The Car Monitor System

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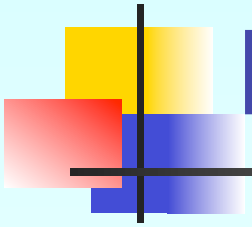


Motivation

- Connect the Driver to the Car
  - Error codes recognized
- Efficiency Reports
  - Remote vehicle diagnostics
- Driving Habits
  - A teenager’s first car
- Expandability

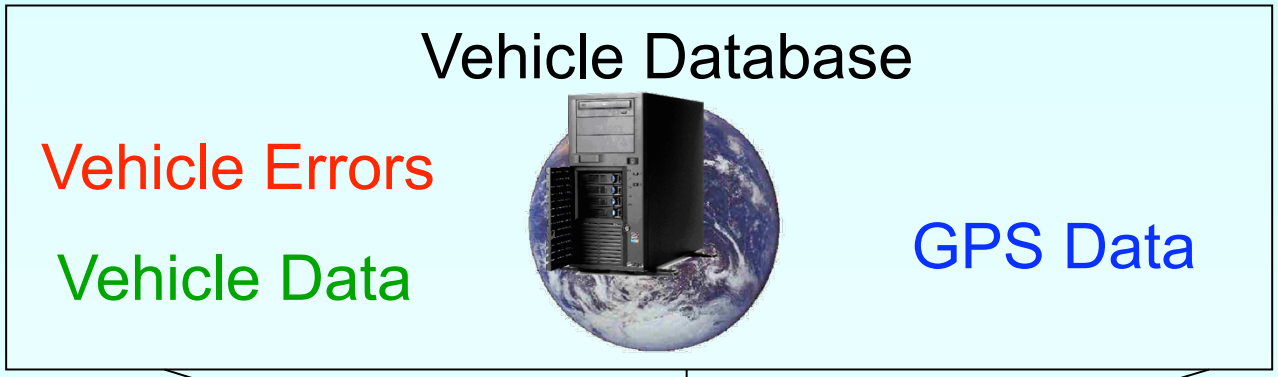
Originality

- Transparent to user
- Long-term recorded history
- Vehicle compatibility
- Low cost

- Comparison to Qualcomm OmniTRACS

Overview: Car Monitor System

- Sensor network
- OBD-II interface
- GPS receiver
- Automatic wireless communication
- Online user interface



Driver

(Hopefully not you!)

Graphs & KML Information

Your Mechanic

eBox II Platform

- Vortex86 200MHz Computer
- Serial and 3 USB ports
- 20 GB 2.5” IDE Hard Drive
- 15 Watt Max Power Consumption
- Demi-Sized Linux Operating System

OBD-II Connection

- FreeDiag
  - Logging scripts
  - Active scanning and monitoring
  - 5 second sampling

- Multiplex Engineering T16-013 device

```
FREEDIAG log format 0.2
# 0000.026 logging started at Sun Feb 25
> 0000.026  scan
> 0019.253  monitor english
D 0022.539 MODE 1 DATA
41 00 be 3e b8 10
41 01 03 07 e1 00
41 03 02 00
41 04 54
41 05 66
41 06 83
41 07 7c
41 0b 21
41 0c 1e 3d
41 0d 2c
41 0e d1
41 0f 32
```

1. Request Available Parameter Types

Get Parameters = "01 00" (Hex) →

← "be 3e b8 10" (Hex)

"1011 1110 0011 1110 1011 1000 0001 0000" (Bin)

Parameters (12th bit is RPMs): 1 = Available or 0 = Not Available

2. Query for a Parameter

Get RPMs = "01 0c" (Hex) →

← "19 5c" (Hex)

3. Decode Received Values

"19 5c" (Hex)

