The Car Jackers

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Introduction

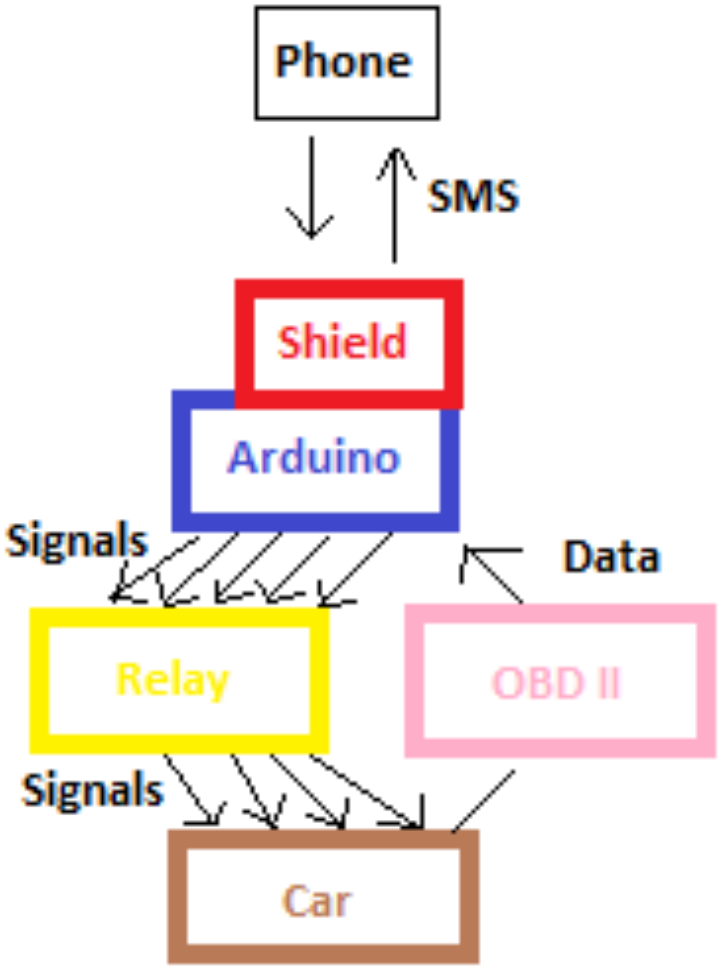
Remote controlled car functions:

- **Heating and Cooling**

- Start and Stop engine

- Door Lock and Unlock

General Layout



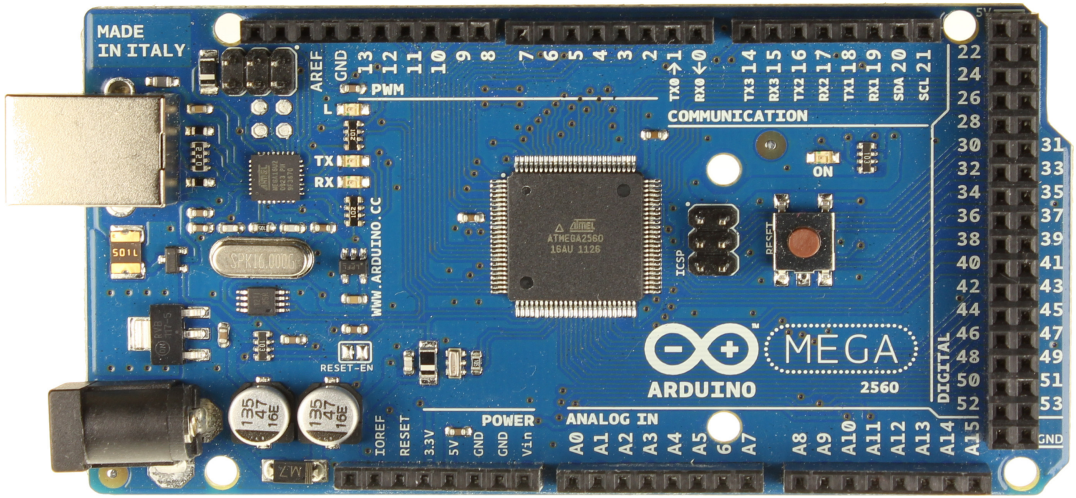
Arduino Mega 2560

Power: 5V (Recommended 7 - 12 V)
3.3V supply generated

Memory: 256KB Flash

I/O: 54 Digital (4 UARTs) at 5 V.

IDE: Arduino 1.0



Cellular Shield SM5100B

Power: 3.3V - 4.2V

I/O: UARTs up to 460kbps

Operates at 1900 MHz

- Quad-band Wired Cellular Antenna SMA

Antenna

- Frequency: 1900MHz

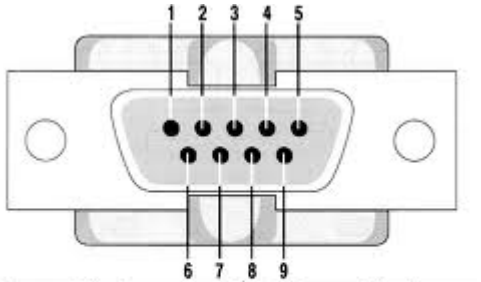
- Gain: 3.5 dBi

On Board Diagnostic System (OBD-II)

