

4 Design

4.1 Design Context

4.1.1 Broader Context

Describe the broader context in which your design problem is situated. What communities are you designing for? What communities are affected by your design? What societal needs does your project address?

List relevant considerations related to your project in each of the following areas:

Area	Description	Examples
Public health, safety, and welfare	How does your project affect the general well-being of various stakeholder groups? These groups may be direct users or may be indirectly affected (e.g., solution is implemented in their communities)	Cybersecurity is a rising concern of many people. We will have a secure application for the users and their accounts.
Global, cultural, and social	How well does your project reflect the values, practices, and aims of the cultural groups it affects? Groups may include but are not limited to specific communities, nations, professions, workplaces, and ethnic cultures.	Make sure that students actually learn the content for the class and don't cheat their way through it.
Environmental	What environmental impact might your project have? This can include indirect effects, such as deforestation or unsustainable practices related to materials manufacture or procurement.	Make sure the server doesn't take up too much energy. Eliminates use of paper for the course and helps stop deforestation.
Economic	What economic impact might your project have? This can include the financial viability of your product within your team or company, cost to consumers, or broader economic effects on communities, markets, nations, and other groups.	Make sure the server doesn't take up too many resources that would require more money than needed.

4.1.2 Prior Work/Solutions

Include relevant background/literature review for the project

– If similar products exist in the market, describe what has already been done

Zybooks and Canvas Quizzes are similar products. They are autograding homework and quizzes. Also other prairielearn classes.

Online classes or textbooks often have accompanying software that also contains online autograded materials. One can expect there to be an online provider, pre existing generated assignments, assignment due dates and visibility properties, assessment functionality, user profiles or account, different user privileges, grading exporting, and technical assistance.

– If you are following previous work, cite that and discuss the **advantages/shortcomings**

One of the advantages is that PrairieLearn provides an example class and some examples of how a question is set up.

PrairieLearn has good documentation for setting up a new project and iterating upon it. PrairieLearn also has an active community for technical assistance. PrairieLearn has its own hosting services that include distribution, deployment, data storage, and tight security. PrairieLearn allows the instructor to create their own questions and define how they are graded. This is an advantage because the instructor can tailor the assignment and assessments for the class.

One shortcoming of working from previous prairielearn classes is that there is not much documentation or ways of seeing how the other the classes work.

A Lot of the shortcomings stem from not using PrairieLearn’s hosting services as native run applications are not supported. This is because the client does not want to pay for PrairieLearn’s hosting services.

– Note that while you are not expected to “compete” with other existing products / research groups, you should be able to differentiate your project from what is available. Thus, provide a list of pros and cons of your target solution compared to all other related products/systems.

Detail any similar products or research done on this topic previously. Please cite your sources and include them in your references. All figures must be captioned and referenced in your text.

<https://www.prairielearn.org/>

<https://canvas.iastate.edu/>

<https://www.zybooks.com/>

PrairieLearn allows the instructor to create their own questions and define how they are graded. This is an advantage because the instructor can tailor the assignment and assessments for the class. PrairieLearn can be hosted natively thus not requiring the payment for hosting.

4.1.3 Technical Complexity

Provide evidence that your project is of sufficient technical complexity. Use the following metric or argue for one of your own. Justify your statements (e.g., list the components/subsystems and describe the applicable scientific, mathematical, or engineering principles)

1. The design consists of multiple components/subsystems that each utilize distinct scientific, mathematical, or engineering principles –AND–
2. The problem scope contains multiple challenging requirements that match or exceed current solutions or industry standards.

To allow for a wide range of access the application will be accessible from the web. We are responsible for ensuring the servers public or university specific availability through the internet. The application will require the storage of user account information. This will need a database and security for sensitive information. The professor wants to be able to edit the assignments. We need to document the editing process for other teams and make a modular design to support it. The application needs to be secure so students can not find answers in the front end. We need to build a front end application capable of displaying questions and gathering user input that is dynamic and changes.

4.2 Design Exploration

4.2.1 Design Decisions

List key design decisions (at least three) that you have made or will need to make in relation to your proposed solution. These can include, but are not limited to, materials, subsystems, physical components, sensors/chips/devices, physical layout, features, etc. Describe why these decisions are important to project success.

We decided to host the PrairieLearn server on our own instead of using PrairieLearn's paid hosting option

We are going with simple questions to allow for a greater variety of questions. This also speeds up the development of questions. The client can also see more prototype questions and iterate on them. The UI for the questions will be in html, and either JS or python scripts. This is a simple methods that has a lot of information available leading to an easy development.

We will be running PrairieLearn through a microservice tool such as docker. This simplifies the deployment and building of the project.

We are going with the database postgres that is built into the PrairieLearn container. This elements a lot margins of error that could lead to a security risk and speeds up development time.

4.2.2 Ideation

For at least one design decision, describe how you ideated or identified potential options (e.g., lotus blossom technique). Describe at least five options that you considered.

Design Decision: data storage implementation

- 1. PrairieLearn container's native database implementation**
- 2. Official ISU database servers**
- 3. Deploy a MySQL server**
- 4. Integrate a 3rd party database service**
- 5. Canvas**

Design Decision: Hosting

- 1. Host our own PrairieLearn server**
- 2. Let PrairieLearn host our course**

4.2.3 Decision-Making and Trade-Off

Demonstrate the process you used to identify the pros and cons or trade-offs between each of your ideated options. You may wish you include a weighted decision matrix or other relevant tool. Describe the option you chose and why you chose it.

When deciding where we wanted to host our course, we wanted to make sure that it was time and cost efficient. After also deciding that we want a project to be long term, easily manageable and be able to oversee everything. Then receiving information from our client that PrairieLearn will charge for hosting a

course due to demand, we decided on cost efficiency being more important. So ultimately we decided to host our own PrairieLearn server which will take more time to configure and deploy but in the long run not cost us anything and be able to be independent from the PrairieLearns' servers if any issues arise.