

Thesis Project Portfolio

Optimizing Office Hours in Computer Science Through Data Analysis
(Technical Report)

Y2K and the Transformation of America's Tech Workforce: An Analysis of the H-1B Visa Expansion
(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

Nikhita Guntu
Spring, 2025
Department of Computer Science

Table of Contents

Sociotechnical Synthesis

Optimizing Office Hours in Computer Science Through Data Analysis

Y2K and the Transformation of America's Tech Workforce: An Analysis of the H-1B Visa Expansion

Prospectus

Sociotechnical Synthesis

Automation and Immigration: How Technological Demands Reshape the Tech Workforce

The relationship between technical work and immigrant labor policy is shown in the response to the Y2K bug and subsequent expansion of the H-1B visa program in the United States. The technical project focuses on software automation in satellite systems, which demonstrates how repetitive engineering tasks can be streamlined through scripting and software deployment. The STS research investigates the broader historical and policy driven labor shifts in the American technology sector. While the two projects are distinct, they are unified by the central theme: the evolving role of labor in response to technological demands. The Y2K crisis exposed important vulnerabilities in legacy systems, which prompted an unprecedented mobilization of global IT talent, particularly through the H-1B visa program. This was a turning point in globalization of the U.S tech workforce. In parallel, modern automation solutions like those developed in the technical project, raise questions about the future of labor intensive jobs. Both these topics provide insight into how technical innovation and policy decisions evolve together, while shaping the workforce demographic, labor values and political response to technological change.

The capstone project focused on analyzing and optimizing computer science office hours using real world data from two University of Virginia undergraduate courses. The data consisted of timestamps, session details and students enrolled in a CSV file. The project aimed to evaluate whether group sessions improved wait and help times during office hours. Through data analysis, it was revealed that in lower-level courses, group sessions marginally reduced the time students spent receiving help from the teaching assistant. However, in higher level courses, group sessions had little to no correction, and in some cases increased wait times. This trend suggests

that as courses get more difficult, the specificity of students' needs vary a lot more. This reduces the effectiveness of group-based assistance. The project also incorporated literature review comparing virtual and in-personal office hours models and explored other tools that integrated remote assistance. Overall, through this project, it was found that a more tailored approach to office hours based on course level and student needs is more supportive. The project highlights the potential for data-driven improvements in academic support . It also raises questions about scalability, personalization and equity in student-faculty interaction within technical education.

The STS research paper analyzes the transformation of the U.S technology workforce demographic through the lens of the Y2K crisis and the following expansion of the H-1B visa program. It examines how the urgency of the Y2K bug exposed a critical labor shortage in the tech sector, which promotes a temporary increase in the H-1B visa cap. This enabled the recruitment of thousands of skilled foreign workers, partially from India and China. Drawing on the Social Construction of Technology (SCOT) framework, the paper explores how various social groups such as policymakers, corporations, foreign workers and domestic labor, shaped the role of the H-1B visa over time. The paper argues that while the program addressed short-term technical needs and contributed to innovation and diversity in the workforce, it also introduced long-term challenges, including labor market segmentation, wage suppression and political volatility. The research shows how the immigration policy became a way to meet economic demand while reflecting socio-political tension around globalization, domestic labor and equitably in tech employment. By considering the H-1B visa within a broader socio-technical landscape, the paper is able to delve into the relation between technological changes, labor policy and the evolving skilled work demographic in the U.S. tech industry.

Working on both the technical and STS project offered a deeper understanding of how technology advancements intersect with workforce dynamics. The technical aspects, which involved automating software processes and analyzing how office hours could be optimized, highlighted how efficiency and innovation are often pursued through solutions that reduce the need for humans. On the other hand, the STS research provided a broader historical context for how the U.S has responded to labor shortage in technology, specially through policy interventions such as the H-1B program during the Y2K crisis. When examined together, these projects show how the push for innovation and efficiency often reshaped the labor force, by importing talent or reducing future labor needs through automation. The technical work allowed for reflection on the consequences of automation, and the STS research contextualized these consequences through the decades of policy decisions and market responses. This dual lens helped establish that technical systems are never neutral and are shaped by social, economic and political structure in a consistent cycle. Both of these projects have allowed for a more comprehensive and better understanding of forces driving change in the tech industry today.