

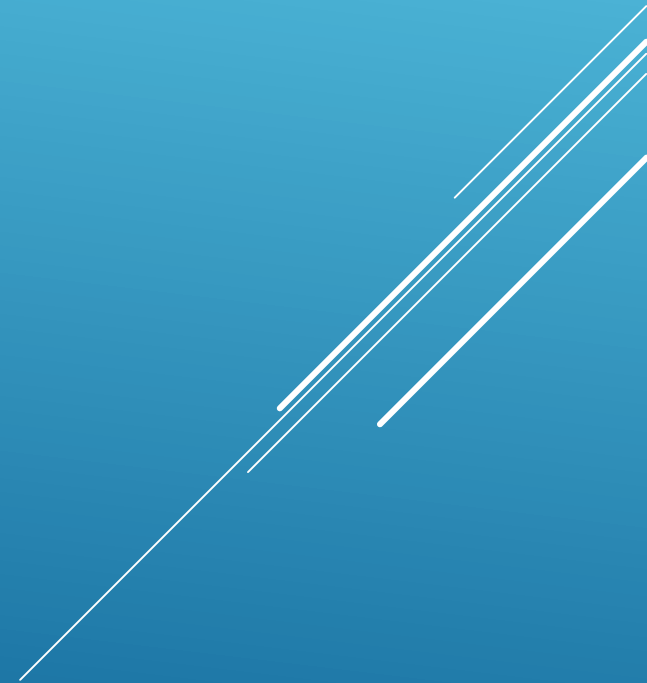
Dynamic Automated Tuning Air Suspension System

Elton Wu (Leader)

Jonathan Rodriguez

Evan Hsiao

George Pina



Product Description

- ▶ The DATA Suspension System is an air suspension system designed to automatically facilitate smooth riding and prevent damage to the vehicle body.
- ▶ This is done by DATA Suspension System that controls and adjusts the vehicles' solenoids.
- ▶ The automated feature is implemented with the sonar's detection and height sensors.

Product Development Team

- ▶ Elton Wu:

- ▶ Height Sensors, Solenoids, Analogue development

- ▶ Jonathan Rodriguez:

- ▶ Sonar, GPS, Schematic development

- ▶ Evan Hsiao:

- ▶ LCD Connector/Display, Software development

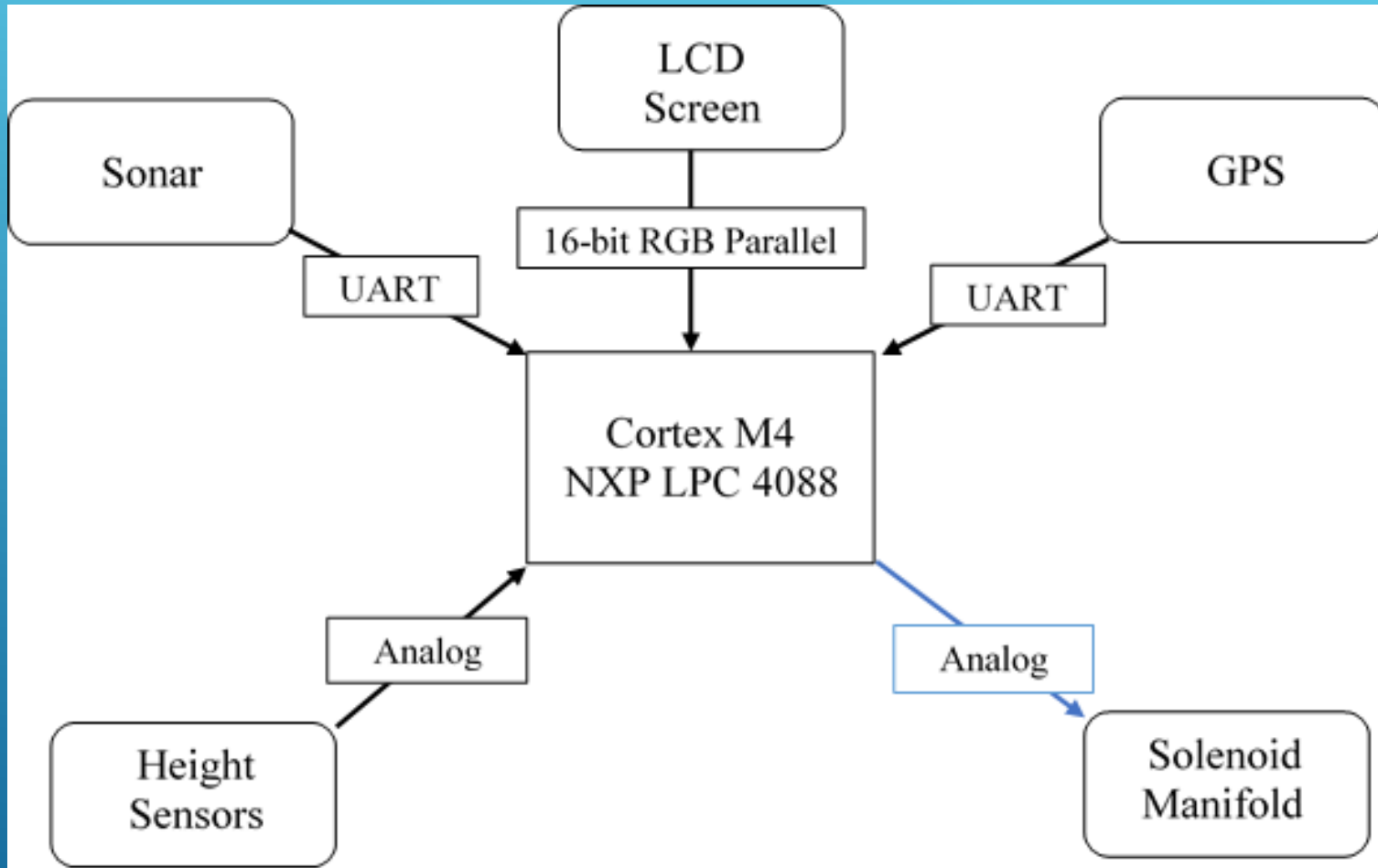
- ▶ George Pina:

