Smart Car: Collision Avoidance

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Mike Krause
George Kachouh
Overview

- Purpose
- Schedule
- Group Work Divided
- Research
- Parts List / Individual Parts
- Overall Block Diagram and Schematic
- Cost Analysis
- Problems
- Design Alternatives
- Previous patents and OSHA regulations
- Conclusion
- Questions
Purpose Of The Smart Car

- Increase safety on the road through collision avoidance
- Primitive Artificial Intelligence (AI)
- Hardware and software integration
- Engineering design and production
## Schedule

<table>
<thead>
<tr>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
<th>Week 4</th>
<th>Week 5</th>
<th>Week 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 17-23</td>
<td>March 24-30</td>
<td>March 31-April 6</td>
<td>April 7 - 13</td>
<td>April 14-20</td>
<td>April 21-27</td>
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<tr>
<td>Initial brainstorming and design comparison</td>
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<tr>
<td>Searched online for possible parts for Smart Car</td>
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</tr>
<tr>
<td>Began ordering parts and receiving them</td>
<td>Hardware implementation</td>
<td></td>
<td>Writing code</td>
<td></td>
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<td></td>
<td></td>
<td>Writing Report and Power Point Presentation</td>
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</tbody>
</table>
Performance Against Schedule

**Estimated Production Times**
- Product production time of 4-5 weeks
- Hardware production time of 20 hours
- Software production time of 10 hours
- Presentation Report time of 15 hours

**Actual Production Times**
- Hardware production time approx. 30 hours
- Software production time approx. 20 hours
- Presentation Report time of 13 hours
George Kachouh

- Early research and development
  - Researched component specifications online
- Hardware
  - Assisted in hardware testing
- Software
  - Assisted writing code
  - Assisted in de-bugging code
- Project Report
  - Assisted in writing report
Group Work Divided

- Michael Krause
  - Early research and development
    - Created early designs for car
  - Hardware
    - Main construction and design of hardware
    - Main hardware testing and debugging
  - Software
    - Assisted writing code
    - Assisted in de-bugging code
  - Project Report
    - Supported in writing parts of report
Group Work Divided

- Ajeena Kurian
  - Early research and development
    - Researched component specifications online
  - Hardware
    - Assisted in hardware testing and debugging
  - Software
    - Assisted writing code
    - Assisted in de-bugging code
  - Project Report
    - Assisted in writing report
Research

- Idea introduced by Mike
- Research done by group
  - Online
    - Parts search
    - Alternative design
  - Person to person
    - Amplification design
    - Sensor alternatives
General Part List

- HC11 Micro Controller
- Radio Shack Street Tiger Car
- H-Bridge
- Infrared Proximity Detector
- Digital Voice Module
HC11-Micro Controller
HC11-Micro Controller

- Current Capacity: 25mA
- Voltage: 6V
- Send and Receive Data
  - Ports used: A and D
  - Pins used
**HC11-Micro Controller**

<table>
<thead>
<tr>
<th>NOT</th>
<th>NOT</th>
<th>PD3</th>
<th>PD2</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>En-B</td>
<td>En-A</td>
<td>B</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Forward</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>Reverse</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Stationary</td>
</tr>
</tbody>
</table>

- **Forward** when En-B = 0 and En-A = 1
- **Reverse** when En-B = 1 and En-A = 0
- **Stationary** when both En-B and En-A are 1
Radio Shack Street Tiger Car
Radio Shack Street Tiger Car

- Current Requirement: 240-280 mA
- Voltage: 6V
  - Uses four AA Batteries
- Reverse Motion
  - Mechanical front drive
H-Bridge
H-Bridge

- Detailed Parts
  - 4 npn FETs
  - Resistors
  - Capacitors
  - Photovoltaic ICs
- Four logic inputs control operation
- Acts like a current amplifier
Infrared Proximity Detector
Infrared Proximity Detector

- Uses a Sharp GP1U581Y IR sensor
- 2 IR LED’s
- Detection range between 8 to 24 inches
- IRPD has two inputs, and one output
  - 2 inputs for each IRLED
  - 1 output for IR Sensor
- Able to detect 35° on each side of the car
- Uses 38 KHz signal Carrier
Infrared Proximity Detector

Note: This illustration shows how the sensor can detect in three quadrants.

- Left Only
- Both
- Right Only
Digital Voice Module
Digital Voice Module

- Notifies user when a barrier is detected
- 20 seconds of audio using 1 MB of RAM at 44.1 KHz, 50kbs
- Recording Requires constant 5V
- Playing requires a 5V pulse
The Full Picture
Block Diagram Of Code

- Timer Begins, 4 seconds
- Setup LCD
- Load Counter Values

- Barrier
  - 0
  - 1

- Delay for 1 second
  - Set Motor Pins = 0

- Use Interrupts for Once a Second
  - Increment Counter 99:59:59

- Activate Voice Module
  - Reverse Voltage to turn 90 degrees
Block Diagram Of Code

- Counter Logic for Time Control
- Cut Voltage to Motor to Delay for 1 second
- Send +5 Volts to Motor for Forward Bias
## Cost Analysis

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio Shack Car: The Street Tiger</td>
<td>$15.88</td>
</tr>
<tr>
<td>DVM-58D Digital Voice Module</td>
<td>$82.45</td>
</tr>
<tr>
<td>H-Bridge designed by GM</td>
<td>$15.00</td>
</tr>
<tr>
<td>Infrared Proximity Detector</td>
<td>$47.00</td>
</tr>
<tr>
<td>M68HC11 Micro-controller</td>
<td>$99.99</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$260.32</strong></td>
</tr>
</tbody>
</table>
Difficulties

- Current Amplification
  - What to use?
- H-bridge
  - Fabrication problems
- Our Code
- Hardware interface
Design Alternatives

- Type of car
  - Turning mechanism
- Sensors
  - Laser
  - Bright LED’s
  - Infrared LED’s
- Amplification
  - Glorified AND Gate
Saab AB uses a system and method for avoidance of collision between vehicles

Donnelly Corporation uses the idea of a proximity detector system for vehicles

ECE 4600 Group 13 incorporated both ideas
Safety Concerns – OSHA

- No pollutants
  - Battery powered

- Accessibility
  - Convenient for the blind
  - Convenient for the handicapped
Conclusion

- Increased safety on the road
- Demonstrates AI decision making process
- Integrates hardware and software
- Demonstrates Group #13 engineering capability
Questions ??