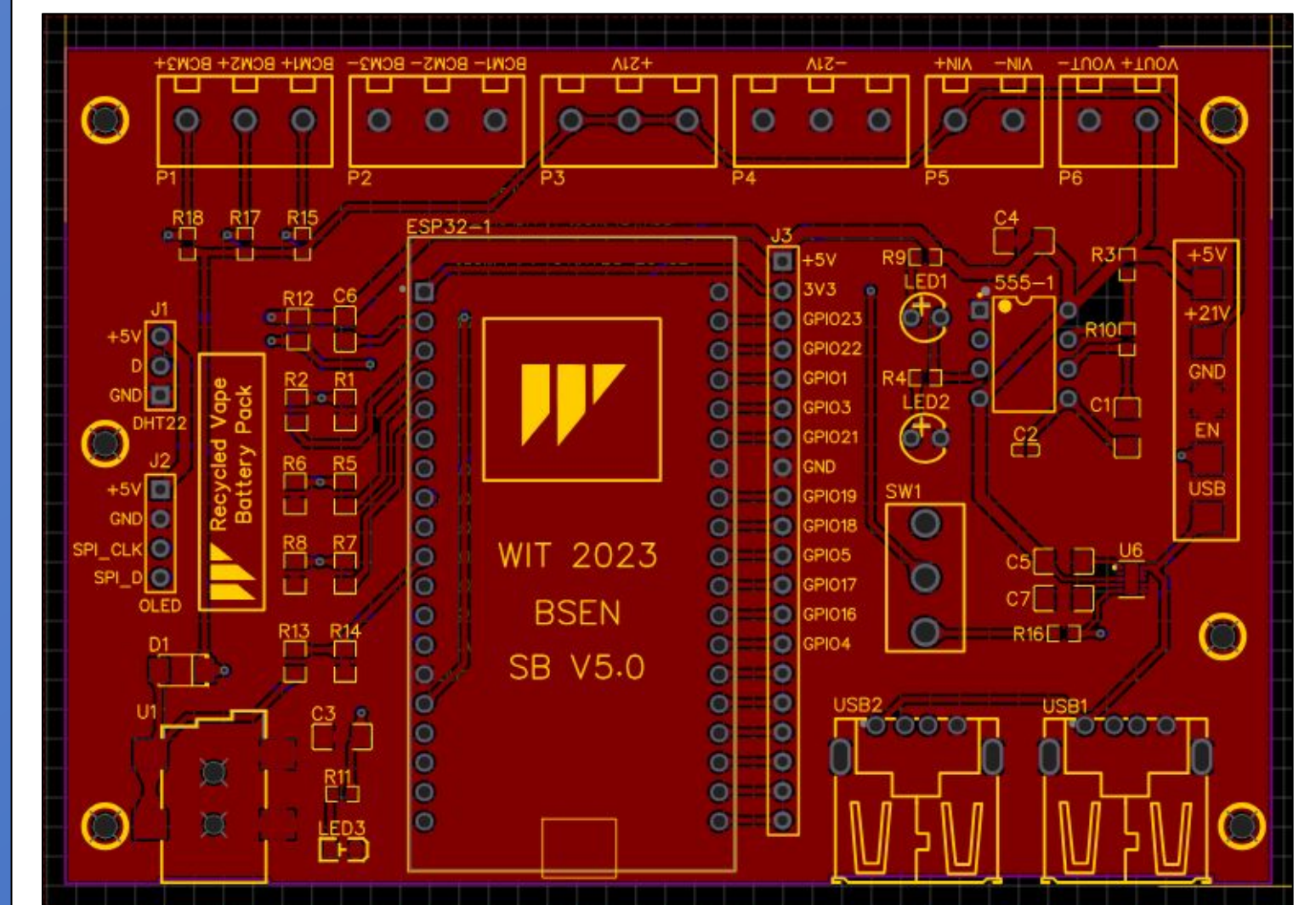
Total Voltage/Voltage per Series Pack = 30.00V
Total Battery Percentage = 142.86%
Pack 1 Voltage = 10.00V
Pack 2 Voltage = 10.00V
Pack 3 Voltage = 10.00V

Pack Humidity = 64.00%
Safe? **Yes**
Pack Temperature = 80.60 F
Safe? **Yes**

Output State : **ON**

OK

Results



Conclusions

The product that this project covers is only a start to solving the issue of waste produced from disposable vapes. With the popularity continuing to grow of these devices it is important that action is taken that allows for reuse of the precious lithium inside. This product aims to be a consumer solution, giving access to a battery pack that will be easy to assemble with simple instructions.

Future Directions

An expansion of this product would take this to a manufacturer/merchant level. Drop-boxes would offer incentives as collection for the batteries. Battery cells would be harvested and used to mass produce the product or used in regular devices if battery health is optimal. Improving to that size would greatly impact the situation of vape waste.

References

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- [3] J. Heelan, E. Gratz, Z. Zheng, Q. Wang, M. Chen, D. Apelian, and Y. Wang, "Current and prospective Li-ion battery recycling and Recovery Processes - Jom," *SpringerLink*, 20-Jun-2016. [Online]. Available: <https://link.springer.com/article/10.1007/s11837-016-1994-y>. [Accessed: 20-Mar-2023].
- [4] Opengreenenergy and Instructables, "DIY Professional 18650 Battery Pack," *Instructables*, 29-Jul-2022. [Online]. Available: <https://www.instructables.com/DIY-Professional-18650-Battery-Pack/>. [Accessed: 20-Mar-2023].