- ▶ Software development

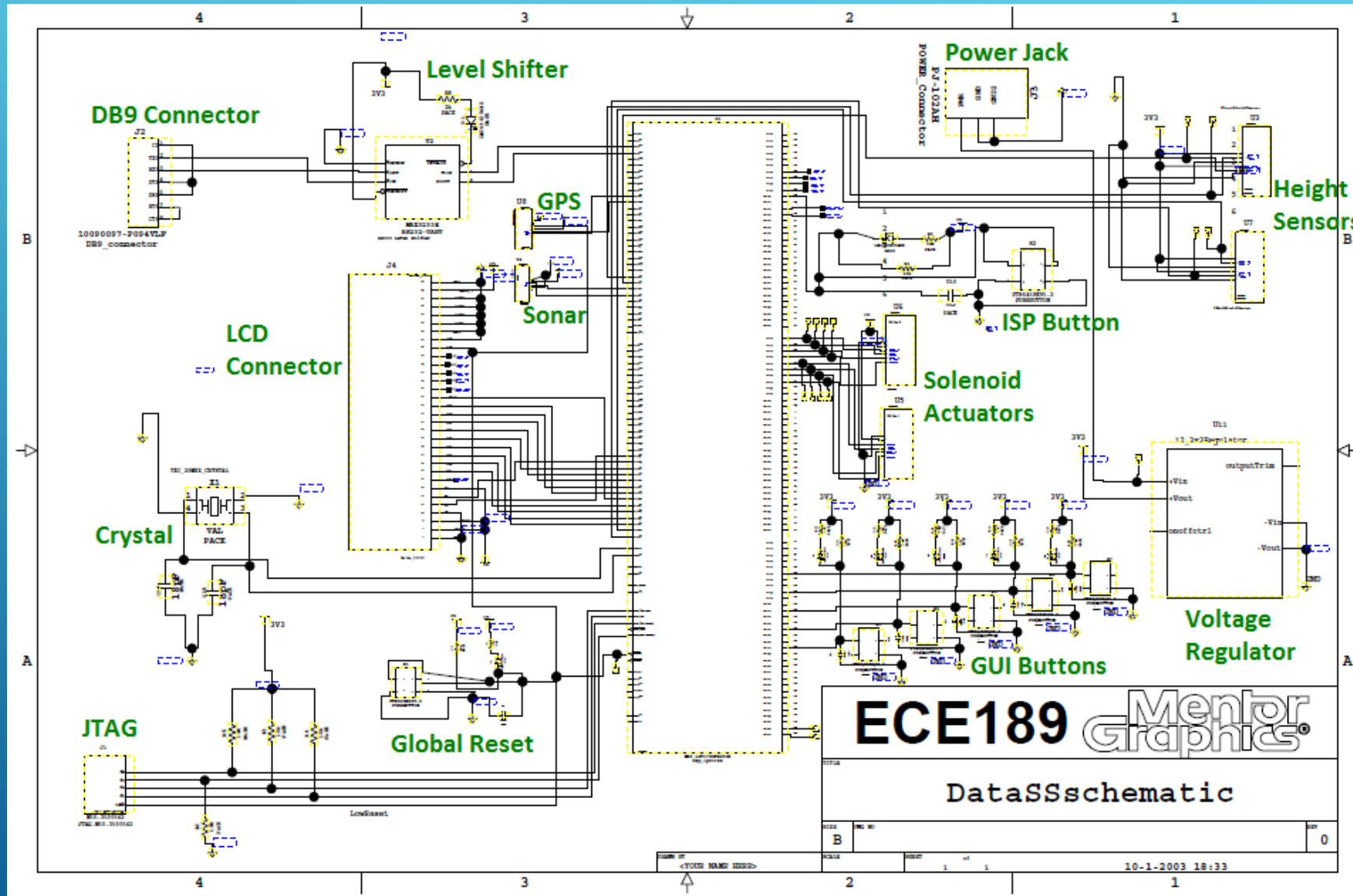
Applications

- ▶ This air suspension system is geared toward passenger vehicles but can be expanded to all vehicles.
- ▶ Here are some apparent advantages of the system:
 - ▶ Road Obstacles (prevent vehicle damage)
 - ▶ Steep driveways, speed bumps, parking curbs
 - ▶ Safety
 - ▶ Reduce rollover risk, change aerodynamic, improve traction