Project Functionality

- To check engine of car

Output: Serial port (RS-232)



Pin	Signal	Pin	Signal
1	Data Carrier Detect	6	Data Set Ready
2	Received Data	7	Request to Send
3	Transmitted Data	8	Clear to Send
4	Data Terminal Ready	9	Ring Indicator
5	Signal Ground		

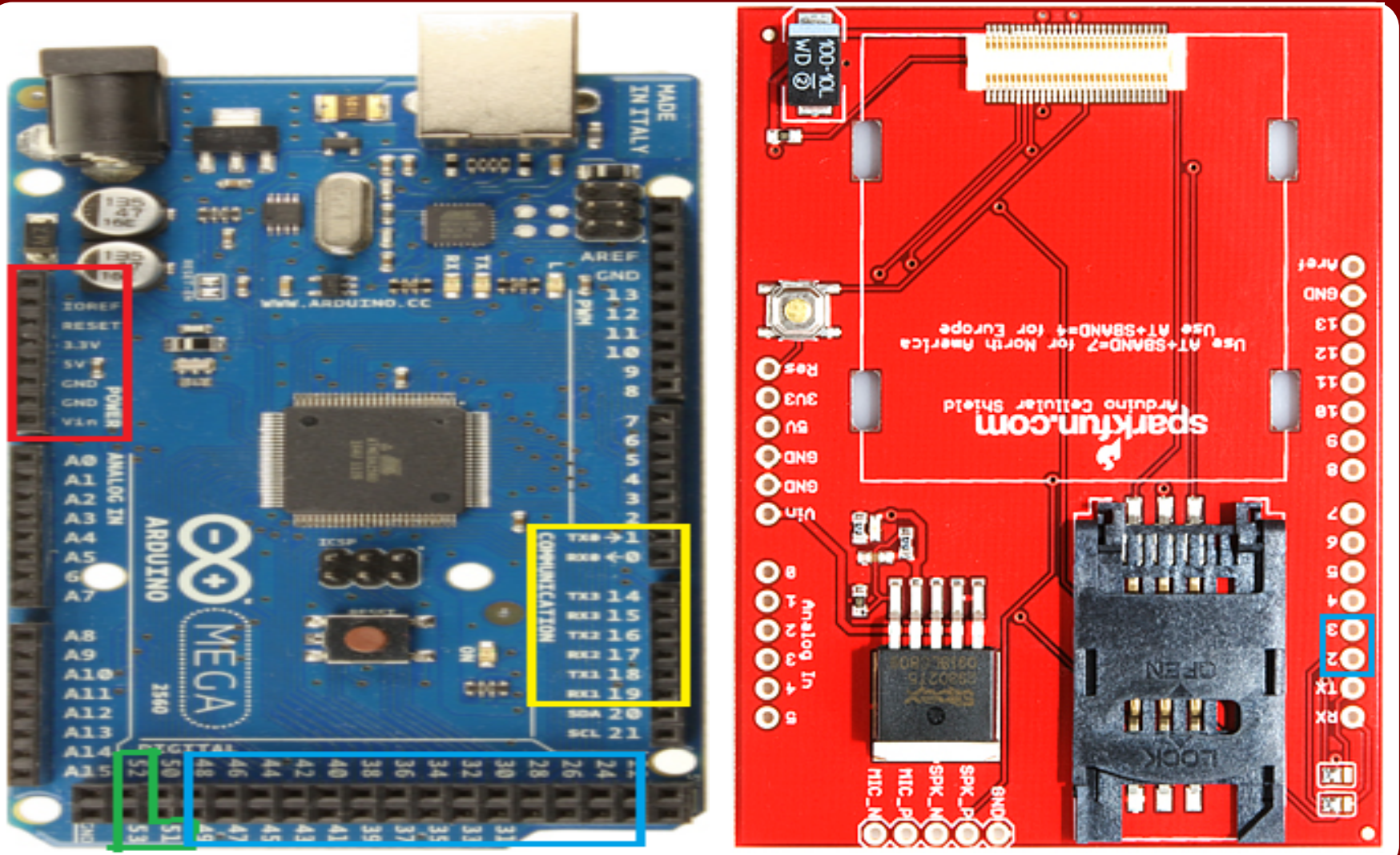
Connections

- Same power, ground, reset, etc.

- Use Serial ports

- Digital pins on the side (pins 51-53 SPI for digital potentiometer)

Connections (diagrams)



Software Design

Android App. - GUI sends the messages to the cellular shield.

Also receives the status

Arduino - Parses messages from Android phone then performs tasks.

