Thesis Project Portfolio

Gamification in Education: Proposal for Gamified Learning Tools in Computer Systems and Organization Courses

(Technical Report)

Racing to Warfare: The Sociotechnical Evolution of FPV Drones in Ukraine

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

Heru Avila

Spring, 2025 Department of Computer Science

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Executive Summary

This thesis portfolio consists of two very different topics that, while not related closely on the surface, are related through my own values of worldliness and the desire to know more about the world around us. My technical topic is on gamification in computer science education, specifically, computer science undergraduate courses such as computer systems and organization (CSO). My STS research paper is on the sociotechnical evolution of FPV drones from hobbyist racing tools to combat weapons in Ukraine. While my technical research topic is in line with my major, my STS research topic is a step away from it, focusing on military technology and current events. This shift in topics represents my desire to understand not just the intricacies of my line of study, but also the world around me and the context that surrounds my life. It is my belief that only by understanding the world around us can we start to take the proper actions to make the world a better place. It is this belief that inherently connects my two research topics..

My technical research paper is a proposal for an application that gamifies computer science topics taught in undergraduate computer science courses, specifically CSO. The rationale behind this proposal was the level of difficulty and speed that certain topics are taught within CSO. With students required to learn difficult topics in a short timeframe, they are forced to choose between deeply learning and understanding the topic and optimizing for quizzes and homeworks. My proposed solution, based on previous research done on gamification in education, is to gamify some of these topics to supplement the student's learning to help their understanding and retention of the material. Because this research project is simply a proposal, there are only expected results. Some results that are expected from this application are faster learning speeds, better retention rates, and increased motivation to learn. The next steps for

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research into this topic are to implement this application and then conduct a study on its efficacy to match expected results to experimental results.

My STS research paper was based on the widespread use of FPV drones as weapons in Ukraine. The question I sought to answer was: what factors have driven the sociotechnical evolution of FPV drones from hobbyist racing tools to frontline combat weapons in Ukraine? Based on my research and the evidence I found, I determined that, through the Social Construction of Technology framework, battlefield necessity, civilian and open-source contributions, and full-scale military implementation were the factors that drove the sociotechnical evolution of FPV drones in Ukraine. It was the combination of these factors that allowed FPV drones to undergo such a rapid transformation. Battlefield necessity and open-source contributions opened the meaning of FPV drones through interpretive flexibility and full-scale military implementation provided closure to FPV drones as weapons. However, all of these factors stem from the needs of relevant social groups for solutions to their problems. While this has allowed FPV drones to become weapons and a solution to Ukraine's material disadvantages, it also opens the door for it to change again. What is now viewed as a key technology for warfare in Ukraine could become obsolete if counters to FPV drones are found.

The work that I have done this year is something that I believe I can be proud of. While my technical research project is simply a proposal for an application, I believe it has the potential to do genuine good not only for undergraduate students but anyone who is trying to learn computer science. However, I am completely satisfied with my STS research project and believe it is a fine addition to the literature on FPV drones as weapons as well as how a sociotechnical evolution such as the one that FPV drones underwent can occur. This does not mean, however, that I have completely covered the topic of FPV drones in warfare. My research is fairly

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superficial due to the page limit of the paper, meaning that there are still large gaps to fill in the literature. Along with this, my research is on volatile current events where the situation can change rapidly, requiring new and up-to-date research in the future. So, while my research provides a good starting point at this point in time, more research should be done as the sociotechnical situation evolves.