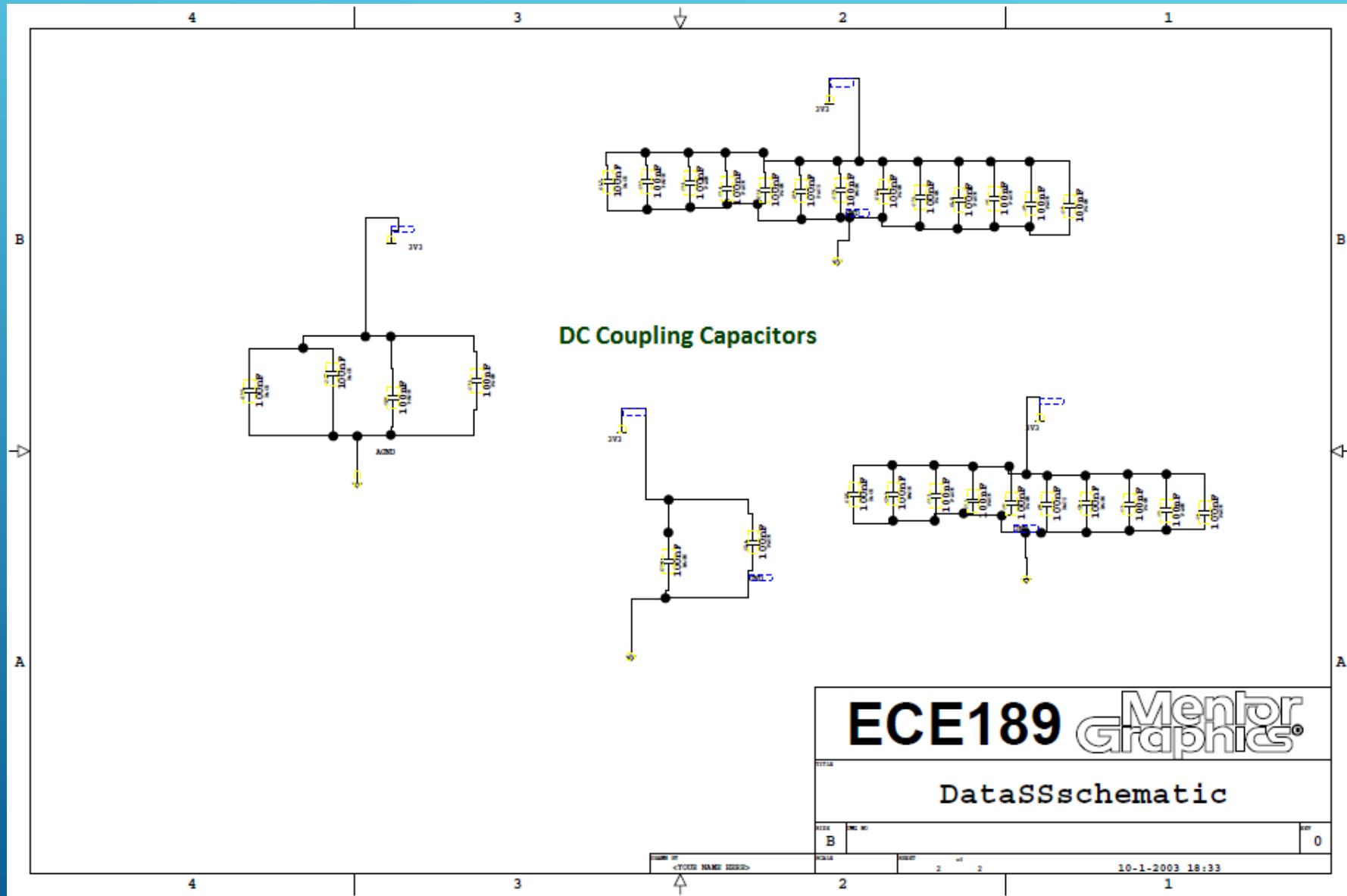
High Level Block Diagram



