Overview

- Objective
- Specifications
- Product
- Limitations
- Hardware
- Circuit Diagram
- Pictorial tour
- PBasic Code
- Prototype Cost Analysis
- Conclusion and Improvements
- Acknowledgements
Objective

- Build a device that helps deaf drivers interpret where sound is coming from
  - Emergency Vehicles
  - Cars honking horns
  - Any loud noise
Specifications

- **Product has to be controlled by BS2**
- **Safety features**
  - Instantaneous shutdown safety switch
  - Software Feature to prevent damage to the BS2 and other components
- **User Interface**
  - Monitoring sound
- **User Control**
  - Controlling sensitivity
- **Analog Sensor**
  - Microphones
- **Digital Sensor**
  - Photoresistor (Light/Dark)
- **Use sensory feedback**
  - Indicates sound direction
What is the Safe ‘N Sound Driver?

- **Aid** for deaf and hard of hearing drivers
- Uses multiple microphones to detect direction of sound
- **User Interface**
  - Dashboard mounted display
  - Uses LEDs to indicate hazard direction
  - Bright LED to let the driver know a loud sound has occurred
    - Under low light settings, Bright LED is dimmed
- **Settings for High / Low sensitivity**
- **Microphone Receptacle**
  - Roof mountable – Magnetized
  - Aerodynamic
  - Water resistant
- **Powered off the car cigarette lighter**
  - quarter amp fuse included
Limitations

- THIS IS AN AID ONLY – DO NOT RELY SOLELY ON THE S.N.S.D. THE DRIVER MUST PAY ATTENTION TO THE ROAD AT ALL TIMES

- Assumes only one audible road hazard at any given time

- Background noise level is moderate compared to hazard noise level
Key Hardware

- 3 Microphones
  - Omni-directional
  - 70-10,000 Hz response
  - Requires 2-10VDC

- Photoresistor
Key Hardware 2

- LM324 Quad Op Amp
- MPC3208 Analog to Digital Converter
  - 8 Channel addressable
  - 12 Bit A2D
  - Minimum clock frequency 10 kHz
- +/- 5 Volt Power rectifier
Circuit Diagram 1: Hazard Detection

Cigarette Lighter Plug
12V
25A Fuse

Voltage Rectifier

MCP3208
8 channel - 12 bit A2D

Vdd
Vref
Agrnd
Clk
Dout
Din
/CS
Dgnd

TO BS2

Back
Left
Right

Back
Left
Right

10µF
1kΩ
1MΩ
+

100pF
1kΩ
1MΩ
-

10µF
1kΩ
1MΩ
+

100pF
1kΩ
1MΩ
-

1kΩ
1kΩ
1kΩ
Circuit Diagram 2: BS2 and User Interface

From Microphone circuitry

MCP3208
8 channel - 12 bit ADC

Pin 15
Pin 13
Pin 12
Pin 9
Pin 4
Pin 14
Pin 11
Pin 3
Pin 2
Pin 1
Pin 0

Rectified by BS2

SPDT Switch
Sensitivity control

VDD

1kΩ

Photo-Resistor

1kΩ

10kΩ

VDD

Cigarette Lighter Plug
.25A Fuse
To BS2

Voltage Rectifier

12V

Rectangle
Pictorial Tour: Safe N’ Sound Driver
Pictorial Tour: Main Circuitry 1
Pictorial Tour: User Interface Casing
Pictorial Tour: Microphone Receptacle
Pictorial Tour: User Interface Casing in Car
Pictorial Tour: Microphone Receptacle on Car
Pictorial Tour: Interfaced with Cigarette Lighter
PBasic Code