25 & 92 (Dec)

$$\frac{(25 * 256) + 92}{4} = \textbf{1623} \text{ RPM}$$

GPS Device

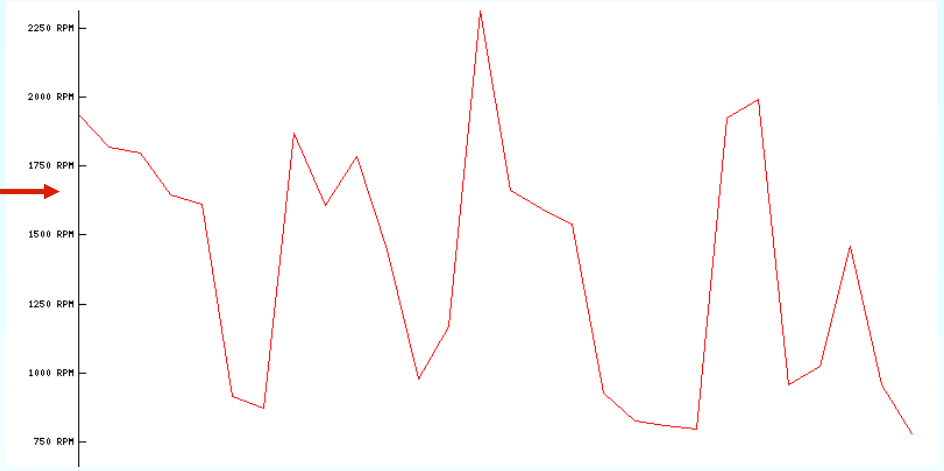
- Garmin GPS 18
  - USB version

- GPSBabel
  - Command line mode
  - Google Earth interface
- 2 second sampling

Online User Interface

```
D 0022.539 MODE 1 DATA
41 00 be 3e b8 10
41 01 03 07 e1 00
41 03 02 00
41 04 54
41 05 66
41 06 83
41 07 7c
41 0b 21
41 0c 1e 3d
41 0d 2c
41 0e d1
41 0f 32
41 11 26
41 13 03
41 14 84 7c
41 15 32 82
41 1c 01
D 0022.539 MODE 2 DATA
42 00 00 7e 3a 80 00
42 02 00 03 03
D 0027.619 MODE 1 DATA
41 00 be 3e b8 10
41 01 03 07 e1 00
```

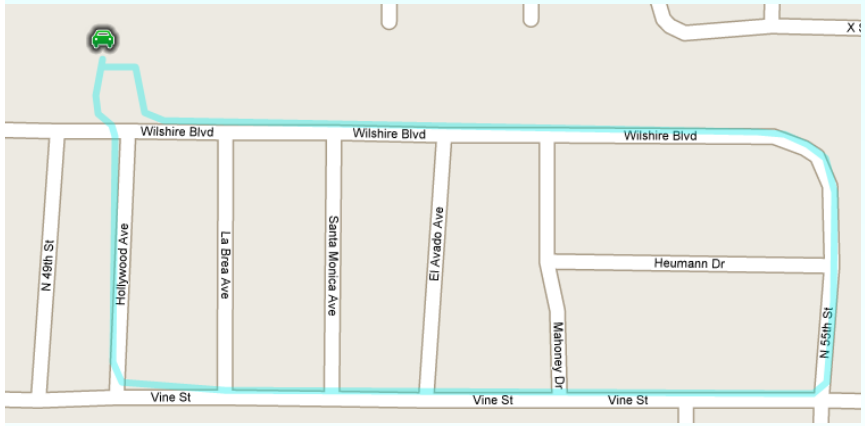
2007-03-04 22:35:52	1014.25	RPM
2007-03-04 22:35:57	1043.75	RPM
2007-03-04 22:36:02	1018.25	RPM
2007-03-04 22:36:08	1021.25	RPM
2007-03-04 22:36:13	1550.75	RPM
2007-03-04 22:36:18	1183.25	RPM
2007-03-04 22:36:23	1205.25	RPM
2007-03-04 22:36:28	2016.5	RPM
2007-03-04 22:36:33	1136.5	RPM
2007-03-04 22:36:38	1410.5	RPM
2007-03-04 22:36:43	2040.75	RPM
2007-03-04 22:36:48	2378.5	RPM
2007-03-04 22:36:53	2162.5	RPM
2007-03-04 22:36:58	1027.25	RPM
2007-03-04 22:37:03	691.5	RPM
2007-03-04 22:37:08	2064.25	RPM
2007-03-04 22:37:14	2597.75	RPM