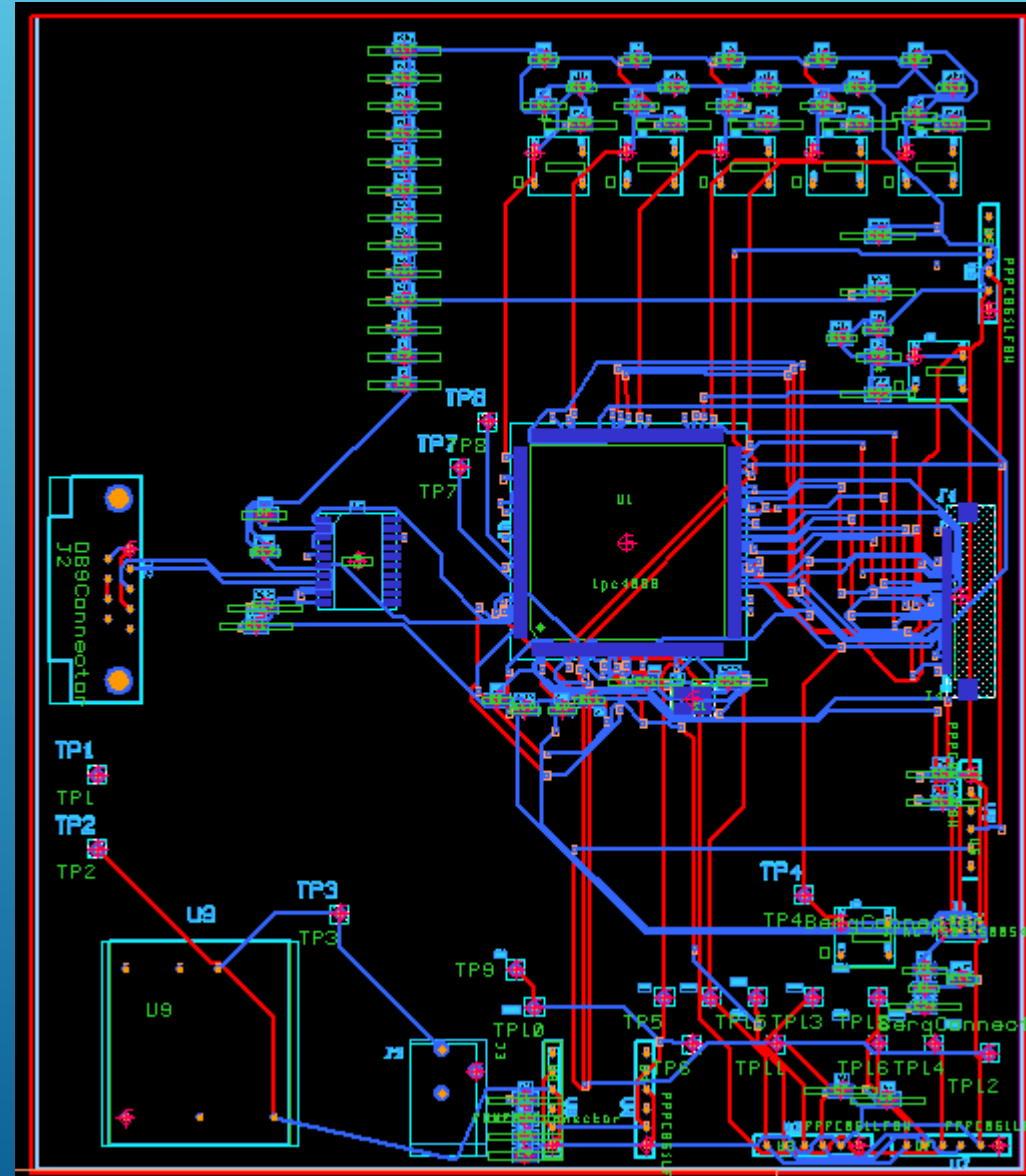
Schematic



Schematic (cont.)



