

SANTA CLARA UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

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ENTITLED

Project Title - TEMPLATE FOR CSEN SENIOR DESIGN THESIS

BE ACCEPTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

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Thesis Advisor

Department Chair

Project Title - TEMPLATE FOR CSEN SENIOR DESIGN THESIS

by

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Submitted in partial fulfillment of the requirements
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Department of Computer Science and Engineering
Santa Clara University
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ABSTRACT

A good abstract is a concise summary (1–2 paragraphs) of the entire project: introduction, problem statement, work accomplished, results, conclusions, and recommendations. When you write the abstract, imagine that the reader will not read anything else, but that you must get your major point across immediately. This requires efficiency of words and phrases. An abstract is written to stand alone, without jargon or reference to figures and tables in the report body.

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Chapter 1

Introduction

The introduction should be approximately 1–3 pages in length, and should contain the following information:

Problem statement: Make a concise statement of the problem, ideally in a few sentences, but no more than a paragraph. For example, try to complete this statement: “The sponsor desires that ... (insert goals of the project) ... subject to the following criteria: ... (insert numbered list).” These goals and criteria help to define the scope of work and the deliverables. **Background or Related Work:** State who else has worked on this problem or similar problems (you should do most of your citations here). For applied projects, provide information on other existing programs which will use your program. **Objectives:** The objectives are a battle plan for the project. They are a breakdown of steps or accomplishments that must be completed to achieve the project goals.

1.1 Problem Statement

Re-use the content from your problem statement.

1.2 Background or Related Work

State who else has worked on this problem or similar problems (you should do most of your citations here). For applied projects, provide information on other existing programs which will use your program.

Describe what systems already exist and why they are inadequate.

1.3 Objectives

The objectives are a battle plan for the project. They are a breakdown of steps or accomplishments that must be completed to achieve the project goals.

1.4 Our approach

Describe the team's approach for developing a system at a high level. Why will your work result in a system that is different / better than existing solutions?

Chapter 2

User Research - example middle chapter

2.1 Methods

Describe what methods you have used to identify user needs. This can include methods such as storyboards and interviews and surveys with target users. Describe how you analyze the data you collect. Include an example.

2.2 Stakeholder needs

Who are the stakeholders for this system? Provide a short description of what you know (so far) about each of the stakeholders and their needs. Highlight cases where their needs may differ. Personas could be appropriate here.

Describe whose needs your system will prioritize. It is ok to state that a potential stakeholder is out of scope for the project. For example, a virtual tour of the SCU campus might target prospective students, but choose *not* optimize for their parents (who are also potential stakeholders/viewers, but have different needs).

2.3 User stories

For each stakeholder that you choose to prioritize, describe one or more user stories that your system will support, e.g., "As a prospective student, I want to find a social group at SCU so that I have friends to hang out with."

Chapter 3

Design and Rationale - example middle chapter

3.1 Design

Describe the design of the system at a high-level. The system should support the use cases described in the previous chapter.

—C4 system context and container diagrams go in this section. See: <https://c4model.com/> (C4 Model Website) —

3.2 Functional requirements

Generally expressed in the form: "system must do <requirement>." These are similar to use cases (i.e, "the user can do XYZ"), but written from the perspective of the system. For example: "The landing page must introduce several different virtual tours and let the user choose one."

See https://en.wikipedia.org/wiki/Functional_requirement

3.3 Non-functional requirements

Generally expressed in the form: "system shall be <requirement>." These are also known as quality requirements. For example: "The virtual tour shall be fast-to-load. That is, the tour itself and any embedded media in it should load quickly enough that it is not a major annoyance for our target users."

See https://en.wikipedia.org/wiki/Non-functional_requirement

3.4 Rationale

Describe why the system is designed this way. What alternatives did you consider, and why is design a good choice.

Chapter 4

Technologies - example middle chapter

4.1 System Components

Describe the technologies you will use to build the system.

