Engaging Students through Community Projects: Impact of Student-led Software Teams on Nonprofit Organizations

Arthur Pachachura, Vedansh Patel
Engineering Projects in Community Service (EPICS)
The Jonsson School of Engineering and Computer Science
The University of Texas at Dallas

The University of Texas at Dallas' Engineering Projects in Community Service (UTD EPICS) is a class where undergraduate students work in multidisciplinary teams that design technical solutions to problems faced by nonprofit organizations in the community. One such project, Trusted Inventory, allowed a growing nonprofit, Trusted World, to adapt to an increasing demand for their services while providing students with technical experiences relevant to their future careers.

Problem to Project

Trusted World is a 501(c)(3) nonprofit organization whose mission is to provide resources, such as food, clothing, and personal hygiene products, to other nonprofit agencies at no cost. Unlike organizations that rely on case managers to provide support to individuals, Trusted World connects donated goods to communities in need by leveraging workers in various agencies, including police stations, schools, and shelters. Although Trusted World once acted as a small community-focused relief operation based solely in Dallas, Texas, the organization is, at the time of writing, assisting 308 clients from 56 cities in the United States.

With a desire to become "the Amazon for nonprofits," Trusted World reached out to UTD EPICS in 2017 with a project: build an inventory system that would be able to keep track of millions of items and thousands of orders across dozens of donation centers, all while employing human-centric design principles to streamline Trusted World's processes. The team was asked to design and implement 1) a database and application programming interface (API) to support Trusted World's operations and 2) provide an administrative user interface to interact with the backend system.

After over 1,800 hours worked by 17 students in the EPICS class over five semesters, Trusted Inventory was released on August 1st, 2019. As of January 1st, 2020, Trusted World used Trusted Inventory to fulfill 1,811 orders containing 175,478 items, including 135,579 meals, valued at an estimated total of $270,133.95.

The EPICS Approach

UTD EPICS runs on a combined lab-lecture approach where students attend one hour of guided classroom study and one hour of lab, supported by their client and technical mentors.

The classroom portion of EPICS focuses on elements of engineering relevant to projects, covering concepts such as the design process, ethics, professional communication, project management and leadership. Students learn how to apply engineering practices toward the design of community-based projects as well as fundamental interpersonal skills. Overall, lectures help students view engineering as "part of a greater process" and not an isolated field of study.

During lab hours, student teams work to design and develop a product for their client. Both the client and one or more technical mentors assist the team by providing feedback and clarifying project requirements, increasing the confidence students have in their solutions. Teams with consistent access to their client and mentors have been more successful at achieving their semester goals than those with limited access.

Impact on Students

In the Trusted Inventory project, students performed user research then designed, documented, developed, and deployed a solution to the problems faced by Trusted World. For the first two semesters, students performed hours of user interviews and analyzed Trusted World's daily operations. Two fundamental issues were

identified by the team. First, Trusted World staff utilized multiple systems to complete common tasks, leading to inefficiencies and inaccuracies in data entry and analysis. Second, the existing systems limited administrators to analyzing data from only one warehouse at a time. Because other commercial solutions were unreasonably expensive and did not fit Trusted World's needs, these issues required students to consider bespoke solutions to the problem.

In the following semesters, students implemented Trusted Inventory, a web and mobile application with an associated API that was designed exclusively for Trusted World and its future licensees.

Students in all semesters learned how to communicate with a client, establish requirements, and determine deliverables based on client input. Similar to a real-world engineering consultancy firm, students were exposed to project management and direct client interaction while being required to actively contribute to the project's progress.

Students had the opportunity to work in a fast-paced Agile software lifecycle, releasing product updates and features as often as every week, and were expected to spend at least three hours per week on the project outside of class. In doing so, team members developed time management and interpersonal skills through hard deadlines, presentations, and weekly commitments. The Trusted Inventory project was not only many students' first introduction to the software industry, but also led to several successful engineering internships.

Impact on Trusted World and the Community

With the Trusted Inventory system, Trusted World has been able to increase the number of unique items inventoried, maintain a multi-state order flow, and implement a more efficient sorting process.

Trusted World is known for being able to provide resources to individuals with unprecedented granularity. For example, if a client orders Men's Pants with a waist size of 32, Trusted World delivers with consideration for the person's sizes, living conditions, age range, and color preference. In order to do so, Trusted World must maintain inventory of each separate size ("Men's Pants 32") in addition to the item ("Men's Pants"). Since Trusted Inventory launched, the number of uniquely inventoried items increased from 448 to 1159, a result only possible with the flexibility provided by the system.

Trusted World is now able to actively track the status of all orders from time placed through delivery with the help of Trusted Inventory. Active and accurate tracking ensures that all orders are fulfilled in a timely manner and allows management to efficiently allocate volunteers. In addition, clients benefit from faster order fulfillment and a wider range of available items.

Michael Garrett, CEO and Founder of Trusted World, reflected on the project: "being involved in the [development process] … helped create a system that increased efficiency" of daily operations and administrative tasks. In contrast to the previous process, volunteers can now quickly complete tasks by performing simple changes on their mobile devices. In addition, Trusted World staff are now able to more completely understand and visualize the state of their operations through specialized reporting functions.

Summary

By working on mission-critical projects for nonprofits, students are able to engage with the community while learning personal and interpersonal skills. Trusted Inventory is a successful case study of a combined lab-lecture approach with direct student-client interaction that increased efficiency of a nonprofit organization and helped prepare students for future careers in industry.

Acknowledgements