Also sends the status from OBD-II to the phone

Software: Arduino

- Send (AT commands) to Serial 1
  - Set frequency to 9600 baud
  - Set text mode, send SMS with the number and message

- Receive values from Serial 1
  - Set output
  - Parse message

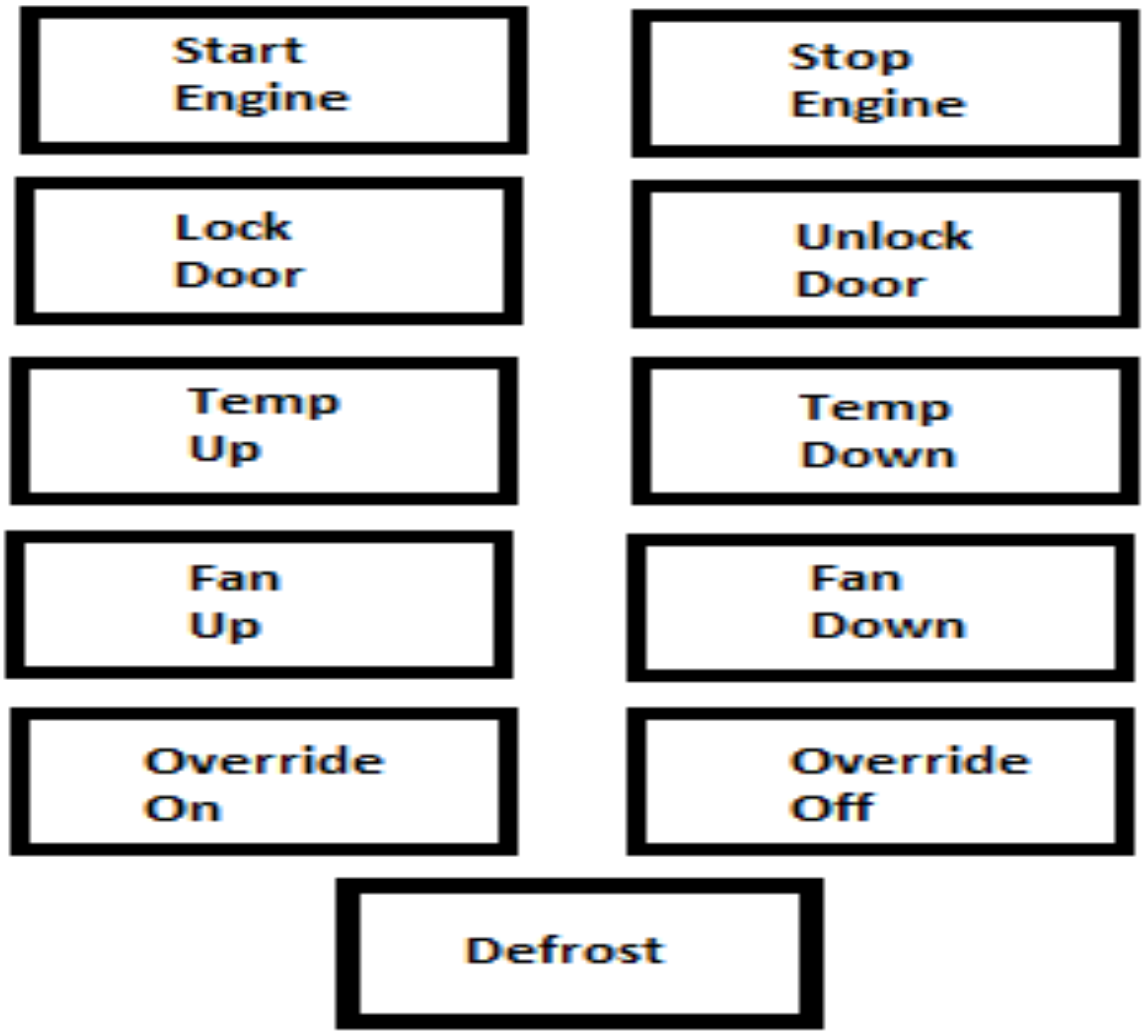
Android Application

- SMS send

- SMS receive then parse or display