Chapter 5

System Evaluation - example middle chapter

Describe how you will evaluate the system you create. In particular, you need to have a plan for how to evaluate your functional and non-functional design requirements.

5.1 Internal Testing

How will test the system with internal users? That is, how will you and the team evaluate it yourselves? This is also called https://en.wikipedia.org/wiki/Eating_your_own_dog_food.

5.2 External Testing

How will test the system with external users? That is how will you get user feedback on your system. This can include methods such as usability testing, interviews with users, and analyzing log data from the product/service. How will you incorporate this user feedback into subsequent iterations of your system?

Chapter 6

Implementation Plan - example middle chapter

6.1 Timeline

Introduce the planned timeline for the work.

6.2 Agile software development

Repeat that we are using agile software development methods—the final system design will change in response to user feedback. Describe how in each two-week sprint, we work towards on one or more of the user stories. In the sprints, these are broken down into tasks that are assigned to specific team members. Show an example of what such tasks look like.

6.3 Project Risks

Briefly discuss any risks to the project and how you will mitigate them.

Chapter 7

Constraints and Standards

7.1 Constraints

Constraints are factors that limit your development process. They could be material such as money or hardware, or non-material such as time or customer satisfaction. Constraints include budget, customer satisfaction, quality, requirements, risk, time, ease of use, reliability, maintenance costs, etc.

Generally, a trade-off exists between time, cost, and scope (features and functionality) and should be discussed. Resources constraints include equipment, materials, software, facilities, and people. In addition, there are legal and ethical constraints to be considered when developing any project.

For example, will your project be maintained after deployment? Did the use of third-party software or hardware affect the design or your project? Did legal requirements such as HIPAA limit the scope of your project? Did the licensing of any components used affect your final project?

7.2 Standards

Standards are specifications or requirements, practices, guides, test methods, etc., covering various materials, products, systems or services. Standards are minimally accepted professional practices and qualities that must be observed. Common examples of standards in computer science and engineering include IEEE standards for electrical engineering and networking, and ISO standards for programming languages and design methodologies.

For example, IEEE provides standards for Ethernet (IEEE 802.3), wireless communications (IEEE 802.11), Bluetooth (IEEE 802.15), Verilog (IEEE 1364), as well as public-key cryptography (IEEE P1363). ISO provides standards for C++ (ISO 14882), UML (ISO 19501), QR codes (ISO 18004), ECMAScript (i.e., JavaScript) (ISO 16262), and software testing (ISO 29119-1), among others.

For example, did you choose specific standards for interoperability or to minimize power consumption? Did you use standard languages and libraries to help ensure maximum portability? Did your user interface conform to industry design standards for the devices used? Did you use any accessibility libraries or tools to make your project more

inclusive?

Chapter 8

Societal Issues

If you do not think an issue, such as ethics for example, has any relation to your project, you can say so, but you should justify this. SELECT AT LEAST FIVE OF THESE ISSUES TO ADDRESS IN AT LEAST ONE PARAGRAPH EACH:

8.1 Ethical

Ethical conduct is what one ought to do in working with others. It is the right thing to do, the moral action. It is not surprising that virtually all of our professional societies and groups, in all professions, have codes of ethical conduct. Professions realize that there are good and bad ways of working with others, and we need to make the distinction. Sometimes it can be difficult to know what is the right thing to do. What ethical questions were or could be raised about your project?

8.2 Social

Engineering is done within a social context, within a community of other people. Sometimes that community is defined very narrowly, sometimes very broadly. A focus on social issues allows us to consider the impact of our work on society. If we develop this product, or implement this system, what will be the effect? All of our human developments, in engineering and elsewhere, have unanticipated consequences, some good, some bad. We have an obligation to reflect on these consequences as well as we are able.

8.3 Political

Many of our projects are very political in nature, requiring us to take into consideration the will of the general public, usually through elected representatives. Engineers who work on public projects need to understand the political processes that make such work possible. What is the potential impact of your project or this type of project on society?

