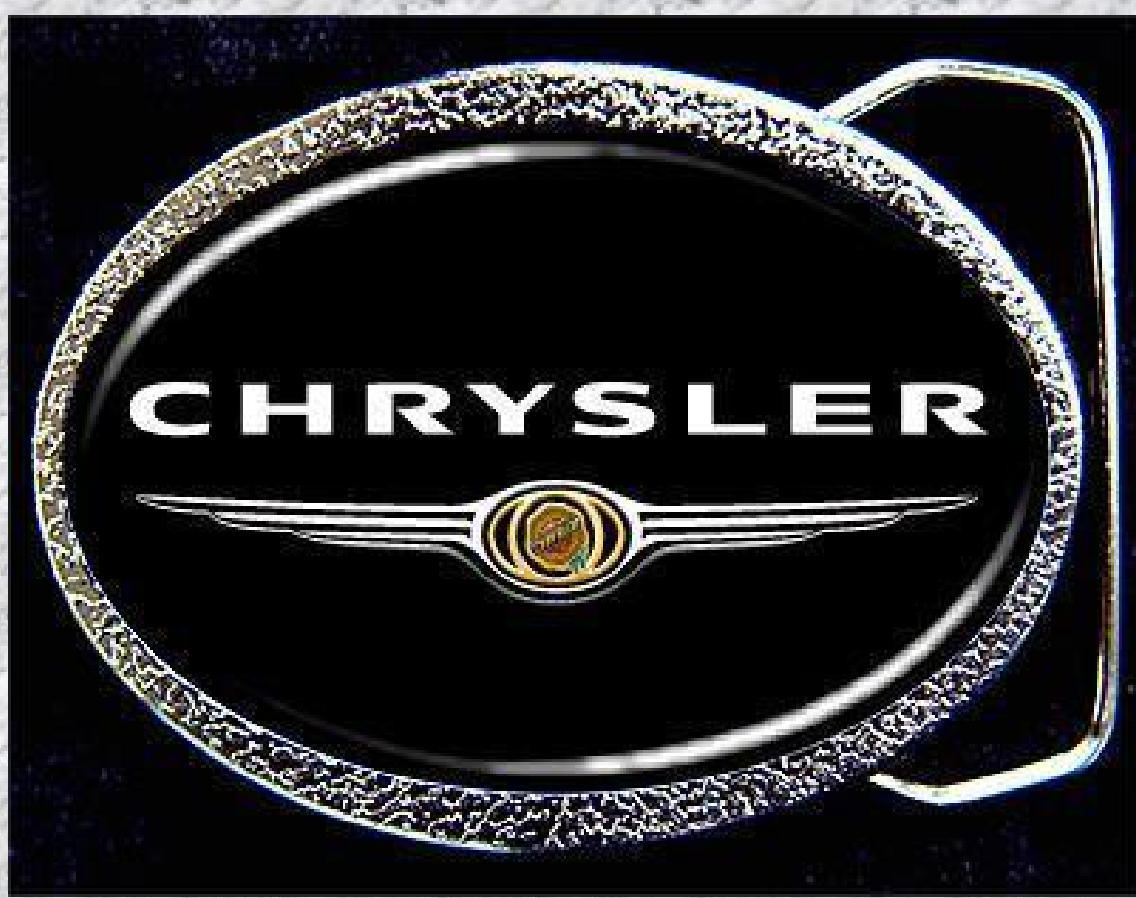