- Onclick handlers for sending SMS with the buttons

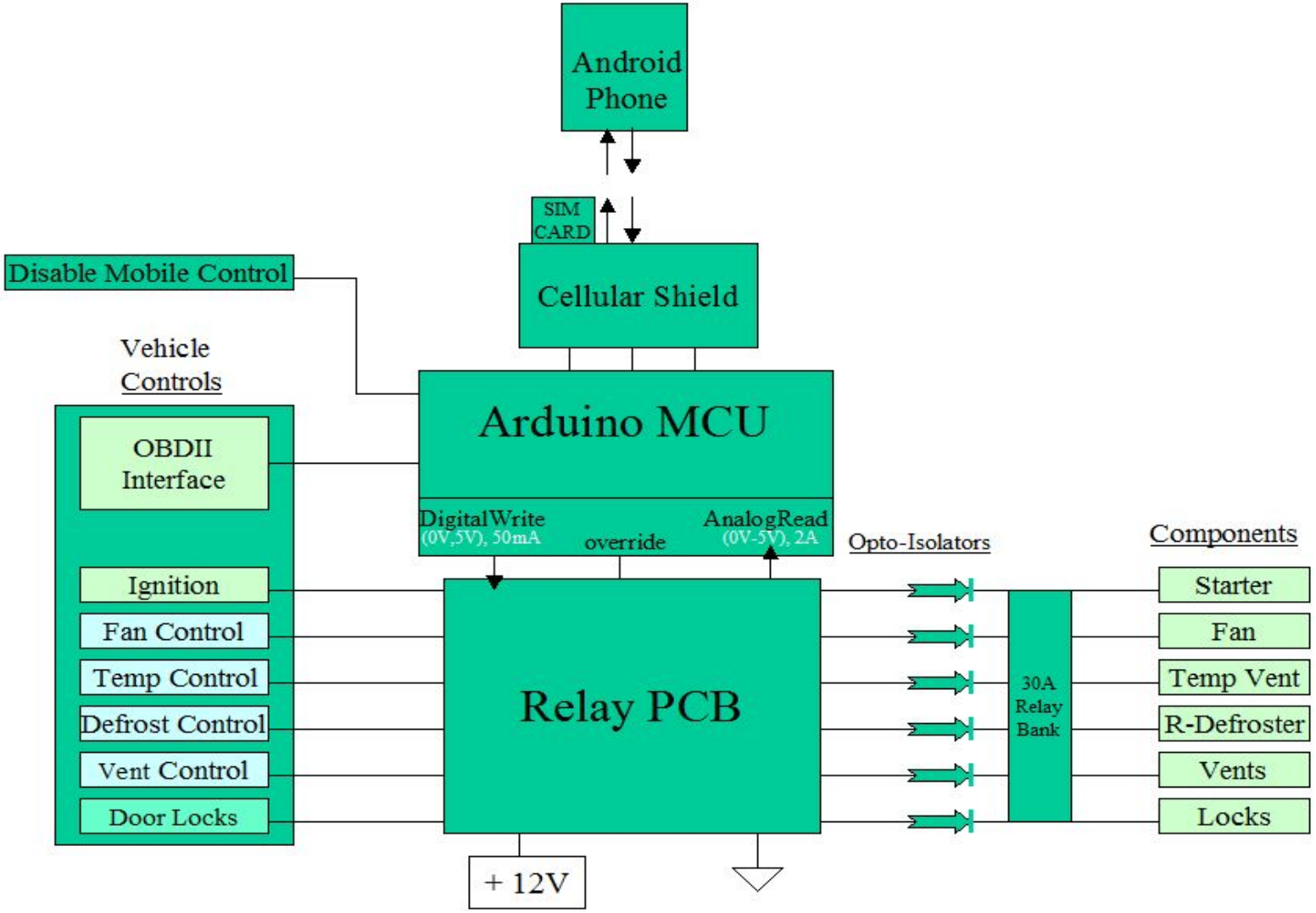
GUI Sample


Start Engine
Stop Engine
Lock Door
Unlock Door
Temp Up
Temp Down
Fan Up
Fan Down
Override On
Override Off
Defrost

Messages and Tasks

Button Name / Task	Message
Start Engine	a0
Stop Engine	a1
Lock Door	a2
Unlock Door	a3
Defrost	b0
Temp Up	a4
Temp Down	a5
Fan Up	a6
Fan Down	a7
Override On	a8
Override Off	a9