PCB Layout



Bill of Materials

Part	Official Name	Vendor	Part Vendor Number	Price	Quantity
Sonar	MB1010 LV-MaxSonar-EZ1	MaxBotix	MB1010	\$29.950	1
Height Sensors	Delphi Ride Height Sensors	Summit Racing Equipment	DFP-ER10031	\$29.970	4
LCD Screen	Newhaven Display Intl NHD-2.4-240320CF-CTXI#-F	Digi-Key	NHD-2.4-240320CF- CTXI#-F-ND	\$13.850	1
LCD Connector	Molex, LLC 0541324062	Digi-Key	WM3436CT-ND	\$2.050	4
3.3V DC-DC Converter	Isolated Wide Input Range 15-Watt DC/DC Converters	Mouser	580-UEI15-033-Q12P-C	\$30.500	4
GPS Module	Adafruit Ultimate GPS Breakout - 66 channel w/10 Hz updates - Version 3	Adafruit	MTK3336-746	\$39.950	1
6-pin Female Header	Sullins Connector Solutions PPPC061LFBN-RC	Digi-Key	S7039-ND	\$0.546	30
10k 0805 Resistor	Thick Film Resistors - SMD 1/8Watt 10Kohms	Mouser	71-CRCW0805-10K-E3 CRCW080510K0FKEA	\$0.028	100
2k 0805 Resistor	Thick Film Resistors - SMD 1/8Watt 2Kohms	Mouser	71-CRCW0805-2.0K-E3 CRCW08052K00FKEA	\$0.049	30
LED 0805	Standard LEDs - SMG Orange	Mouser	755-SML-210DTT86 SML- 210DTT86	\$0.130	100
Push Button	C&K Components PTS645SK95-2 LFS	Digi-Key	CKN10051-ND	\$0.186	30
Berg Connector	FCI 68000-401HLF	Digi-Key	09-3466-ND	\$0.0557	100
Solenoid	DC 12V 1/4 Inch Electric Solenoid Valve	Amazon	14002532	\$9.070	8
Relay	Sainsmart 4-Channel 5V Relay Module for PIC ARM AVR DSP Arduino MSP430 TTL Logic	SainSmart	20-018-101-US-KS	\$3.990	2
				Total Cost =	\$459.17

Processor

Cortex M4 NXP LPC4088

- ▶ Clock Speed: 120MHz
- ▶ Supply Voltage: 2.4-3.6V
- ▶ Memory: 512KB Flash, 96KB RAM, 4KB EEPROM
- ▶ Serial Interfaces: UART, I²C, USB, Ethernet, SPI, SSP, I²S, CAN
- ▶ Analog Interfaces: 12-bit ADC, 10-bit DAC, Dual Comparators
- ▶ 109 General Purpose Input/output Pins



Solenoid Manifold

- ▶ Digital High-Low Interface
- ▶ Controlled by relay from processor
- ▶ Set of 8 solenoids connected together with pipes
- ▶ Placed 2 solenoids for each corner of the vehicle



Height Sensors

- ▶ Delphi ER10031 Height Sensor
- ▶ 3-pin analog interface
- ▶ Essentially a potentiometer with an arm