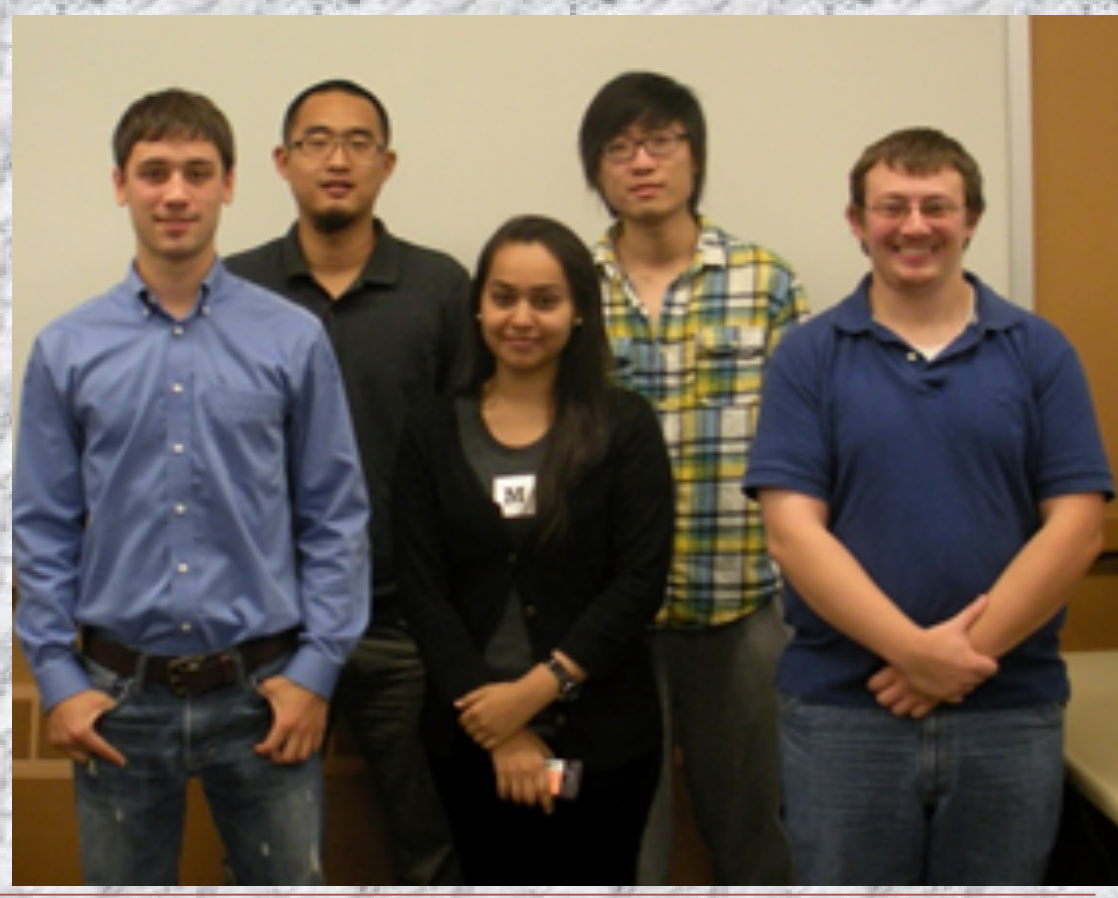




