OBDII Automotive Data Logger Design

Author: Kristian Smith, Computer Systems Engineering

Advisor: Randy Moulic, PhD.

UAA College of Engineering
University of Alaska Anchorage

System Components

Arduino Uno Microprocessor

Sparkfun OBDII UART

ITead Studio SIM900 GSM

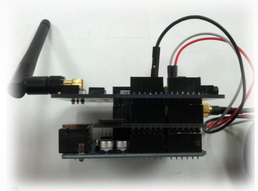
ITead Studio GPS

Design Goals

Design a data-logging device with the following features:

- ⇒ **Translates most OBDII protocols**
- ⇒ **Communicates with CAN-bus protocols**
- ⇒ **Collects GPS coordinates**
- ⇒ **Accesses different vehicle PID's for desired application**
- ⇒ **Communicates over 3g/4g and SMS**
- ⇒ **Must not be cost prohibitive for the everyday consumer**
- ⇒ **Standalone operation**
- ⇒ **Saves data to SD card**
- ⇒ **Needs no external power source**
- ⇒ **Simple programming interface**

Assembled Device



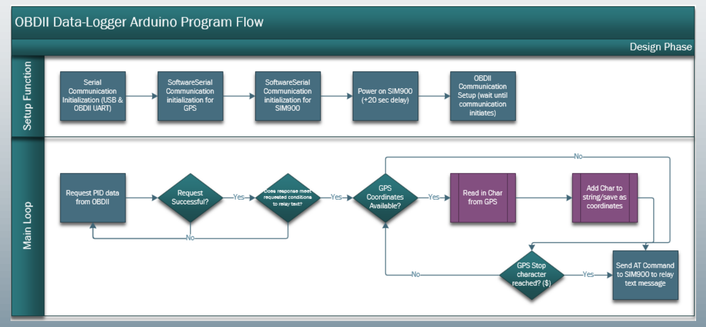
Hardware Setup Procedure

- ⇒ **Stack the SIM900 GSM Cellular shield onto the Arduino.**
- ⇒ **Place the Tx and Rx jumpers on pins 2 and 3 of the SIM900, respectively.**
- ⇒ **Stack the GPS board onto the SIM900 and place the GPS Tx and Rx jumpers onto pins 4 and 5, respectively.**
- ⇒ **Plug the Arduino into the computer hosting the Arduino IDE (via USB) and upload your custom program.**
- ⇒ **Plug in the Tx and Rx pins from the OBDII UART board with wires connecting to pins 0 and 1 on the top board (GPS) in order to communicate with the Arduino.**
- ⇒ **Press the SIM900 power button and ensure that the network light begins to blink every 3 seconds versus every 800ms.**
- ⇒ **Ensure the GPS and cell antennas are placed for best reception.**
- ⇒ **Plug in the RS232 cable to the OBDII UART board and the opposite end into the vehicle's diagnostic port.**

Cost Comparison

Device	Stand-Alone	GSM-Enabled	Programmable	GPS	Data Logger	CAN	Approx. Cost (USD)
Bluetooth OBD Scanners		√	√	√	√		$150-$500
PC Scan Tools	√					√	$30-$400
Hem Data Mini Logger	√			√	√		$800-$1500
Car Chip Pro	√			√	√		$305
Data Scout					√	√	$500
DashDyno SPD ProPack	√				√	√	$320
IOSX OBD-II Datalogger	√	Opt.		Opt.	√		$700
Arduino/GSM/ GPS/OBDII Device	√	√	√	√	√	√	**$160**

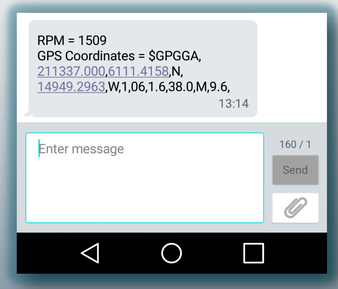
Program Flow



Functionality

- ⇒ **The program constantly polls a specific PID from the OBDII port (currently RPM)**
- ⇒ **When the condition is set, the program collects GPS coordinates, if available.**
- ⇒ **The coordinates are passed into a function along with the PID data to the SIM900 shield.**
- ⇒ **The SIM900 cellular shield then relays a text message to a specified number.**

In the current program settings (seen in the figure to the right), when the vehicle goes over 1500 RPM, GPS coordinates and exact RPM are sent through SMS.



OBDII Data Acquisition Speeds

Model Year	Make/Model	Data Points/ Second
N/A	ECUSim 5100	38.0
1996	Ford Bronco	5.5
1998	Oldsmobile Bravada	19.6
1999	Dodge Ram 1500	22.0
2000	Ford F350	20.9
2001	Chevrolet Tahoe	26.4
2001	Mazda B3000	25.7
2003	Saturn L200	26.8
2004	Chevrolet Avalanche	26.2
2004	Chevrolet 2500 HD	24.5
2004	Chevrolet Astro	22.8
2005	Jaguar X-Type	4.2
2005	Honda Accord	4.5

Future Research

Cold Weather Oxygen Sensor Analysis

- ⇒ **Closed loop vs. open loop oxygen sensor analysis**
- ⇒ **Determine the effect of colder climates on sensor warm-up time**

Adaptive Maintenance Strategies

- ⇒ **Conditions in which a common failure occurs can be collected by the data-logger and used for diagnosis**

Vehicle Monitoring

- ⇒ **Fleet Maintenance/Monitoring**
- ⇒ **Anti-theft device (on CAN-bus enabled vehicles, could remotely lock doors and shut down vehicle)**

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