Temperature Regulated Analysis of Coagulopathy

Corbin Jee | David Mleczko | Lucas Relic | Albert Tran | Brycen Westgarth

Background

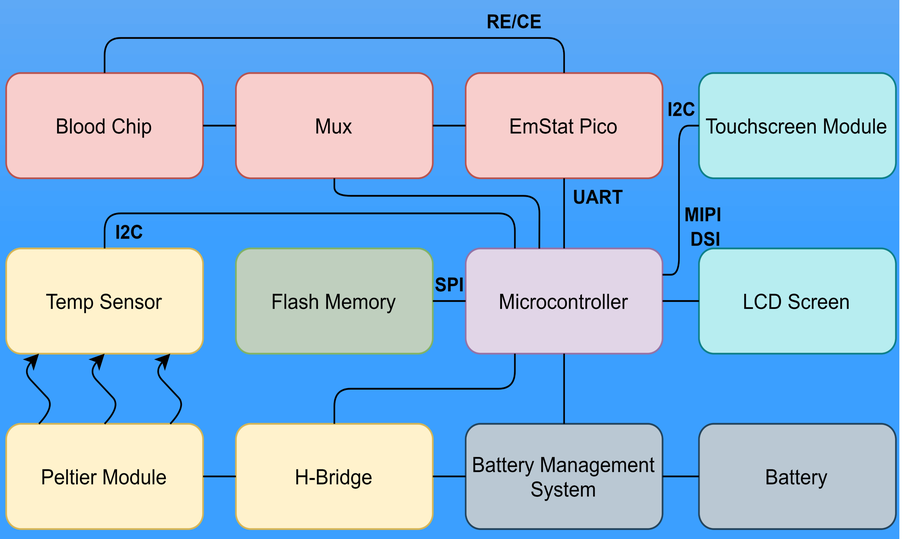
Trauma-induced coagulopathy (TIC) is a lethal condition that affects our blood's normal clotting behavior. Given that 30% of TIC-related fatalities occur within the first hour, rapid detection and treatment is imperative to patient safety. However, current coagulopathy detectors are only available as large, stationary machines in hospitals and consume valuable time to deliver results.

Overview / Design Specs

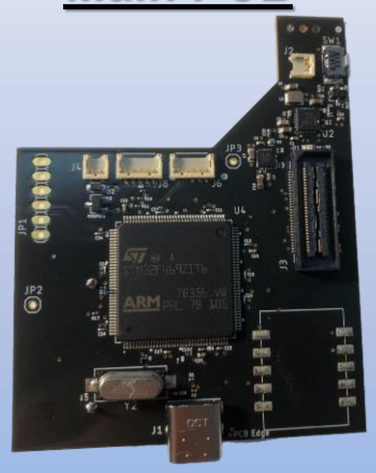
TRAC is a portable, handheld trauma-induced coagulopathy detector intended for use in the field, capable of delivering results in under two minutes. This enables first responders to quickly and correctly treat their patients.

Features
- Intuitive touchscreen interface for ease of use
- Internal temperature control system that brings the blood chip to a target temperature for more accurate results
- Integrated rechargeable battery

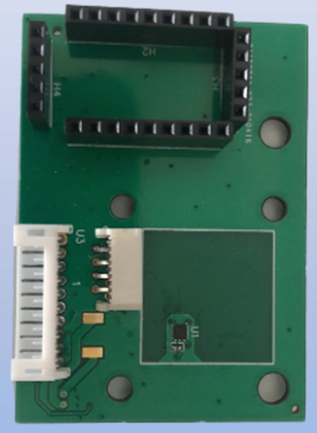
Block Diagram



Main PCB



Peripheral PCB



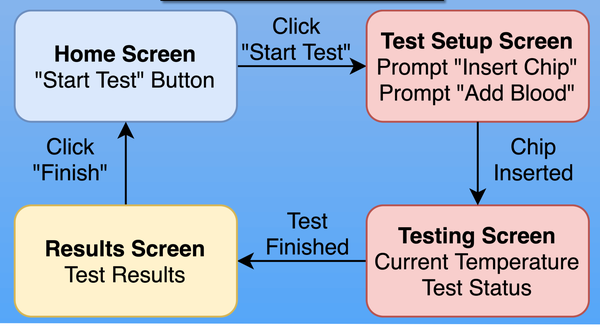
Main PCB
- Controls the touch screen through the MIPI DSI interface
- Communicates with the peripheral board to start the temperature control cycle and initiate the coagulopathy test
- Has space for an optional communications board

Peripheral PCB
- The blood chip is inserted into the connector in the center
- Continuously reads the temperature of the test environment for accurate temperature control
- The EmStat Pico sits in close proximity to the blood chip to reduce noise while performing the coagulopathy test

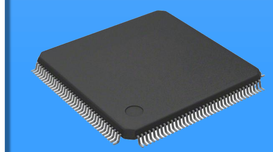
Assembled Device

- USB Type C port at the bottom for charging
- Blood chip is inserted at the top of the device
- Hot air produced by the Peltier module is exhausted through the opening at the left side of the device

UI Workflow

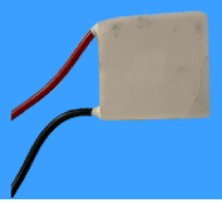


Hardware / Key Components



STM32F469I Microcontroller
- ARM Cortex M4 (180MHz)
- Supports MIPI DSI interface for touchscreen compatibility
- Low power draw and fast boot times

EmStat Pico
- Connects to electrodes on the blood test chip to perform the coagulopathy test



Peltier Module
- When powered, one side heats up and one side cools down
- Used to control the temperature of the blood test chip to give accurate results

High Discharge Rate LiPo Battery
- Features a 30C discharge rate to maximize the heating/cooling rate of the Peltier module

Acknowledgements:
Special thanks to Scott and Tyler from Aptitude, Professor Yogananda Isukapalli, and TA's Trenton Rochelle and Boning Dong