Advanced Breakout Board

Team 5 (from left to right): Andrew Haumersen (Presentation), Meng Cao (Lab Coordinator), Sana Siddique (Web Designer), Xuran An (Documentation), Richard Hendrick (Leader)

Sponsor: Chrysler Group, LLC **Facilitator:** Dr. Jian Ren

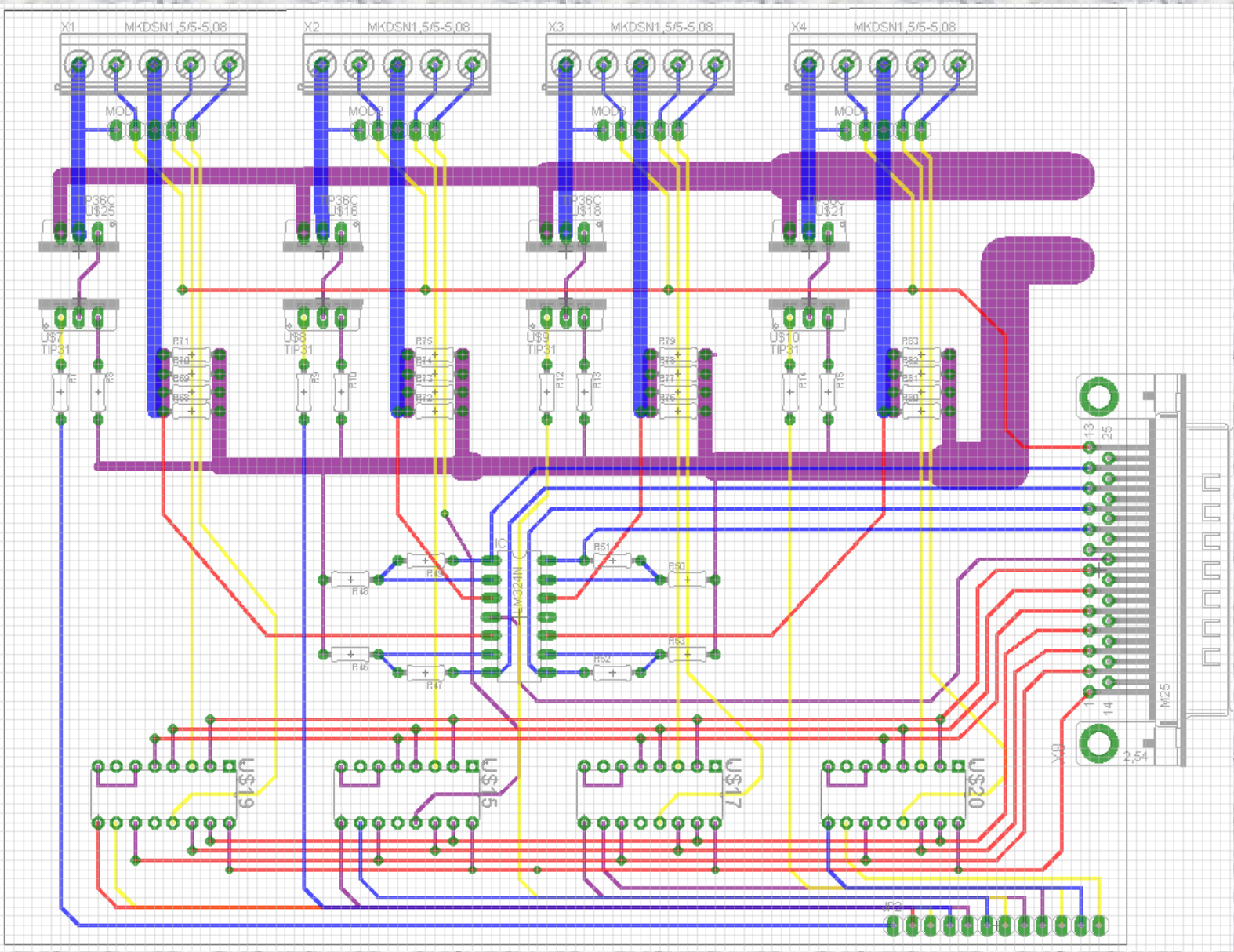


Abstract

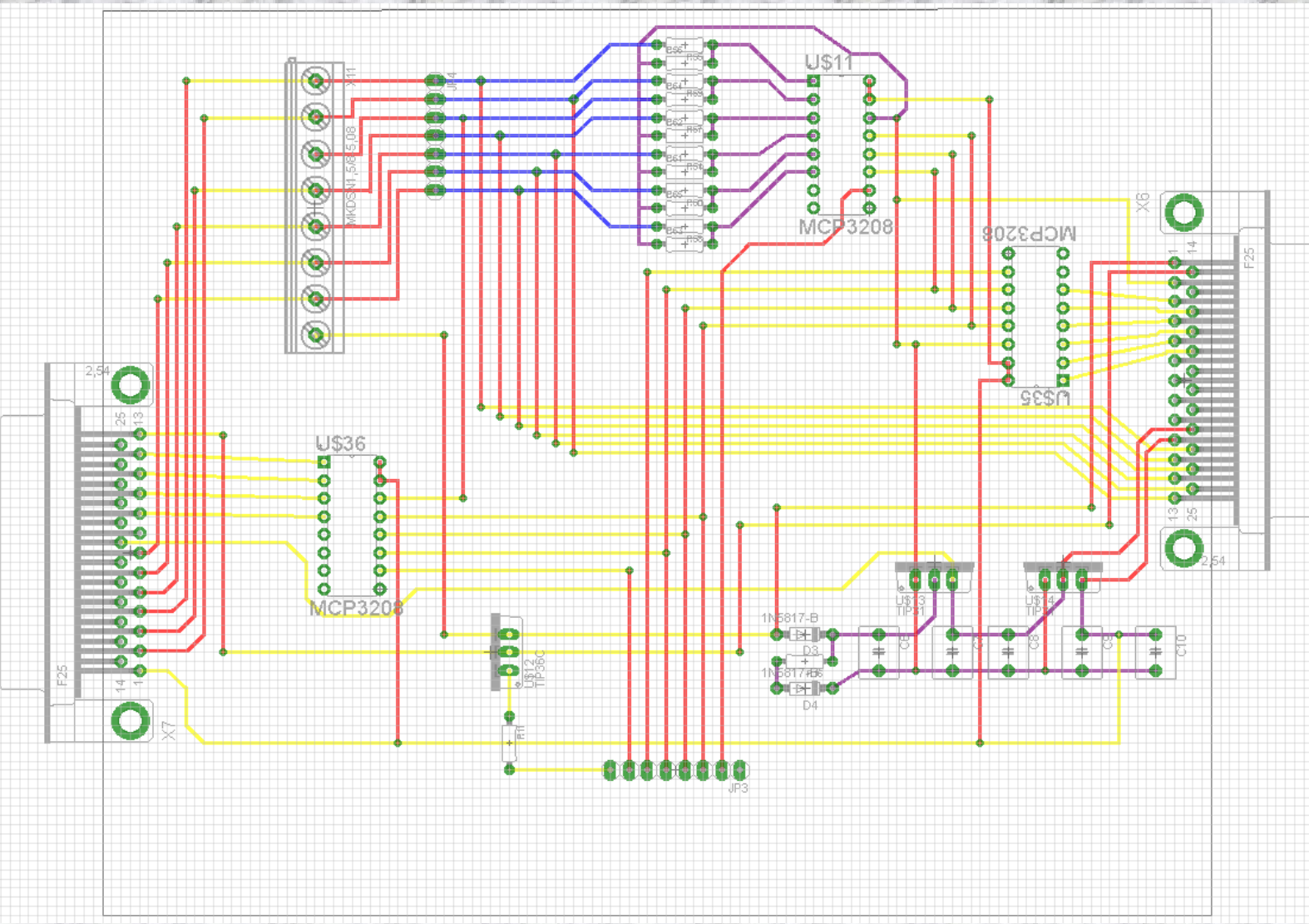
Our project goal was to create an advanced breakout board for testing, monitoring and toggling new Electronic Control Modules (ECUs) on a pre-prototype vehicle build. The device needs to reduce testing time on modules used for creating pre-prototype vehicles. By decreasing debugging time during early development work, it reduces the overall testing time required to achieve a working prototype. This will allow the engineers to identify issues with module connectivity prior to installation.

