**<Project Name>: Team ?**

*Place picture of project with team members here.*

*Complete the caption, below.*

*Delete this text box before pasting in your photo!*

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| *Team Members (left-to-right on picture, above)* | *Class No.* | *Lab Div* |
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| *Report/Functionality Grading Criteria* | *Points* |
| Originality, creativity, level of project difficulty | 20 |
| Technical content, succinctness of report | 10 |
| Writing style, professionalism, references/citations | 10 |
| Project functionality demonstration | 20 |
| Overall quality/integration of finished product | 10 |
| Effective utilization of microcontroller resources | 10 |
| Significance of individual contributions\* | 20 |
| *Bonus Credit Opportunities* | *Bonus* |
| Early completion | 0.5% |
| PCB for interface logic | 2% |
| Poster (required for Design Showcase participation) | 1% |
| Demo video (required for Design Showcase participation) | 1% |
| Design Showcase participation (attendance required)\* | 1% |

##### \**scores assigned to individual team members may vary*

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| *Grading Rubric for all Criteria (Including Bonus)* | *Multiplier* |
| *Excellent* – among the very best projects/reports completed this semester | 1.0 - 1.1 |
| *Good* – all requirements were amply satisfied | 0.8 - 0.9 |
| *Average* – some areas for improvement, but all basic requirements were satisfied | 0.6 - 0.7 |
| *Below average* – some basic requirements were not satisfied | 0.4 - 0.5 |
| *Poor* – very few of the project requirements were satisfied | 0.1 - 0.3 |

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1. **Introduction**

*Provide a brief functional description of your project and describe the role each team member played,*

*Length should be about one page.*

The purpose of this project was to create an adaptive cruise control HUD (heads-up display) to be used in an automobile that would display its current speed as well as velocity relative to whatever object happens to be in front it. For this project, the HC9S12C microcontroller has two main functions: to interface with said automobile’s ECU (engine control unit), and to communicate with a LIDAR distance sensor.

Interfacing with a car’s ECU allows the connected computer (or, in this case, microcontroller) to access a wealth of diagnostic information. Though it certainly would have been possible to try and measure the car’s velocity through other means, interfacing with the ECU is both a simple and reliable method that doesn’t require the use of an external sensor in addition to the LIDAR already being used. As an added bonus, the board can be powered through the OBD-2 port that is used to communicate with the ECU, thereby removing the need for some sort of power adapter due to the absence of a wall outlet in automobiles. To retrieve information, such as current speed, a request must be sent and then a response received via the chip’s onboard SCI peripheral.

The LIDAR sensor measures distance, so it can be used to approximate velocity or relative velocity if two measurements are taken in quick succession. If mounted on the front of a car, then, it could calculate the difference between the speed of the user’s automobile and the one in front of it. Assuming the car in front is maintaining a consistent speed, the microcontroller would be able to suggest how much faster or slower than the user’s current speed that their cruise control should be set to maintain a constant distance.

Patrick SCI drivers, PCB design, MAX232 implementation, Power supply implementation

Will

Tyler has done nothing ☺.

1. **Interface Design**

## *Describe any external interfaces utilized (e.g., switches, LEDs, sensors). Include your Eagle or OrCAD schematic as Appendix B.*

*Length should be about* *one page.*

This project makes use of three LEDs, two four by seven segment displays, two shift registers, a LIDAR distance sensor, and a serial to OBD connection. The three LEDs are there to indicate that the user’s automobile is either going too fast, too slow, or about the right speed based on the car in front of it. The LEDs are simply connected to output pins on the microcontroller. One of the four by seven segment displays is going to be used to display the user’s current speed, as was returned by the ECU of the user’s vehicle. The other will display the user’s speed relative to the car in front of him or her, determined by using the LIDAR sensor. Both of the four by seven segment displays are interfaced to the microcontroller via shift registers using SPI.

# **Microcontroller Resource Utilization**

*Describe how the microcontroller’s peripherals (ATD, SCI, SPI, TIM, PWM) as well as its other on-chip resources (RTI, SRAM, flash memory, etc.) were utilized, including the mode(s) in which they were programmed to operate. Provide rationale for the choices made.*

*Length should be about one page.*

1. **Software Narrative**

*Describe what the software does and how it is organized/structured (i.e., event-driven, state machine, etc.). Submit your complete software listing on-line separately. Include a flowchart to document program structure in Appendix C.*

*Length should be about one page.*

1. **Packaging Design**

*Describe the packaging design for your project; include drawings/photos in Appendix D.*

*Length should be about one page.*

1. **Summary and Conclusions**

*Describe what you learned from completing the project and what you might do to improve your design if you had more time.*

*Length should be about one page.*

1. **References**

*List any references (e.g., data sheets, application notes, web sites) used in formulating your solutions.* ***Be sure to cite these references in your report.***

*NOTE: Use IEEE format.*

**Appendix A:**

**Individual Contributions**

**and**

**Activity Logs**

**Activity Log for:** <name-1> **Role:** <role on team>

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**Written Summary of Technical Contributions:** <name-1>

*Provide a concise but sufficiently detailed description of your technical contributions to the project.*

*Length should be about one page.***Activity Log for:** <name-2> **Role:** <role on team>

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**Written Summary of Technical Contributions:** <name-2>

*Provide a concise but sufficiently detailed description of your technical contributions to the project.*

*Length should be about one page.***Activity Log for:** <name-3> **Role:** <role on team>

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**Written Summary of Technical Contributions:** <name-3>

*Provide a concise but sufficiently detailed description of your technical contributions to the project.*

*Length should be about one page.***Activity Log for:** <name-4> **Role:** <role on team>

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**Written Summary of Technical Contributions:** <name-4>

*Provide a concise but sufficiently detailed description of your technical contributions to the project.*

*Length should be about one page.*

**Appendix B:**

**Interface Schematic**

**and**

**PCB Layout Design**

*Paste a copy of your Eagle or OrCAD interface schematic here and (optionally) PCB layout.*

*Be sure to clearly identify the team member(s) responsible for producing this documentation.*

**Appendix C:**

**Software Flowcharts**

*Include software flow diagrams and/or pseudo code here.*

*Be sure to clearly identify the team member(s) responsible for producing this documentation.*

*NOTE: Software source listing file must be submitted on-line and should NOT be included here.*

**Appendix D:**

**Packaging Design**

*Paste illustrations/pictures of your project packaging here.*

*Be sure to clearly identify the team member(s) responsible for producing this documentation.*