Code for Safe N Sound Driver
## Prototype Cost Analysis

<table>
<thead>
<tr>
<th>Product</th>
<th>Quantity</th>
<th>Unit Price</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS2, Board of Education and kit</td>
<td>1</td>
<td>$130.00</td>
<td>$130.00</td>
</tr>
<tr>
<td>Omni-directional Microphone</td>
<td>3</td>
<td>$2.49</td>
<td>$7.47</td>
</tr>
<tr>
<td>Solder</td>
<td>1</td>
<td>$2.99</td>
<td>$2.99</td>
</tr>
<tr>
<td>Soldering tip</td>
<td>1</td>
<td>$1.99</td>
<td>$1.99</td>
</tr>
<tr>
<td>1/4 Amp Fuse</td>
<td>1</td>
<td>$1.59</td>
<td>$1.59</td>
</tr>
<tr>
<td>Fuse Holder</td>
<td>1</td>
<td>$1.99</td>
<td>$1.99</td>
</tr>
<tr>
<td>Illuminated Power Switch</td>
<td>1</td>
<td>$3.69</td>
<td>$3.69</td>
</tr>
<tr>
<td>Casing Hardware</td>
<td>1</td>
<td>$2.38</td>
<td>$2.38</td>
</tr>
<tr>
<td>PC Boards</td>
<td>1</td>
<td>$6.98</td>
<td>$6.98</td>
</tr>
<tr>
<td>IC Pin Socket</td>
<td>2</td>
<td>$0.99</td>
<td>$1.98</td>
</tr>
<tr>
<td>Shrink Wire Tubing</td>
<td>1</td>
<td>$1.95</td>
<td>$1.95</td>
</tr>
<tr>
<td>Casing</td>
<td>1</td>
<td>$6.99</td>
<td>$6.99</td>
</tr>
<tr>
<td>Wire</td>
<td>1</td>
<td>$3.99</td>
<td>$3.99</td>
</tr>
<tr>
<td>Velcro</td>
<td>1</td>
<td>$1.49</td>
<td>$1.49</td>
</tr>
<tr>
<td>Cigarette lighter plug</td>
<td>1</td>
<td>$3.49</td>
<td>$3.49</td>
</tr>
<tr>
<td>Cigarette lighter outlet</td>
<td>1</td>
<td>$6.49</td>
<td>$6.49</td>
</tr>
<tr>
<td>Capacitors</td>
<td>3</td>
<td>$0.99</td>
<td>$2.97</td>
</tr>
<tr>
<td>Epoxy Paste</td>
<td>1</td>
<td>$4.99</td>
<td>$4.99</td>
</tr>
<tr>
<td>Super Bright Jumbo LED</td>
<td>1</td>
<td>$2.59</td>
<td>$2.59</td>
</tr>
<tr>
<td>Power Rectifier</td>
<td>1</td>
<td>$1.00</td>
<td>$1.00</td>
</tr>
<tr>
<td>Diodes</td>
<td>1</td>
<td>$2.49</td>
<td>$2.49</td>
</tr>
<tr>
<td>Microphone Casing</td>
<td>1</td>
<td>$9.97</td>
<td>$9.97</td>
</tr>
<tr>
<td>Magnets</td>
<td>2</td>
<td>$1.00</td>
<td>$2.00</td>
</tr>
<tr>
<td>Various Resistors/Capacitors/LEDs etc</td>
<td>1</td>
<td>$5.00</td>
<td>$5.00</td>
</tr>
<tr>
<td>Battery Clip</td>
<td>1</td>
<td>$1.39</td>
<td>$1.39</td>
</tr>
<tr>
<td>Analog to Digital Converter</td>
<td>1</td>
<td>$18.00</td>
<td>$18.00</td>
</tr>
<tr>
<td><strong>SUBTOTAL</strong></td>
<td></td>
<td><strong>$235.86</strong></td>
<td></td>
</tr>
<tr>
<td><strong>TAX (8.625%)</strong></td>
<td></td>
<td><strong>$20.34</strong></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>$256.20</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Projected Mass Produced Price**: $50

*Driving Safely - Priceless*
Conclusion and Improvements

- Prototype was a success
- Multiple LEDs in each direction for sound level
- More accurate microphones
- Wireless connection between user interface and roof mounting
- Ability to interpret different sounds
  - Scan for frequencies reserved for communication by emergency personnel
Acknowledgements

- Chani Herman
  - Deaf Driver - Inspiration for the Safe ‘N Sound Driver
- The Christian Music Web
  - http://www.christianmusicweb.com/microphones/mic_project.html
  - Interfacing a condenser Microphone
- Hong Wong
  - Graduate Assistant, Department of Mechanical Engineering, Polytechnic University.
  - Power Rectifier
  - Guidance