Technical Approach

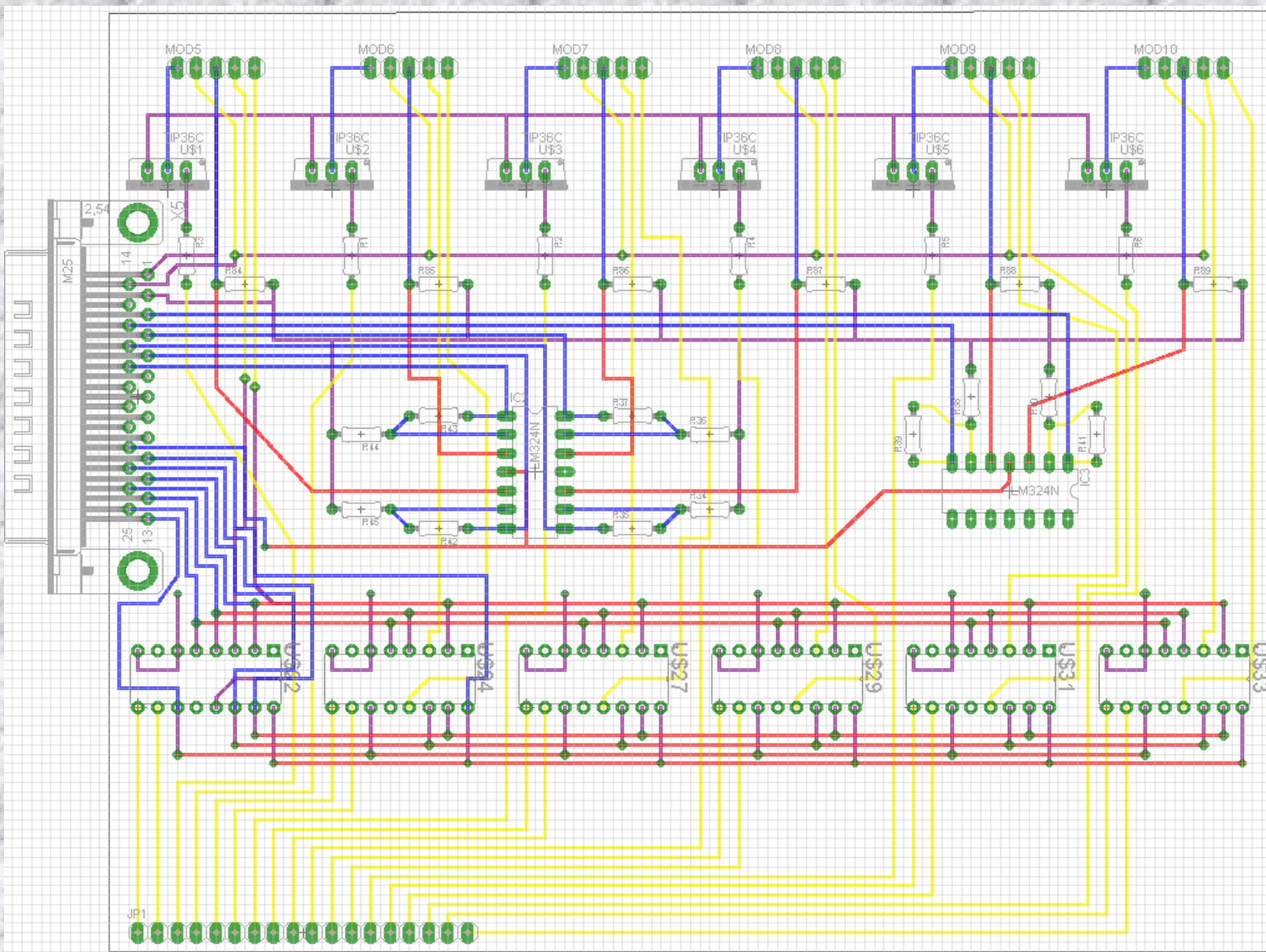
In order to connect up to 10 different modules to three different can buses at any time, take real time voltage and current readings, and toggle both power and ignition on/off we created a three PCB layout. The first board (pictured below) is of our four high power circuits which required much larger traces.



The next board is our center control board which connects to both the high and low power boards using d-sub. This board contains our power circuit and voltage reading circuit for all three CAN buses.



