Group/Project Title

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Date of Submission

## Capstone Design ECE 4440 / ECE4991

## Signatures

## Statement of work:

In this section, each team member should provide 1 or 2 paragraphs describing their individual contributions to the project. This needs to be detailed and list several specific examples of work performed and how it fit within the context of the whole project.

## Table of Contents

This should list the page of each of the major headings and subheadings below. An example is shown below.

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## Table of Figures

(This should list the page of each figure used in your document, including the full caption.) Word has tools to help you do this very easily)

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**Abstract**

This should be a 1 paragraph overview of your project. It should be concise but give the reader a clear sense of what your project is about.

## Background

You should encompass the following bullet points in this section. (Note that bullet points are not used in your write up – but are here just to make sure that you cover all of the points.)

* Why you chose this project
* What’s been done similar in the past. Include references as necessary (IEEE Style)[1]
* Your spin on the project, i.e. what differentiates it from past work by others.
* What background from previous coursework does your project call into play.

You should also have the following subheadings in this section:

## Constraints

### Design Constraints

You should discuss design and manufacturing constraints in this section. Examples would include CPU limitations, software availability, manufacturing limitations, i.e. the limits imposed by our PCB suppliers, or parts availability in the necessary timeframe. You should reference the suppliers used.

### Economic and Cost Constraints

## External Standards

In this section, you should explain any external industry standards that came into play during the course of your project. For example if you project use a wireless interface then you dealt with IEEE standards for wireless Ethernet. If you project dealt with AC line voltages in anything other than a wall transformer you dealt with NEMA standards. The part spacing and track spacings on your PCB’s were derived from IPC standards. You should **provide references** to these standards and explain how they were considered in your project.

### Tools Employed

In this section you should list and explain the application of all of the major tools you used this semester. This includes software for math analysis, i.e. Mathcad or Matlab, software for programming, i.e. LabVIEW or C/C++ including Code Composer, and tools for simulation and design, i.e. Multisim and Ultiboard. You should explain what role each played in your work, and which tools you had to learn, or improve your skills on, in doing your project. **Each tool should be referenced.**

## Ethical, Social, and Economic Concerns

In this section you should address how your project might affect society, both from a human interaction perspective as well as an economic one. You should consider issues such as privacy, security, or how devices such as yours might influence society both for good as well as not. For example, how would a system that employs robots affect human employment opportunities? What are the ethics of automated weapons systems? How would your device affect those who might be economically disadvantaged? (You get the idea here, I hope!)

### Environmental Impact

This section is very important and must be filled out completely. Each subheading must be addressed. Consider each point below in its subheading.

### Sustainability

### Health and Safety

### Manufacturability

### Ethical Issues

### Intellectual Property Issues

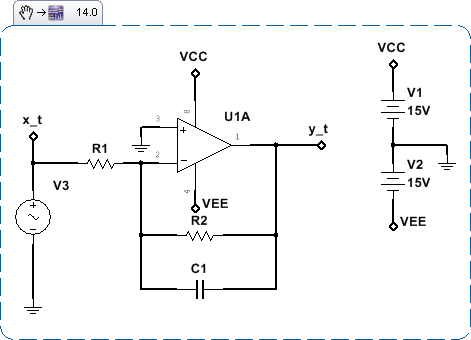
In this section you should discuss the patentability of your project. You should include references to 3 US patents whose claims encompass material similar to your project and explain why (or why not!) you feel your project might be patentable in light of those claims. Your project does not have to be patentable, but you need to explain why , or why not. You should list specific claims in the patents and explain of the are dependent or independent claims.

## Detailed Technical Description of Project

This should a very detailed section. It should include the points. (Not bulleted in your report!) It should explain in sufficient detail that would allow a 4th year undergrad to exactly duplicate your results at the beginning of their fall semester.

* What it is
* How it works
* Components used – All should be referenced![2]
* Design Decisions and tradeoffs
* Block Diagrams
* Schematics (use sections of schematics and explain thoroughly and legibly)
* Board Layouts (explain why layout decisions were made)
* Problems and design modifications

Here is an example figure, properly captioned etc.



**Figure 1 Basic Opamp Shelving Filter**

## Project Time Line

This section should include the Gantt chart from your proposal as well as a final chart (showing the differences). You should explain the following and how your time lines changed throughout the course of the semester.

* Gantt Chart – tool from collab
* Serial tasks
* Parallel tasks
* Who does what
  + Primary
  + Secondary
* Cognizant of dates discussed on the first day of class

## Test Plan

You should show the test plan from your proposal and explain how you followed this plan or how you modified it. You should explain each of your testing procedures, and how you divided your system into testable sub modules. If testing caused a partial redesign of your device, you should explain how you arrived at that conclusion and how it influenced your redesign.

## Final Results

In this section you should explain the functionality of your final device in detail. You should honestly assess and explain which of the success criteria defined in your proposal you met and which you did not.

## Costs

In this section, you should outline your costs, with a detailed spreadsheet in your appendix. You should also consider how costs would change if you were to manufacture in 10000 unit quantities, i.e. look at Digikey to get estimates of costs in large quantities, and consider if automated equipment could be used to assemble your device and how that might influence costs.

## Future Work

In this section you should offer suggestions as to how the project might be improved or expanded upon if a future group of students wished to create a new project based upon yours. You should consider difficulties that were not foreseen at the beginning, and offer advice on pitfalls to watch for.

## References

[1] J. A. Morente, A. Salinas, S. Toledo-Redondo, J. Fornieles-Callejon, A. Mendez, and J. Porti, “A New Experiment-Based Way to Introduce Fourier Transform and Time Domain #x2013;Frequency Domain Duality,” *IEEE Trans. Educ.*, vol. 56, no. 4, pp. 400–406, Nov. 2013.

[2] “MSP430G2553 | MSP430G2x/i2x | MSP430 ultra-low-power MCUs | Description & parametrics.” [Online]. Available: http://www.ti.com/product/MSP430G2553. [Accessed: 06-Dec-2016].

## Appendix

In this section you should include helpful information that does not fit into the above categories but will be helpful in understanding and assessing your work. Complete code listings should be in this section, and detailed cad drawings.

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