8.4 Economic

Economic considerations in engineering concern the costs of the various steps in the project. Such costs are usually dependent on the engineering decisions that are made during the design phase. Alternative approaches may offer cost options. We also need to consider the cost of money. How do we pay for the cost of a product development? If we must borrow significant amounts of money how do we account for the cost of the loan in the pricing of the product? What economic considerations arose in your project?

8.5 Health and Safety

We develop our products for the use of the public. Hence we must consider health and safety issues related to our product. How safe does a product have to be? Are there laws that determine this? Are there related ethical issues? What health effects are relevant? What health and safety issues arose in your project?

8.6 Manufacturability

Manufacturability issues are of great importance. Can the product be built? Is there an easier way to build this product than first imagined? What development time issues arise? What are the cost issues? Could your project be manufactured? What problems might arise?

8.7 Sustainability

Sustainability means two things in engineering; one is a narrow sense, one broad sense. In the former sense sustainability refers to the degree to which a product that is developed can continue to be viable and useful for a reasonable amount of time. A product that fails soon after it is built and cannot be repaired or updated or modified to fit new needs is not a sustainable product. In the broader sense a community or region or a world, perhaps, that uses its resources effectively so that it can sustain its life for a long time is said to be sustainable. We say that such a community has a sustainable economy. Engineering can help develop sustainable economies. What sustainability issues arise?

8.8 Environmental Impact

All of our products and systems have some environmental impact, in the uses of valuable resources, or in the production of pollution, or in other changes in our surroundings. The engineer is obliged to consider such impacts, and to point them out where they arise, or are a threat. What are the environmental issues related to your product?

8.9 Usability

Usability refers to what is sometimes called “user-friendliness.” Is the device straightforward, easily learned and easily used by the end user. Is your product usable?

8.10 Lifelong learning

Lifelong learning is a necessary part of all professions. You wouldn’t want to have a doctor who did not know the latest procedures and medications to protect your life. And you wouldn’t want an engineer who didn’t know the analysis tools that had been developed since graduation, or the cost-effective materials that had just come along. We just have to keep up. Learning never stops. Did this project help prepare you for the time when you will have to learn on your own, or did it inspire you to study new material?

8.11 Compassion

One definition for compassion is an awareness of and sympathy for the suffering of another. Compassion means to recognize the suffering of another. But let’s look at a broader definition. Let’s define compassion as “the awareness of and sympathy for the suffering of another, and the desire to relieve that suffering.” What does that have to do with engineering? Simple! One of the things that engineers can choose to do in life is to look for and try to relieve suffering where they find it. Perhaps it means replacing an ancient water supply system that is leading to disease in some tiny village, or designing a communication system to protect seniors with illnesses, or designing prosthetic devices for crippled children. Even if we do not decide to make the relieving of suffering the focus of our life’s work, it is still critically important to our fullness as a human being that we feel compassion for the suffering. It is a part of the education that we hope you acquired at Santa Clara.

Chapter 9

Conclusion

State what you learned from your work. In this section:

- Summarize what you did. This can be viewed as the evidence.
- State what you learned (the actual conclusions that you are drawing), and relate them to the project objectives.
- List the advantages and disadvantages of your work. In what ways is your solution deficient or lacking? You are not divulging a weakness in your work when you state problems that still remain.
- State directions for future work and list any open problems.

Chapter 10

Acknowledgments

Acknowledge the contributions of the sponsor, university staff, other students, faculty, and other persons who were of assistance. This section is optional.

Chapter 11

References

You must include a list of references that you cite to support facts that are not common knowledge or expert opinions that you include in your report. In general, it is better not to use a bibliography of sources consulted for general background knowledge; instead, make a habit of citing the sources that you actually use. The format of the citations (which appear within the body of your report), and the format of the list of references (that appears near the end of the report, just before the appendices) should follow the guidelines described by the library.

Chapter 12

Appendices

Include complete source code listings, logic diagrams, parts lists, parts layout, data tables, background calculations, and other information needed for completeness, but would bog down the discussion in the body of the report.