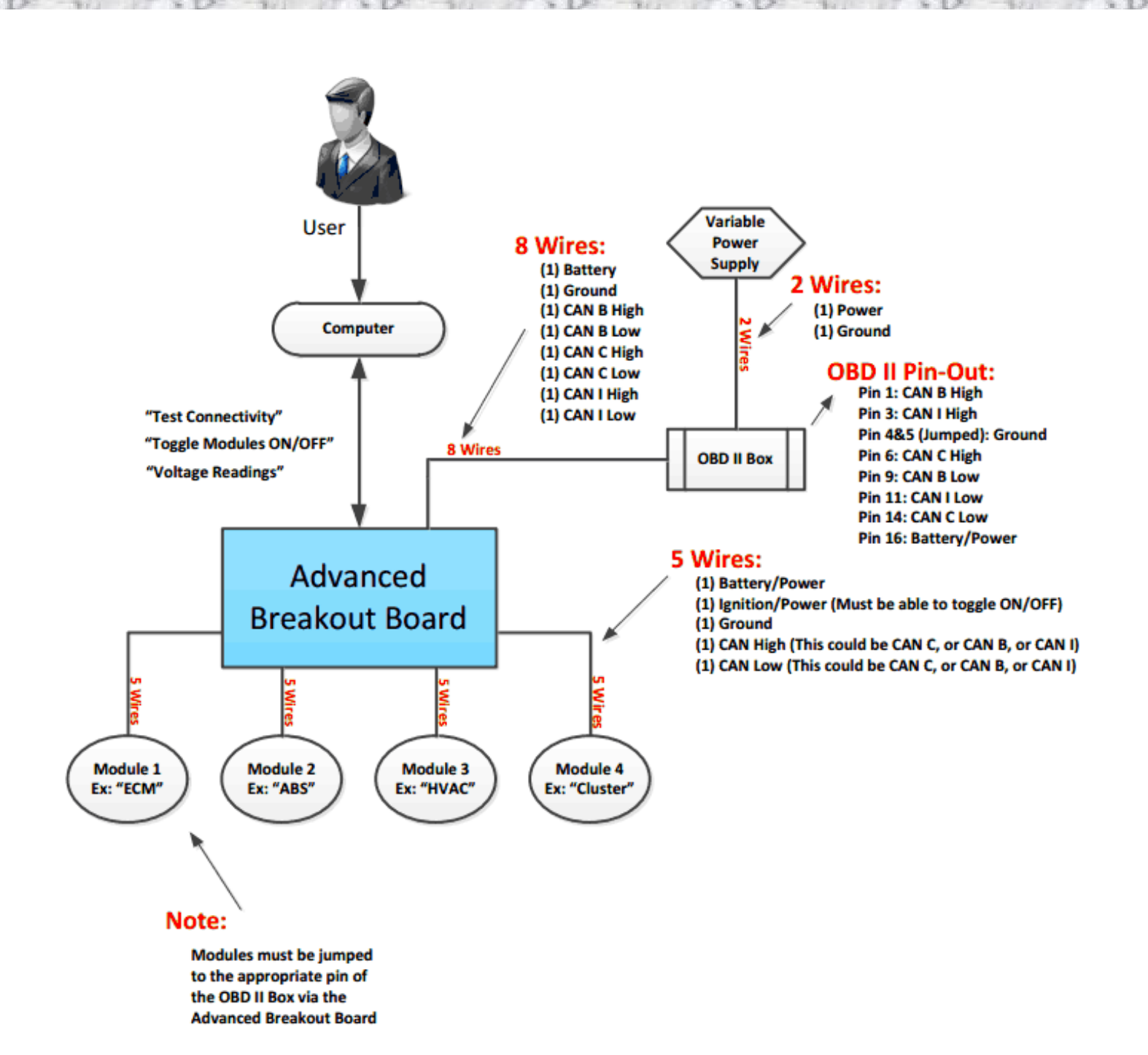
Our final board contains six low power circuits and all the circuits for current readings on each of the modules. The GUI, displayed in the bottom left, allows the user to see these readings and make changes to the connected CAN buses.