Hardware Design



Relay Driver

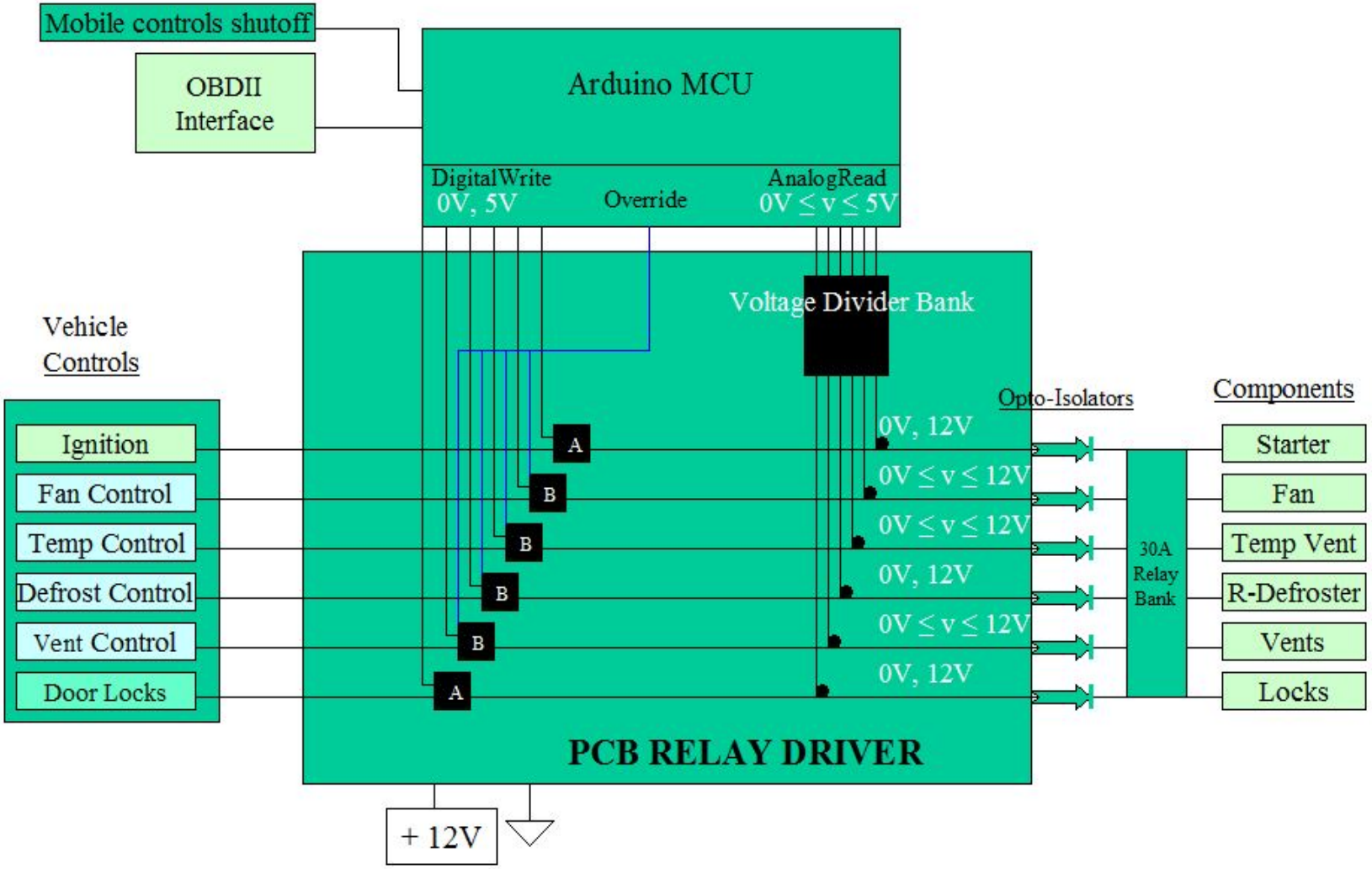
- PCB design

- Amplify Signals from Arduino

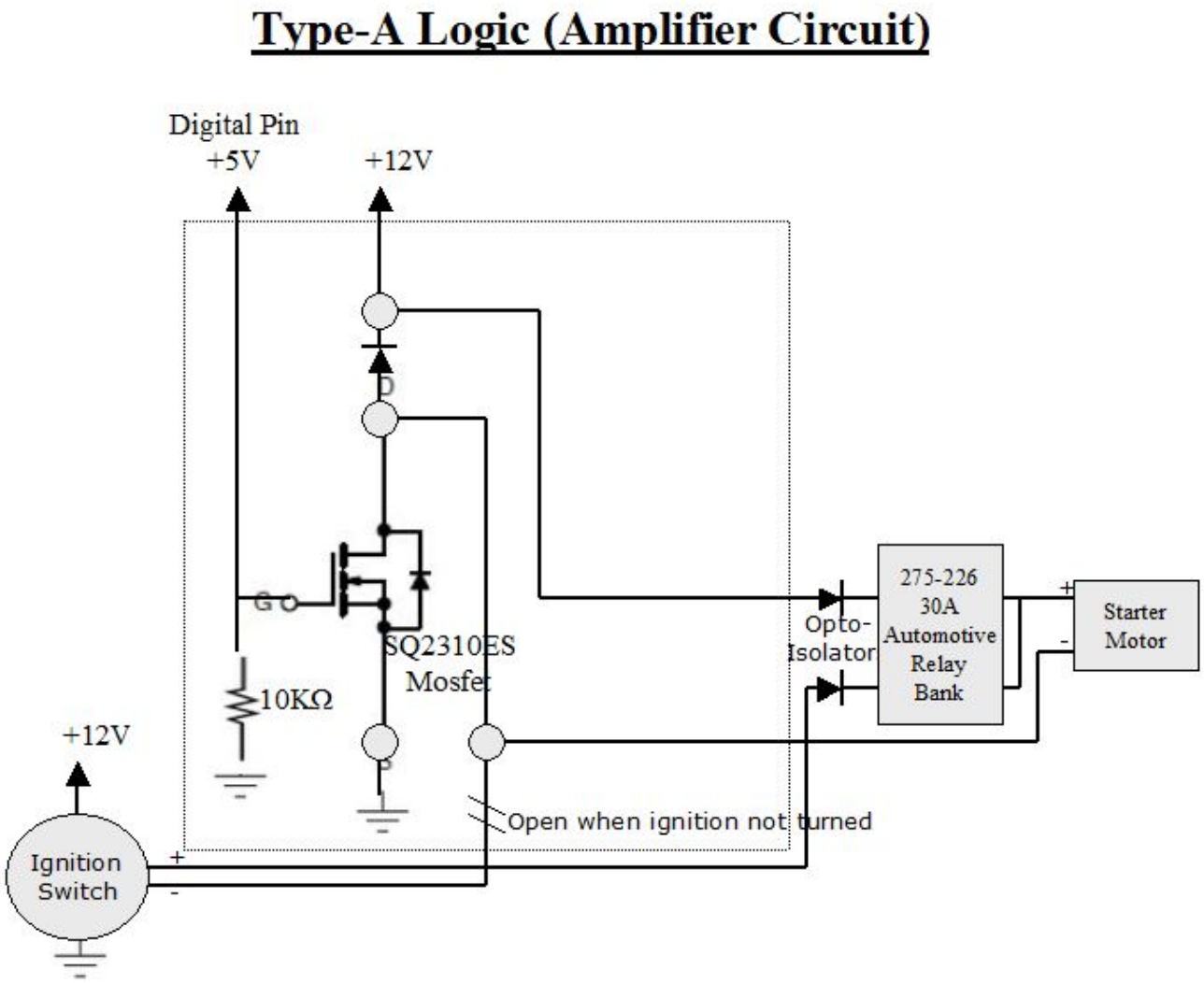
- Override signal by Arduino used as SELECT line for SPDT Relay Switches

