

CARE-PCR Limitations and Recommendations

Limitations:

1. The system only operates using a loaned 4s battery pack. There is no charger due to the malfunction of the procured BQ24616EVM charger.
2. Lid heating was not integrated into the system, leading to potential condensation on the lid during formal thermocycling with samples.
3. The maximum temperature of the system is limited to 80°C. The minimum temperature has not been tested but is speculated to be around 20°C.

Recommendations:

1. **Improve H-Bridge Current Rating:** The 2A H-bridge is a bottleneck, limiting the system's capability. Upgrading to a higher current rating is recommended.
2. **Migrate Codebase to STM32 Microcontroller:** This would provide better Flash and SRAM, allowing for a smaller PCB size.
3. **Consolidate Components on a Single PCB:** This will prevent power instability due to loose wire connections.
4. **Investigate Ramp Rates of TES-12704 Peltier at Different Current Draws:** Determine if TES-12704 can achieve a ramp rate of 1°C/s at 3A-4A.
5. **Increase Maximum Temperature:** With a more powerful Peltier, the system's maximum temperature can be increased.

Proposed Plan of Actions:

1. **Add a Charging Circuit:** If possible, procure another BQ24616EVM for its protection features and safety termination timer. Alternatively, create the proposed charger in the CoE 199 paper.
2. **Revisit Core Heating Loop's Heating Elements:** Optimize the Peltier and heater to achieve a ramp rate of 1°C/s.
3. **Use a More Efficient Single Channel H-Bridge:** Although the VNH2SP30 was not effective in tests, future groups could explore other options to avoid losses and increase power.
4. **Add a Lid Heating Feature:** This is essential for the actual PCR process to prevent condensation.
5. **Consider Alternative Materials for the Device Casing:** Materials can include wood, fiberglass, 3D printing materials, etc. The casing is too small to house all the components since we just mainly used OpenPCR's design. Change it to your liking.

EEE 196:

1. Apparently, the system is unstable when connected to the power supply. But it is ok when connected to a battery. Make sure the circuit is working properly first.
2. Address the recommendations and proposed plan of actions first so that the system is working as intended.
3. Make sure that CARE-PCR is working properly at the end of EEE 196 so that the EEE 199 will be more on the modifications of CARE-PCR.
4. Propose modifications