Software Ethics Course Proposal

A Technical Report submitted to the Department of Computer Science

Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Computer Science, School of Engineering

By
Steven Yi
May 11th, 2021

On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

Signature _____ Date _____
Steven Yi

Approved _____ Date _____
Dr. Mohammad Mahmoody, Department of Computer Science

Software Ethics Course Proposal

Technical Project as part of UVA CS Capstone

Steven Yi
University of Virginia
Charlottesville, VA, USA
scy9vs@virginia.edu

ABSTRACT

Cybersecurity and privacy systems can be a double-edged sword, and both benefitting society and enabling behind-closed-doors criminal activity. I propose a course that would teach students about the ethics of security and privacy software technologies. Previous courses have noted general ethical dilemmas in software, especially as it pertains to privacy; however, there is no course that focuses purely on software ethics. The main purpose of this course will be to increase awareness of possible ethical dilemmas. While course material will focus on security and privacy software, it may also include case studies on autonomous vehicles, AI models, and other software systems. The course will help increase ethical awareness, which has been noted to be de-emphasized in American engineering education.

1 Introduction

Computer science technologies aren't inherently moral or immoral, and they are especially notable in cybersecurity. Technologies used to protect users' data can also be used to hide criminal activity from law enforcement in a way that is theoretically inaccessible without direct assistance from the party in question, which could impede legal investigations. Although there are classes to address engineering ethics as well as class time in some CS classes, there is no regularly offered CS course that covers engineering ethics.

Todo: address "culture of disengagement?"

2 Related Work

There are courses that address ethics, at least within the UVA Bachelor's of Science in computer science degree path. Additionally, there are some computer science courses that address ethics in some form. However, there is no regularly scheduled course that specifically focuses on software ethics.

2.1 STS 4600

STS 4600, subtitled "The Engineer, Ethics, and Personal Responsibility," is perhaps the class at UVa that is the closest to the desired software engineering ethics course. According to the syllabus of my own STS 4600 class, the class is designed to develop "an understanding of professional and ethical responsibility." [1]. This class is well-designed; however, it is only available to students studying under the School of Engineering and Applied Sciences, and it thus unavailable to computer science majors or minors in the College of Arts and Sciences. Additionally, the course is more geared towards all engineering undergraduate students and consequently does not focus solely on computer science-related topics.

2.1 CS 3710

CS 3710, subtitled "Introduction to Cybersecurity," addresses some of the desired topics in computer science. It also has a lesson dedicated to software ethics, focusing on ethical frameworks as well as both theoretical and actual moral issues in cybersecurity. Some lessons on the technical aspects of cybersecurity also have dedicated slides and time for software ethics. While it does bring up ethics, since the class is designed to teach the technical aspects of cybersecurity, the class draws more focus to the technical aspects, with ethics as an important, but secondary, topic. There are also many more topics beyond cybersecurity that are worth discussing in a more ethics-focused class.

The course I am proposing is aimed at fixing these by drawing more focus to the ethical dilemmas behind software. The course will also draw on additional topic matter, such as from CS 4501—Privacy in the Internet Age.

4 Course Design

The course proposal deliverable has three distinct parts: a syllabus outlining the course and course logistics, a week's worth of class material, showing both introductory material and an example case study, as well as an assignment based off of the case study.

4.1 Syllabus

The syllabus outlines basic expectations for the class. As a software ethics class, the stated goal is to develop an ethical mindset specifically in computer science and software engineering disciplines. In addition to describing the already prepared material

representing a week's worth of lecture material and a take-home assignment, the syllabus also describes topics that would be explored, as well as the potential for a semester project where students prepare their own case studies.

The syllabus established prerequisite classes. As the class aims to cover a wide variety of computer science topics, I deemed it impractical to require CS courses that cover all of the topics. Instead, I opted to design the course material so that each topic has dedicated time for at least a high-level explanation. Since this covers material enough to facilitate a well-informed discussion, it did not seem necessary to have a more in-depth knowledge; therefore, no special prerequisite classes beyond CS 2150 were needed.

