Cyberlearning Environment Design for Engineering Education

The Problem

Engineering students are often tasked with designing and managing multiple concurrent abstract tasks without any decision support tool to effectively guide and track their progress. Additionally, current limitations of natural resources make it necessary that students be taught about sustainable life cycle engineering.

The Question

What is the effect of user interface design and augmented reality on the user experience of pedagogical engineering web applications and students' comprehension of subject material?

The Method:

User Interface Design & Augmented Reality for S-PASS

Our study particularly focused on transforming the current static learning environment of the Sustainable Product Architecture and Supplier Selection (S-PASS) tool into a more dynamic learning environment to promote engineering students' learning for sustainable life cycle engineering. Employing user interface design and augmented reality, we developed two enhanced versions of the S-PASS tool, 1) web-based without augmented reality and 2) web-based with augmented reality. We hypothesize that when the current version and the new versions of the S-PASS tool are evaluated by undergraduate and graduate STEM students using pre- and post-user experience surveys along with eye tracking, that it will become apparent that the more dynamic learning environments improve students' tasks and learning performance.

Redesigned flowchart

Web development

Redux — **Redux-Store** Single source of truth

React — **React** Dynamically renders content on the page. Handles user interaction

A-Frame Allows for augmented overlay of a marker

Data / Update / Render

Wireframes

Augmented reality demo:

Scan the QR code with your mobile device, then point your camera at the "Hiro" marker. (Not compatible with iOS 10 or older.)

Website

Future work:

User Testing—Perform user tests with System Usability Survey (SUS), pre-evaluation, post-evaluation, and eye tracking

Virtual Reality—Further develop the S-PASS module to implement virtual reality (VR) and examine the effects of VR on higher engineering education.

Areas of application:

In addition to this project's application within the CooL:SLiCE platform, these results are valuable for commercial and government organizations for informing the design of current and future pedagogical tools.

Thrust area:

Visualizing and prototyping

Project type:

Current

Deliverables & benefits:

We have delivered a working prototype of the S-PASS tool and information architecture for the CooL:SLiCE website. The user interface design on the S-PASS has been dramatically improved and also makes use of augmented reality as a learning tool for product manufacturing design.
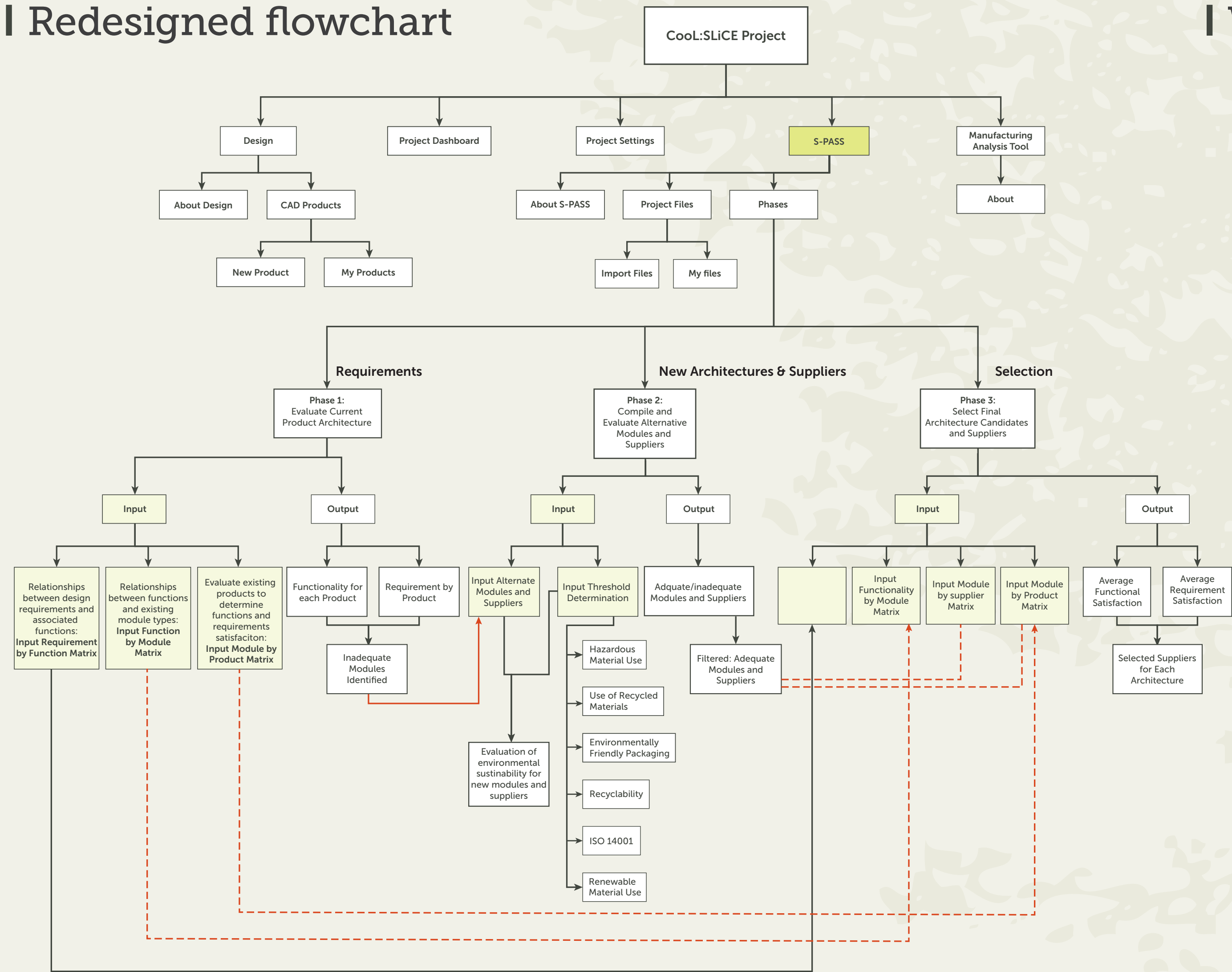
Current state of research:

Sustainability tools and methods are lacking; moreover, the interdisciplinary nature of sustainability makes it too complex for any single discipline to cover.
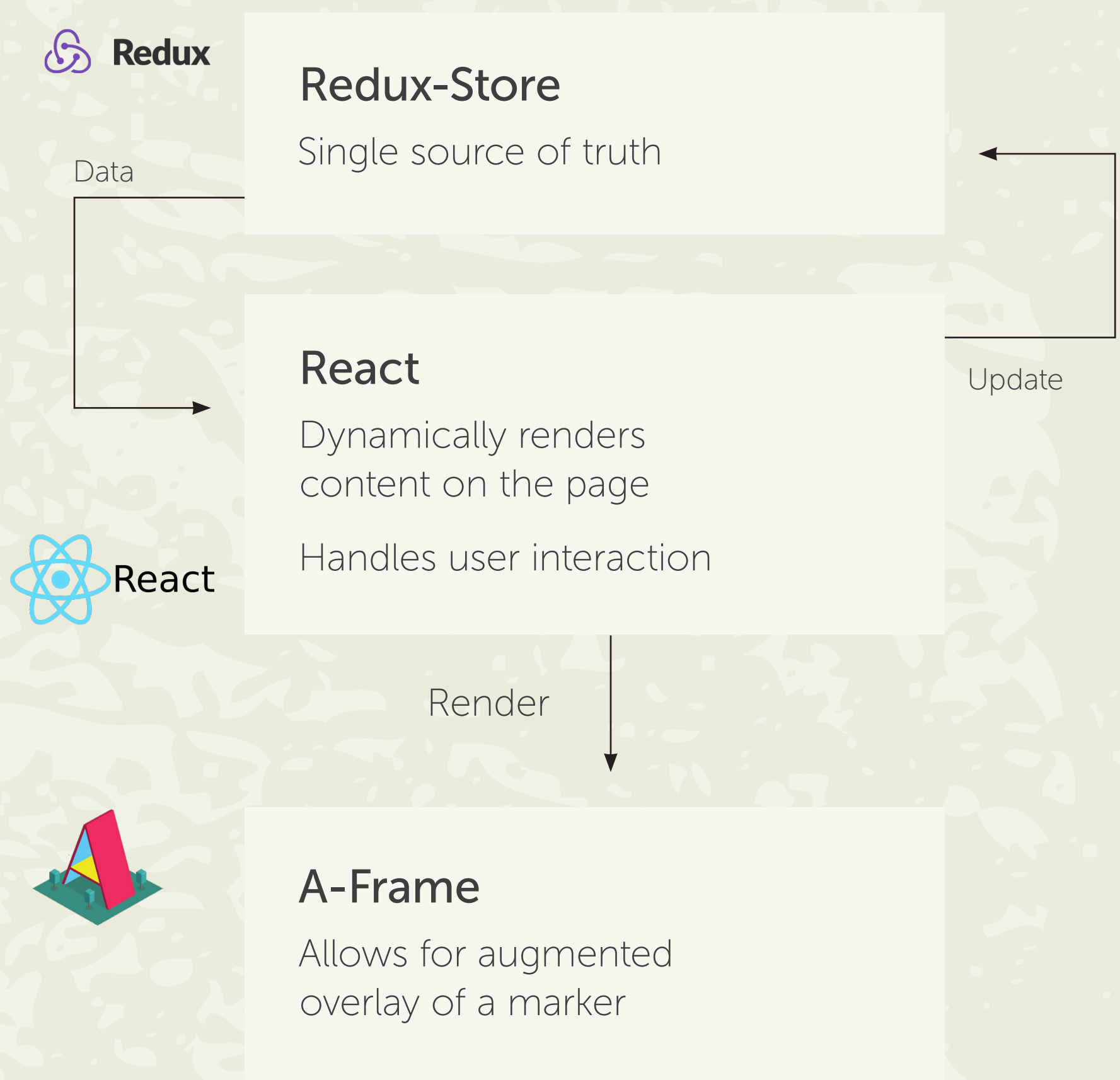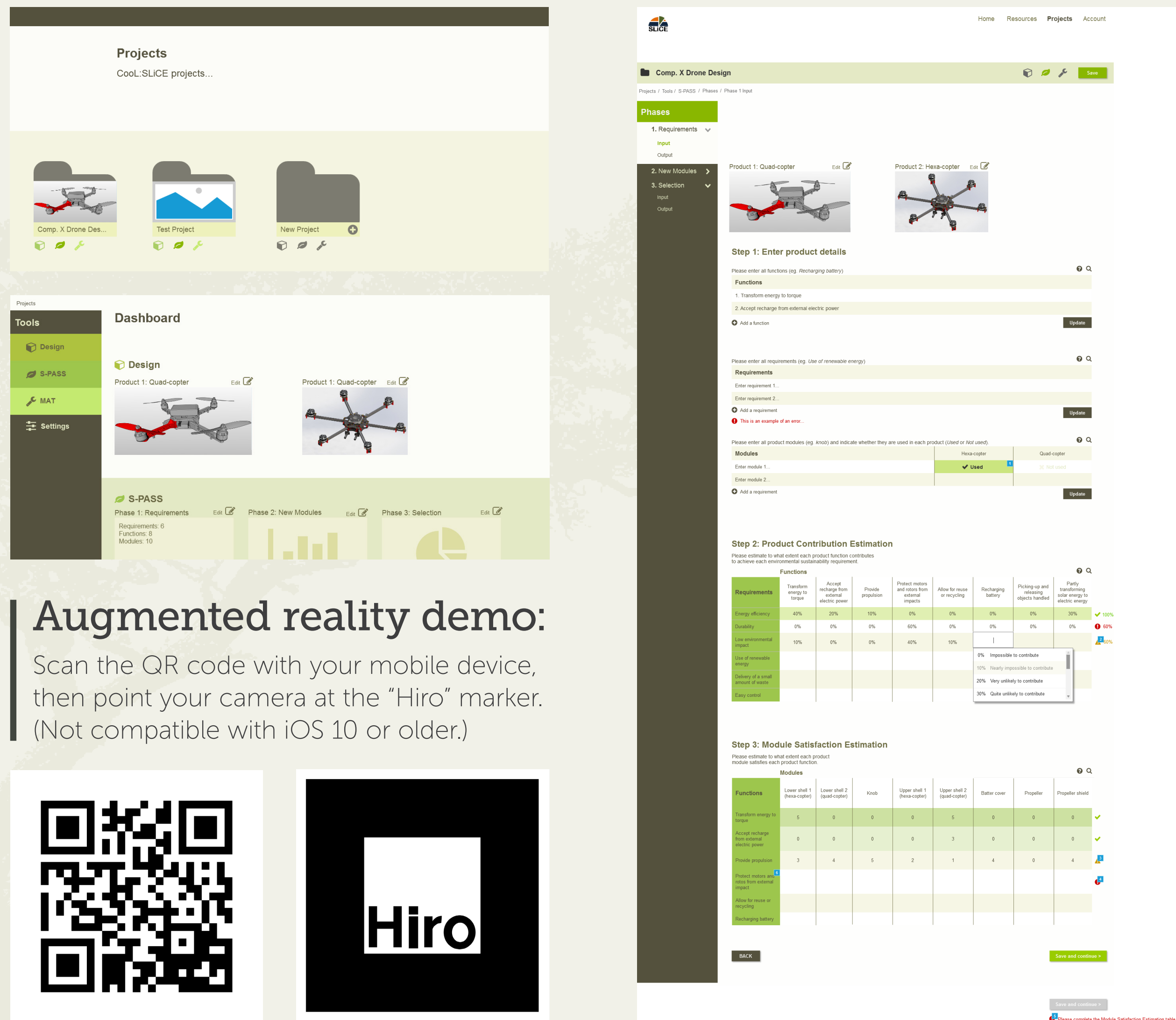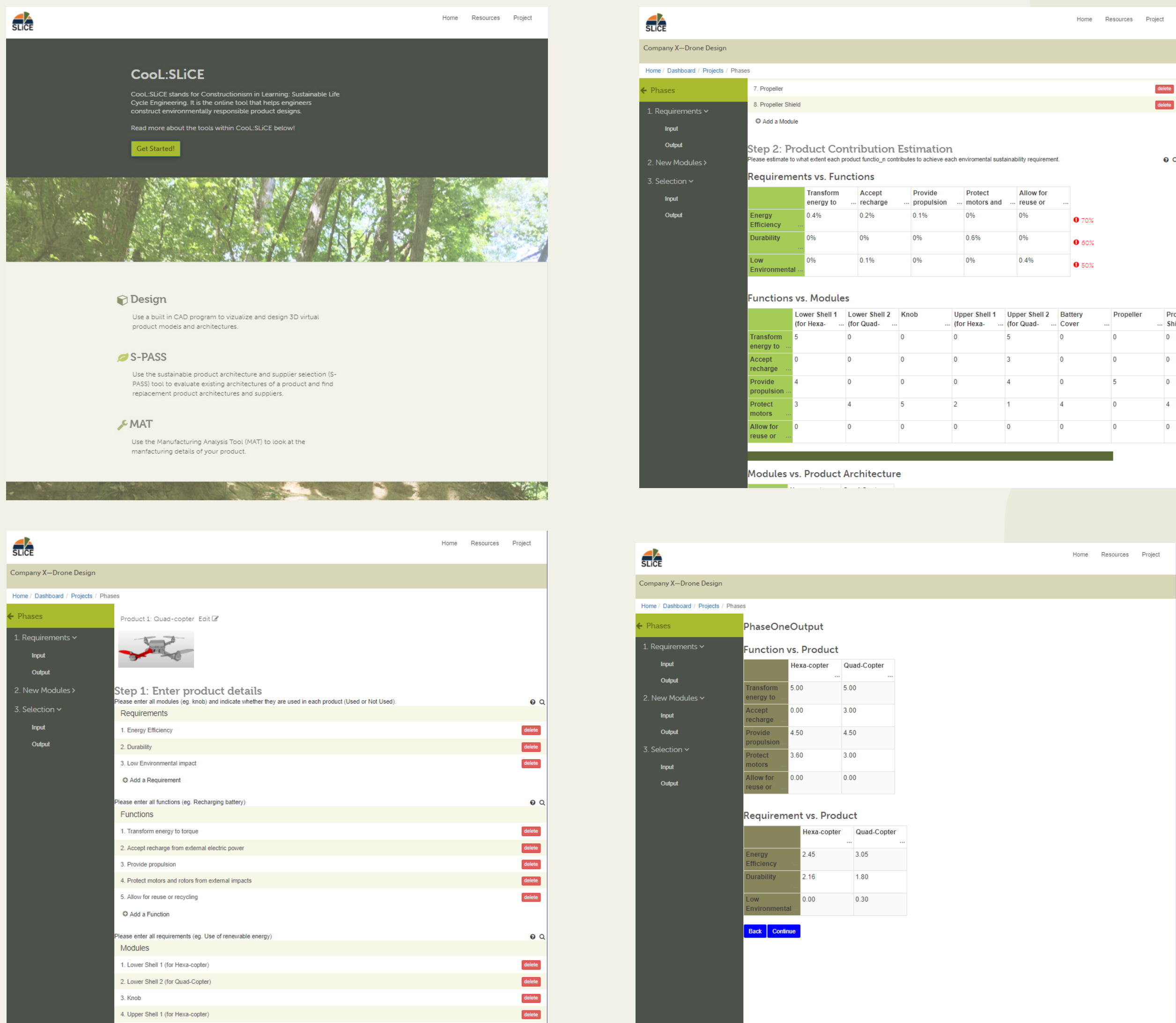
Percent complete:

20%

Industrial relevance

Promoting undergraduate learning for sustainable life cycle engineering.

This research effort has expanded on the development of the cyberlearning platform Constructionism in Learning: Sustainable Life Cycle Engineering (CooL:SLiCE). Specifically, it has focused on transforming the current static learning environment of the Sustainable Product Architecture and Supplier Selection (S-PASS) tool within CooL:SLiCE into a more dynamic learning environment.

This project:

Informs user interface design for cyberlearning environments

Informs research on augmented reality in higher education

Facilitates sustainable life cycle engineering in higher education

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