- Operates like multiplexer and selects between dashboard controls or Arduino logic

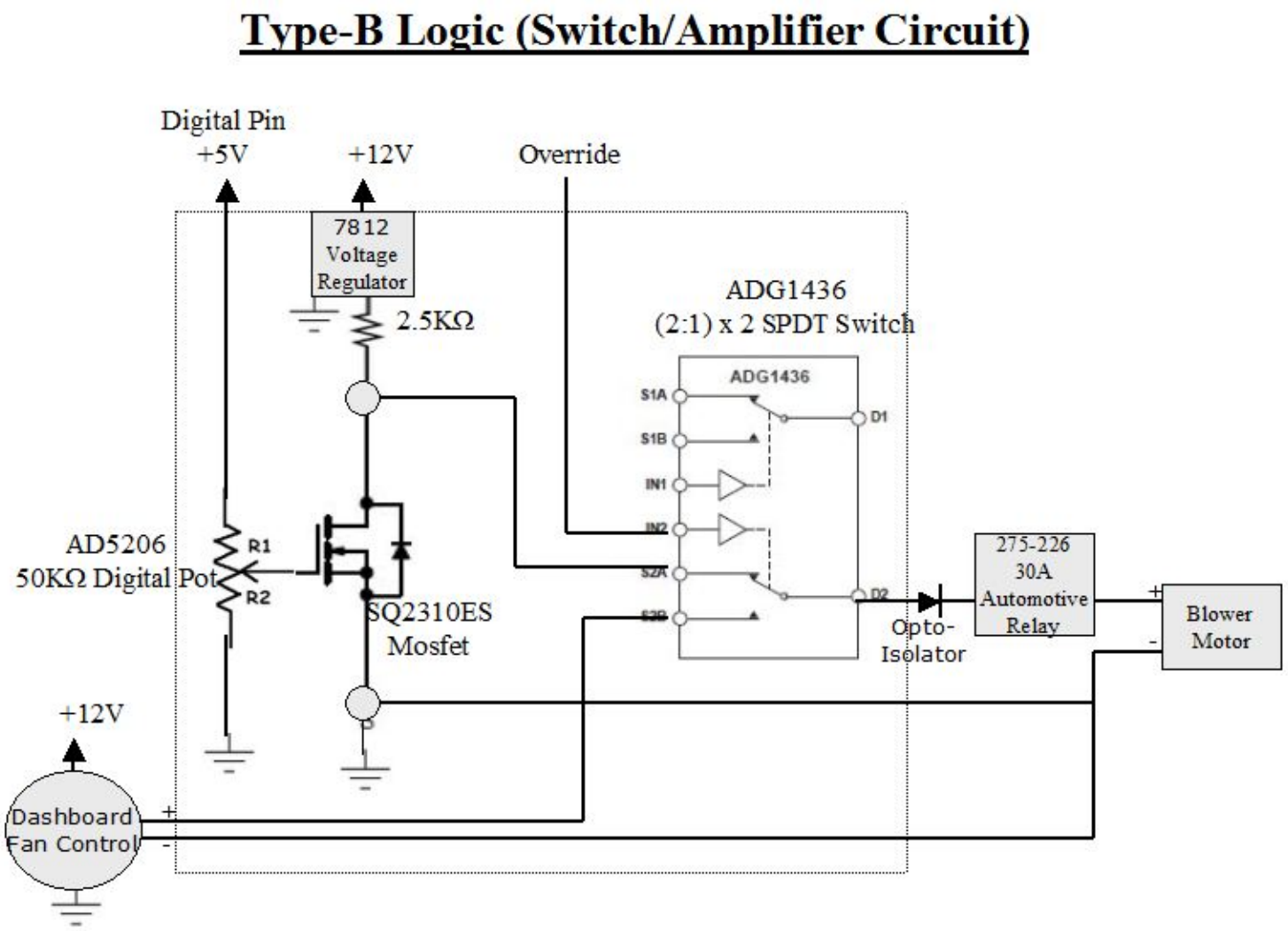
Relay PCB Diagram



Switch Relay

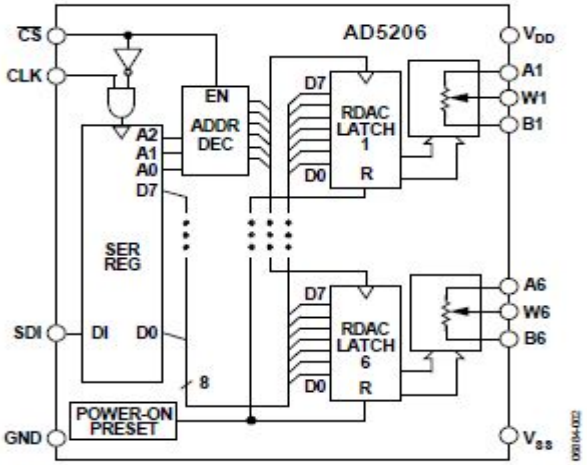


Amplifier/Switch Relay



AD5206 Digital Potentiometer

- 256 positions
- Multiple independently programmable channels
- 6-channel
- Terminal resistance of 10 kΩ, 50 kΩ, or 100 kΩ
- 3-wire SPI-compatible serial data input
- +2.7 V to +5.5 V single-supply operation



