Dynamic Automated Tuning Air Suspension System

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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 Rodriquez:
  - 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
PCB Layout
## Bill of Materials

<table>
<thead>
<tr>
<th>Part</th>
<th>Official Name</th>
<th>Vendor</th>
<th>Part Vendor Number</th>
<th>Price</th>
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<tr>
<td>Sonar</td>
<td>MB1010 LV-MaxSonar-EZ1</td>
<td>MaxBotix</td>
<td>MB1010</td>
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<td>Height Sensors</td>
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<td>Summit Racing Equipment</td>
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<td>Adafruit Ultimate GPS Breakout - 66 channel w/10 Hz updates - Version 3</td>
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**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, 9600 baud
  - 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
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!