4.2 Lecture Material

The course presentations are organized in a way most fitting to two 75-minute sections per week. The first presentation is more designed as a "first-week" topic, setting the stage and developing frameworks that will be used throughout the rest of class.

4.2.1 Ethical Frameworks. The first presentation is, as previously stated, geared towards "setting up" important models and frameworks of thought that will be greatly useful for analyzing cases and topics that are further discussed in class. The most important "tool" is ethical frameworks. Adapted from CS 3710, I chose to include four frameworks: utilitarianism, consequentialism, virtue, and deontological. While other ethics classes, such as STS 4600 also included other ethical frameworks, I chose to only include those four frameworks, as I chose the ones that I believe that are most applicable to software engineering and cybersecurity. In addition to describing the ethical frameworks, I thought it was important to point out that society can often be too complicated to use a single ethical framework in a situation, so I also encouraged students to mix frameworks, using more than one framework to justify whether something was ethical or not.

4.2.2 Case Study: Tor. The second presentation is an example of a case study, which establishes a basic framework by which other cybersecurity or computer science topics are analyzed. For this example, I chose the Tor browser, which is an overlap in material between CS 3710 and CS 4501. First, Tor is explained from a technical standpoint, so that students will gain a high-level technical understanding of how Tor works as a system. I opted for a high-level explanation, leaving out more technical, code or theory-level details, as I aimed to strike a balance where students would learn enough information to make a decently well-informed decision, but not overwhelm the lecture and "crowd out" capacity for ethical discussion. Once this is complete, the course material shifts to discussion. In the discussion, the frameworks are brought back up, or at least encouraged to be used in discussion. While the technical explanation followed by the ethical discussion looks very similar to the slides for Tor in CS 3710, I hope to draw more focus and invest more class time in the discussion portion. After the first discussion, the presentation has more details on the possible controversy, including Tor's imperfections, showing that it may not be the theoretically "perfect" secure anonymity system. After explaining that, the presentation returns to the discussion, factoring these new caveats into the discussion.

4.3 Assignment: Tor Exploration

The final portion of the week of course material is a take-home assignment. I figured it would be best to make the assignment related to some of the lecture materials. The purpose of the assignment is to give hands-on experience for the students. At least in the example of Tor, this is relatively straightforward. The assignment has the students explore Tor on their own, with the intent of proving its relative ease of use (for the most part, it functions like a normal web browser) and built-in anonymity features. The students also explore Tor-specific features, such as hidden services.

After the students use Tor, the assignment has students write a brief reflection and analysis of how their experience was, and whether it changed their opinion on whether Tor is ethical or not. Due to uncertainty about the eventual class size (and the ratio of professors/graders to students), I opted to request smaller, shorter reflections from the students to reduce workload on graders. However, if possible (with a smaller class), longer, more thought-out reflections may be desired from the students.

5 Conclusion

To address inadequate ethical education in engineering, I proposed a course to study ethical dilemmas specifically in software engineering. Combining ethical frameworks discussed in CS 3710 with material in CS 4501—Privacy in the Internet Age brough a focus to cybersecurity topics. Using a similar course model to STS 4600, I can arrange class time to direct focus more towards the ethical discussion rather than the technical aspects.

7 Future Work

In terms of future work, there are a few paths to continue down that would help complete a semester's worth of class work. The case study on Tor was just an example of what a case study-type lecture could be. In addition to adding more cases, I would like to expand into different class structures that could lead to more interesting discussions. The class would likely be repetitive and prone to student disengagement if each lecture on a topic was always structured with technical explanation followed by classroom discussion; consequently, I see a need for variation in course structure.

Beyond that, I also would like to see different topics covered. In the syllabus, there were many topics beyond cybersecurity and anonymity systems, such as AI usage and "big data." If given more time, I think it would be productive to expand on these topics and attempt to produce lecture material discussing ethical issues surrounding these topics and many more.

REFERENCES

[1] Erin A. Cech, 2014. Culture of Disengagement in Engineering Education? *Science, Technology, & Human Values* 39, 1 (2014), 42-72. DOI:http://dx.doi.org/10.1177/0162243913504305