Reverse Engineering

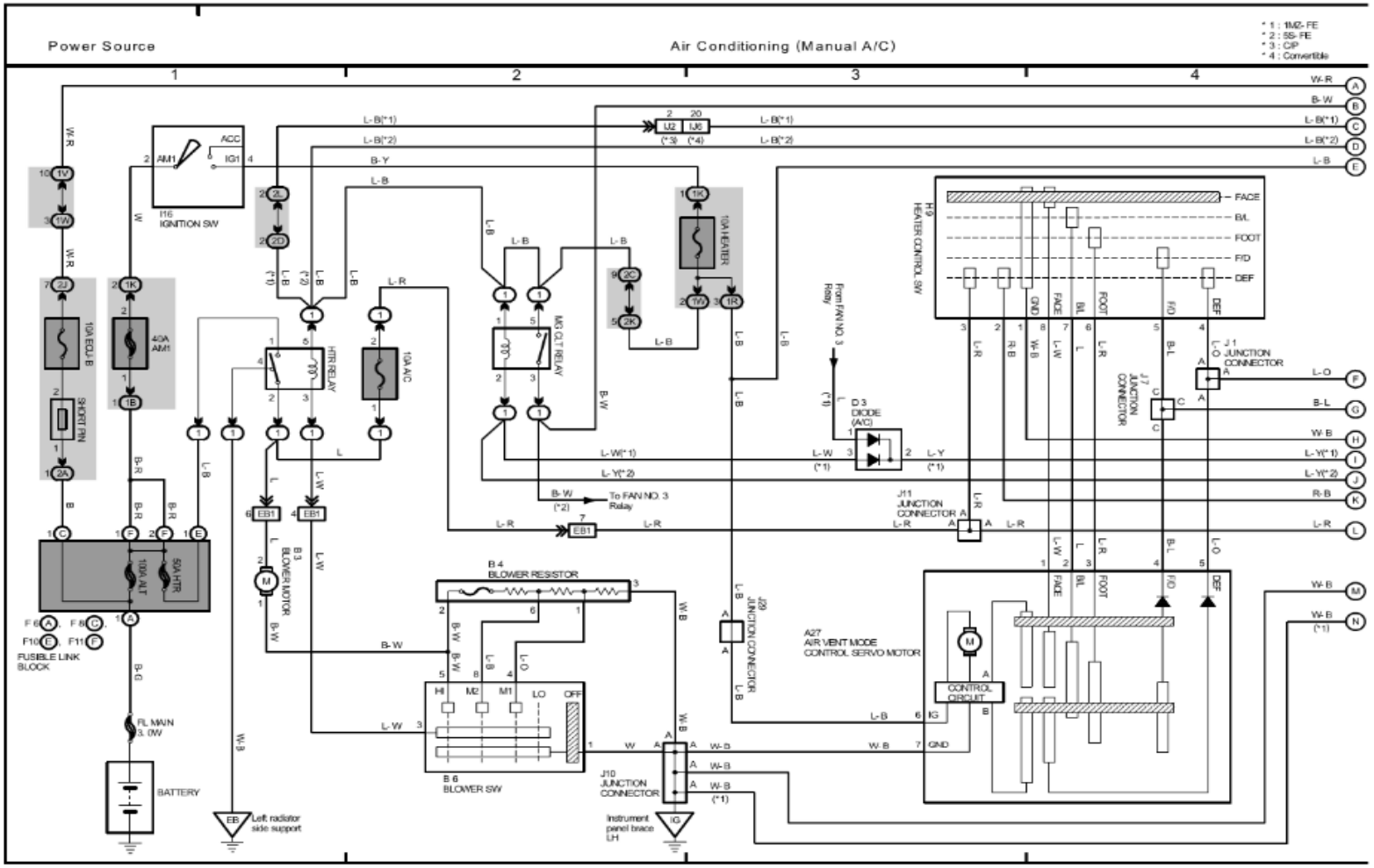
- Measure actual voltage and resistor values from each setting of dashboard controls. Typical +12V
  - Digital potentiometer values stored in Arduino software for each setting. Used as voltage divider from 5V digital output then amplified by Relay PCB to proper levels

- Translate OBDII codes (Ignition status to Arduino)

