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Mentors:

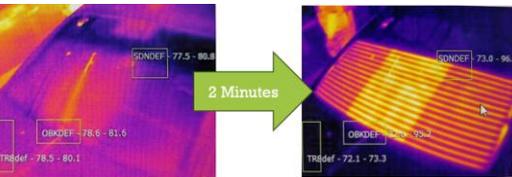
Customer Background

Testing Heated Surfaces (HS) in a manufacturing environment is difficult and time-consuming when relying on measuring temperature alone.



Problem Statement

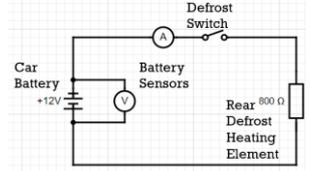
Develop a new testing method to ensure the proper operation of the HS in the vehicle production line.



Requirements

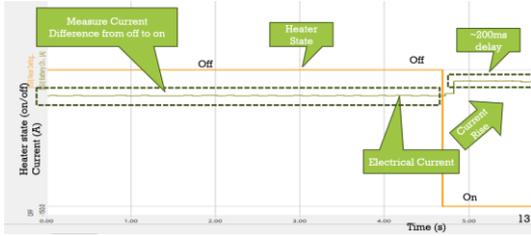
Req. #	Design Requirements	Metric
1	Mirror Heater testing reliability	Accuracy of 99.9%
2	Rear Glass Heater testing reliability	Accuracy of 99.9%
3	Wipper Heater testing reliability	Accuracy of 99.9%
4	Measure Electrical Current	Accuracy of +/-0.01A
5	Determine Vehicle Specifications (has heated Mirror/Wipper ect.)	Determine Specs on all Subaru Vehicles
6	Process Time	< 45 Seconds
7	Low Human interaction	Fully Automated

Experimentation and Concepts



Rear defrost circuit

Concept to test operation by measuring current. HS is a large resistors with high current consumption.



Rear defrost current readings

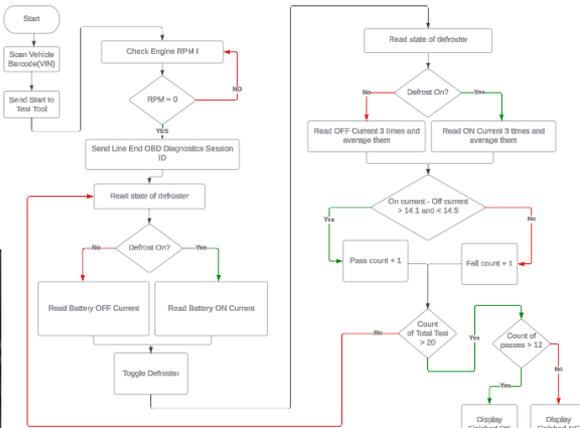
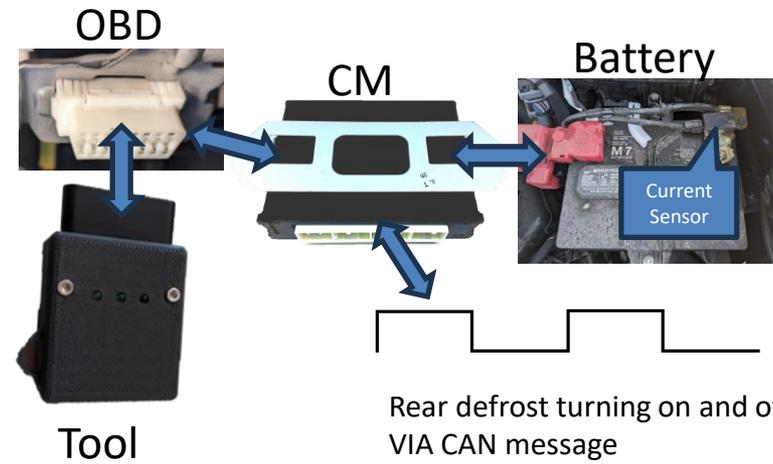
Testing

	Test 1	Test 2	Test 3	Test 4	Test 5	Overall
Vehicle 1	OK	OK	OK	OK	OK	OK
Vehicle 2	OK	OK	OK	OK	OK	OK
Vehicle 3	OK	OK	OK	OK	OK	OK
Vehicle 4	OK	OK	OK	OK	OK	OK
Vehicle 5	OK	OK	OK	OK	OK	OK
Vehicle 6	OK	OK	OK	OK	OK	OK
Vehicle 7	OK	OK	OK	OK	OK	OK
Vehicle 8	OK	OK	OK	OK	OK	OK
Vehicle 9	HIGH	OK	HIGH	OK	OK	OK
Vehicle 10	HIGH	OK	OK	LOW	OK	OK
Vehicle 11	HIGH	OK	OK	OK	OK	OK
Vehicle 12	OK	OK	LOW	OK	LOW	OK
Vehicle 13	OK	OK	OK	OK	OK	OK
Vehicle 14	OK	LOW	OK	OK	HIGH	OK
Vehicle 15	OK	OK	OK	OK	LOW	OK
Vehicle 16	OK	OK	OK	OK	OK	OK
Vehicle 17	HIGH	HIGH	OK	OK	OK	OK

Testing completed on 50 units, all units passed 3 of 5 tests = 100% success rate

Final Design

The Final Design uses a Tool plugged into the On-board Diagnostics (OBD) port to communicate with the Control Module (CM) via the Control Area Network (CAN) bus. The Tool quickly measures battery discharge current before and after turning on the heated surfaces, making a judgment in under a second.



Final Tool PCB