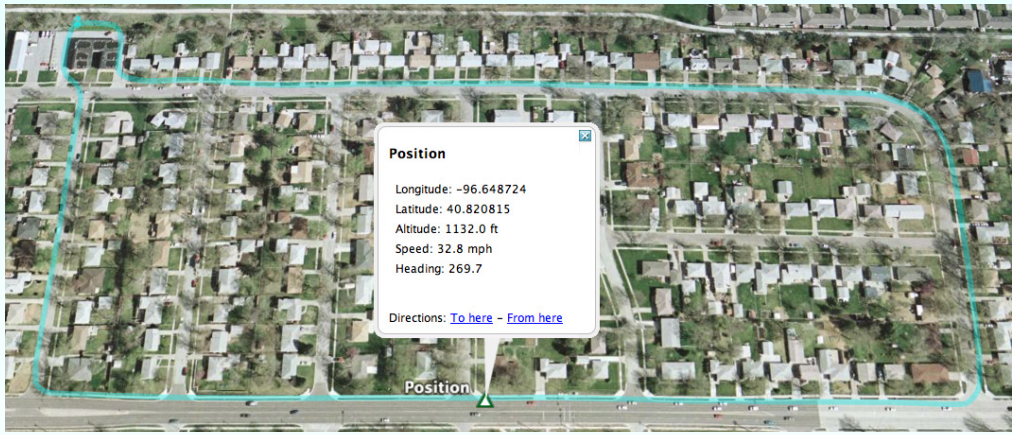


- Convert FreeDiag log files into graphs using PHP

Online User Interface

- KML files viewable by Google Maps or Google Earth





Google Maps

Google Earth

Performance Specifications

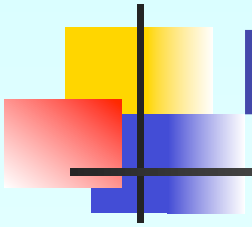
- eBox startup time: 60 seconds
- GPS satellite acquisition time:

State	Time (sec)
Cold	45
Warm	15
Hot	2

- GPS accuracy: <3 meters (WAAS)
- Maximum number of trips ~20,000 with HD
  without synchronization: ~1000 with flash

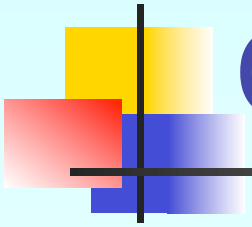
Implementation Costs

Component	Development Cost	Production Cost
Microsoft eBox II Platform	Provided by department	$120
Multiplex Engineering T16-013 OBD-II Interface	$87	$80
Garmin GPS 18 USB OEM	$67	$60
Ashton Digital Air Dash WRUB-2011i Wireless USB	On loan	$20
2.5” 20 GB hard drive	On loan	$20 (flash drive)
Total	**$154**	**$300**



Project Extensions

- Improve web interface
  - Mapping and graphing
- Optimization
  - DSL and eBox
- Combine GPS and OBD
  - Dynamic kml document generation
- Remote configuration management
- Integrated embedded device
- Real-time applications

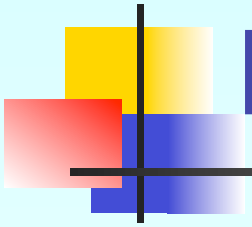


Car Monitor System Demo

- *The Car Monitor System* (CMS) Wiki Site
  - http://cse.unl.edu/~tandrew/wiki
- Upload Recorded Scripts
  - http://cse.unl.edu/~tandrew/obd/index.php
- Trip Manager
  - http://cse.unl.edu/~tandrew/obd/trips.php
- Demonstration Drive
  - Drive around the block

Conclusion

- Purpose of the Car Monitor System
- Completed Standalone Model
  - No further components necessary
  - All primary specifications met
- Questions



References

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  - Demi-Sized Linux
- http://en.wikipedia.org/wiki/OBD-II_PIDs
  - OBD-II PID specifications