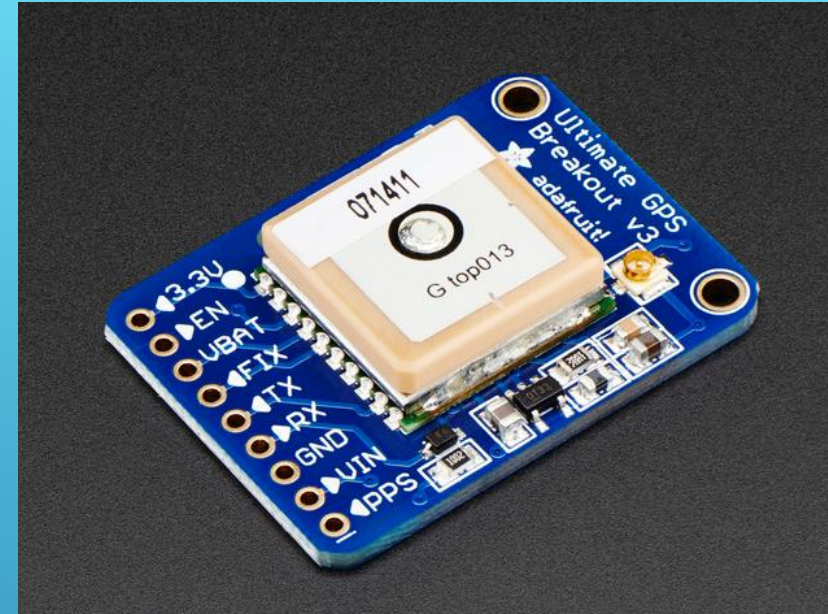
Sonar

- ▶ UART Interface – Serial
 - ▶ 0 to Vcc, 9600 Baud, 81N
- ▶ Power Requirement: 3.3V
- ▶ Readings every 50ms (20Hz)
- ▶ 0 to 254 inch detection
 - ▶ 1 inch resolution
- ▶ Manufacturer: Maxbotix



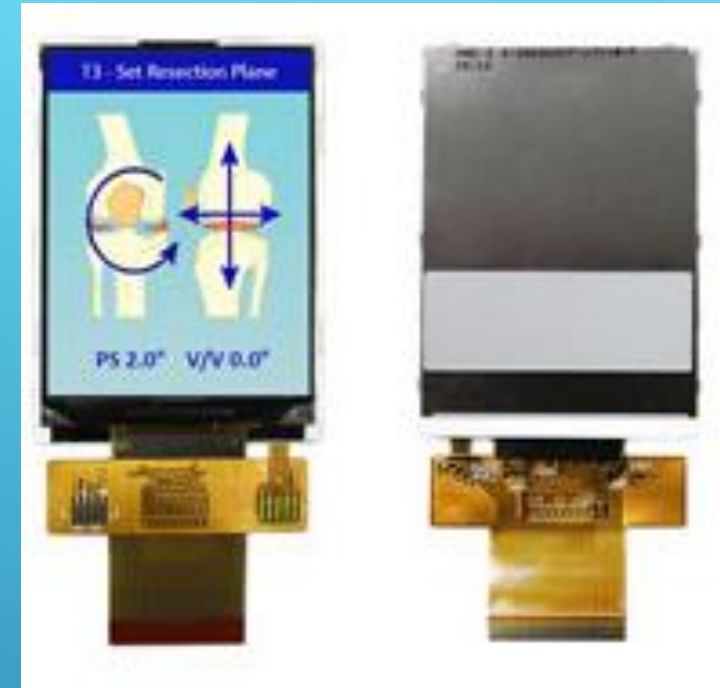
GPS Module

- ▶ UART – Serial
- ▶ Positional Accuracy: < 3 meter
- ▶ Velocity Accuracy: 0.1 m/s
- ▶ Output: NMEA message, 9600baud
 - ▶ Contains position and time information
- ▶ Cold start: 34 sec
- ▶ Manufacturer: Adafruit



LCD Screen

- ▶ Interface: 16-bit RGB Parallel
- ▶ Main connection is through a FFC LCD Connector
- ▶ Screen size is 2.4" Diagonal
- ▶ 240 x 320 Pixels in Portrait Mode
- ▶ White LED Backlit
- ▶ Manufacturer: New Haven Display
- ▶ Power requirements: 3.1V, 2.8V, 1.8V




LCD Connector

- ▶ Interface to Processor: 16-bit RGB Parallel
- ▶ 40-pin
- ▶ 0.5 mm pitch
- ▶ FFC type connector
- ▶ Lead free
- ▶ Manufacturer: Molex Electronic Solutions



Technology/ IP Reuse

- ▶ LPC 4088 Processor
 - ▶ Solenoids
 - ▶ LCD
Display/Connector
- 
- A decorative graphic consisting of several parallel white lines of varying lengths, slanted upwards from left to right, located in the bottom right corner of the slide.

Critical Elements

Height Sensors

- ▶ Must work for the system to be automated

Solenoids

- ▶ Must work to regulate air bags for suspension system

Sonar Module

- ▶ Must work for the system to be automated

Closure

Questions?

Comments?

Thank You!

Three white diagonal lines of varying lengths and thicknesses are positioned in the bottom right corner of the slide, extending from the right edge towards the center.