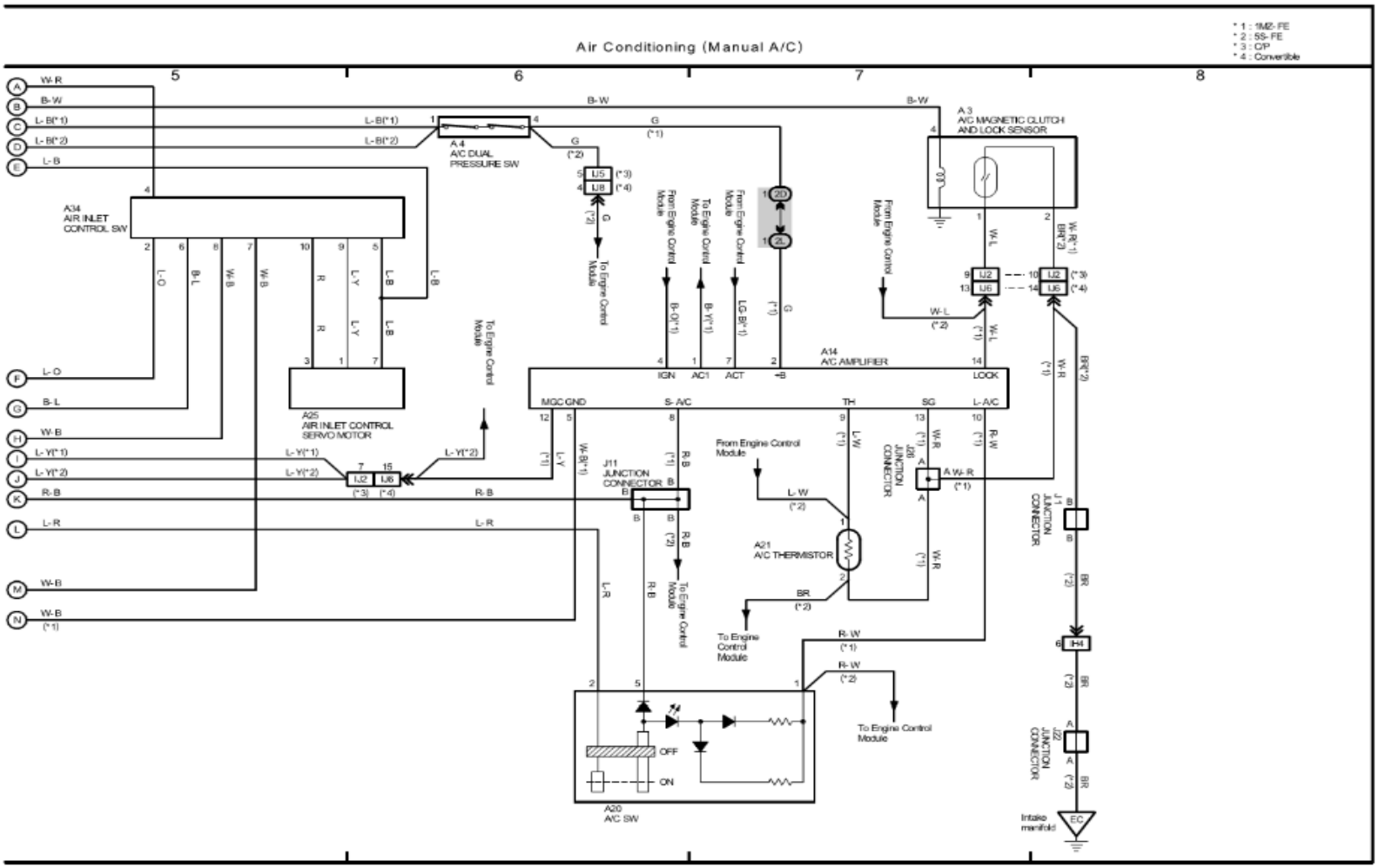
- Door locks (Monitor) - work in tandem with actual locks.

- Locate seat sensor - All Mobile controls disabled after person in driver's seat. 5 second timeout on Ignition Control

2005 Toyota Camry Wiring Diagram-A



2005 Toyota Camry Wiring Diagram- B



Task List And Schedule

1. Communication between Phone and Arduino	Complete
By July 31, 2012:	
2. Reverse Engineering of Vehicle	2 weeks
3. Build PCB Design for Relay Driver	3 weeks
4. Android Application and Arduino code	3 weeks
By Demo Day:	
5. Connect & Test: Arduino and Relay Driver Interface	4 weeks
6. Connect & Test: Car and Relay Driver Interface	6 weeks
7. System Testing: (Phone to Car)	4 weeks
8. Finishing touches: System testing and UI upgrade	2 weeks

Components List (B.O.M.)

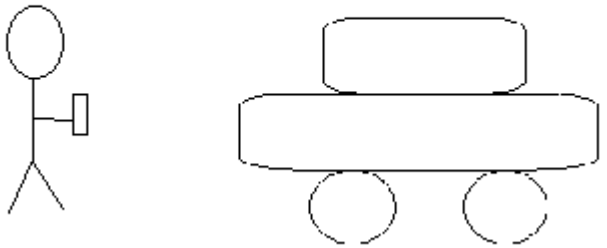
Toyota Camry	$...
Android Phone	$...
Sim Card (3) - AT&T	$ 75
Arduino Mega 2560 - Sparkfun	$ 70
Cellular Shield SM5100B - Sparkfun	$100
PCB (relay driver) - Altium	$100
OBD-II - uResearch	$ 20
wiring diagrams (alldata.com)	$ 27
Misc. (cables, antenna, etc.)	$ 20
Total	**$412**

Risk Management

- Relay Driver will require a lot of testing before installing. May need to buy blower motor, vent servo motors, etc... to test in lab first
- All PCB components may not be accessible in PCB design library. May have to design own footprints or build relay driver on proto-board instead
- Must make sure all sectors are isolated so back elecro-magnetic flux does not fry components
- Danger of making car inoperable. Always make wiring diagrams before disassembling

Demo Day

- Vehicle parked outside in parking lot
- Need about 10 mins to show all the functions
- Android interface sends SMS to Cellular Shield
- Parsed to Arduino
- Arduino sends signal to Relay Driver
- Stuff happens



Questions