Budget Analysis

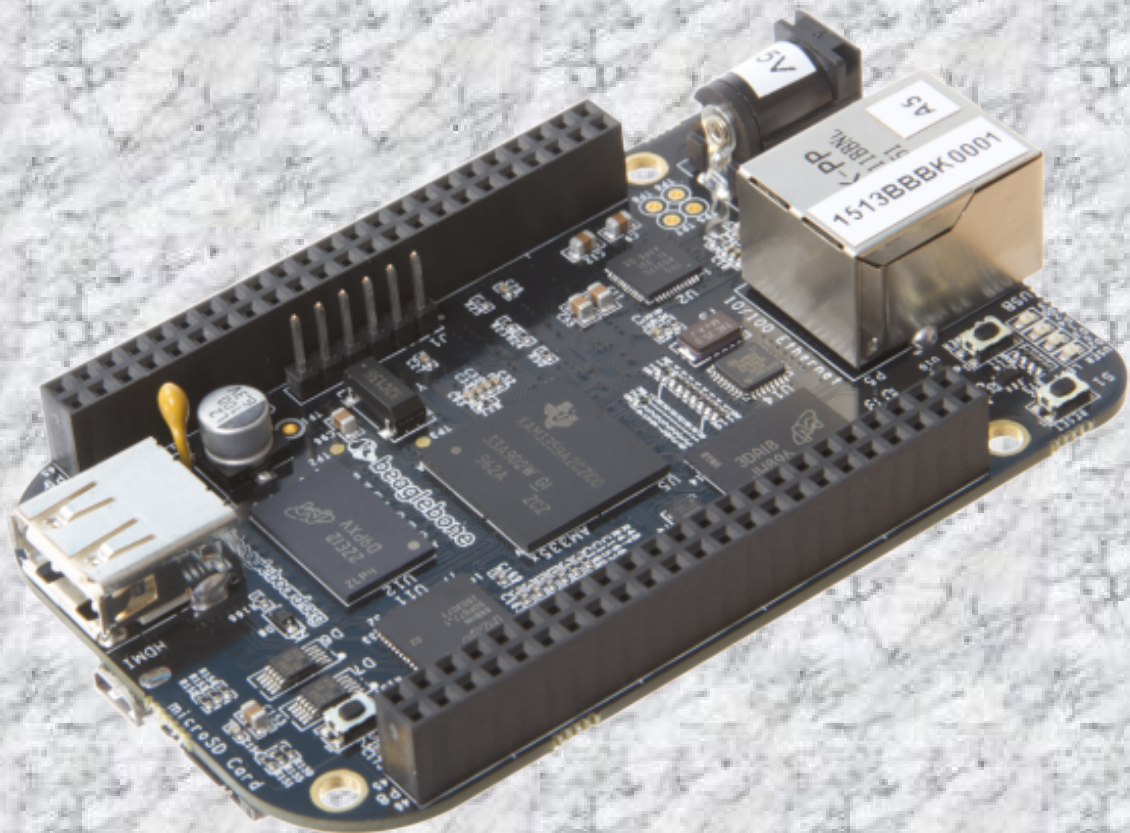
Item	Quantity	Total (\$)
12-Bit A/D Converter	3	10.44
Connectivity DIP Socket	15	2.85
Quad Voltage Level Shifter	7	1.37
Analog Mux/DMux	10	4.70
Male/Male, Female/Male, Female/Female Jumper Cable	1	7.79
25 Pin D-SUB Connector, RCPT	2	2.16
25 Pin D-SUB Connector, PLUG	2	5.52
5 Pin Terminal Block, 28-12AWG	4	3.06
2 Pin Terminal Block, 26-18AWG	2	0.50
8 Pin Terminal Block, 24-12AWG	2	3.44
0.01 Ohm Resistor	25	2.10
1 Row 10-Pin Header	4	0.54
1 Row 2-Pin Header	10	0.23
TIP36A Transistor	4	8.56
Control PCB	1	33.00
High Power PCB	1	66.00
Low Power PCB	1	66.00
BeagleBone Black	1	45.00
Total		263.26

End-Product Description



Basic structure of final system with our device

Along with sufficient power, the design will also be providing each module with stable communication buses that will not interfere with each other or pick up any outside noise from surrounding circuitry. All of these controls, along with the readings taken from the circuit, need to be displayed on a graphical user interface that allows the engineer working with the modules to view any of these readings.



Objectives	Description
Life cycle	Our device will be used long term to test new ECUs by Chrysler for pre-prototype vehicles. We need to ensure the quality and upgradability of our product in the future.
Accuracy	The information being read can be very sensitive and can fluctuate often. Therefore, data being read needs to be within $\pm 1\%$ accuracy.
Easy testing	Our device needs to allow testing and data readings to be displayed in an easy-to-use GUI instead of testing by hand with multi-meters and messy wires.
Safety	We need to make sure the device is safe while it is being used since four of the ten terminals will need to handle up to 15A of current draw.

