System Architecture Document
Team 7

CS 499: Senior Design Project

University of Kentucky

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Introduction

Customer

Our customer is Ms. SK O'Brien, Assistant Professor, designer, and artist for the University of Kentucky's Department of Product Design. She teaches some classes in the College of Design and is our main point of contact.

Necessity

- Our web-based application provides Students and Professors alike in the Product Design Major with a strong learning/data resource. Our product allows students to practice learning assessments consisting of matching games, fill in the blanks, and quizzes, as well as providing teachers with a database of information about the history of Product Design.
- This application serves as an open-ended database, allowing future users to enter/alter information within the database and create more user experiences for students and professors. The database will contain the current expansive history of Product design, from the beginning of what we know of product design to current era. It also will be a visually enhanced experience, emphasizing the visual aspect of lessons.

Target Users

Our focus is on the students, professors, and information specifically within the Product Design Major. For students, we want to provide students with ways to learn about the history of Product Design, testing their recalling abilities with matching games and fill in the blanks while providing a cumulative assessment of quizzes to solidify this knowledge.

Background

The Product design major is a fresh major recently added to the University of Kentucky. Being fresh, the major has little to no supporting resources compared to other, further solidified majors at the university. Many big majors at the University of Kentucky have resources such as McGraw Hill for Business and Marketing, that aid in providing students with readings and assignments in one big area to teach students accordingly. With the absence of this aid in the Product Design Major, it was our opportunity to act.

With our application, the product design major will have a technological resource to aid in the teaching of students and saving time and resources with professors.

Differentiator

The competition of our product can be directly compared to other resources such as McGraw Hill, Duolingo, and Quizlet. The one thing these products have in common: the lack of visual learning. Duolingo uses auditory senses and animated characters, but the content itself does not provide a strong visual aspect aside from displaying characters. McGraw Hill provides a textbook and a vast number of questions complimenting the textbook content but relies on the text and language to teach without any sort of visual aid. Our application will feature various forms of visual aids such as images of products, important figures, stationed at the center of the screen or scattered about to match. Variety with visuals is our goal.

Justification

In a world of technology and the transformation of traditional teaching methods, the idea for our product is to design a tool that goes along with this transformation. We do not want another slideshow, a new textbook, or more paper homework and tests, but instead something we can access with what we interact with: our technology. With our technology what do people see? pictures, videos, graphics, unless it's an eBook we can guarantee it will have some form of imagery, hence our focus on the element.

Requirements Overview

Contents

The final product goal is a web application comprised of an open-ended database of the expansive history of Product Design and specific terminology. Users should be able to access the bank of info via flashcards alongside the ability to self-assess retaining the information.

Motivation

Users should feel encouraged to use the application as a study tool and for self-assessment of basic topics within Product Design to not only prepare based on struggling topics but ease the workload of a professor and provide opportunity to cover more content of the major.

Form

- Existing users log in on the main webpage based on whether they are on a student account or admin account. Additionally, new users can sign up on clicking a hyperlink
- Once logged in, the user is presented with a menu page organized based on chapter content, with each chapter providing both flashcards and self-assessment quizzes
- The goal of our Web Based Learning Application is to provide opportunity for quick lessons of Product Design topics and to use as a study tool bank

Formatting for this section is based off Introduction and Goals in the arc42 documentation

User Stories

- As a user who may have visual impairments, I would like to have the option to alter the screen elements such as color, brightness, et cetera, to allow myself to have the optimal experience in accessing the application.

  Acceptance Criteria:

  - The product should have a settings option available at the menu screen that pulls up a sub-menu, allowing the user to change screen color, brightness, and other visual features such as text size.

- As a user who wants to make sure they retain any information learned beyond just within the application, I would like to be able to select the option to participate in quizzes for different topics and subtopics however many times necessary to round out and conclude that I did learn and retain information.

  Acceptance Criteria:

  - The product should offer a “quiz” option at the main menu, which allows

the user to take a short, multiple-choice quiz that tests them on information from flash cards.

- As a user who would like to be able to access this web application on multiple devices, I want the design to be flexible with many different devices available such as a laptop, phone, or tablet for ease of use and mobility of the application.
  Acceptance Criteria:
  - The product should have a flexible screen size and layout, which changes automatically when accessed by different devices with different dimensions.

- As a user who would like to retain information, I would like for the quizzes when accessed each time to be randomized to test my ability to remember and apply information as opposed to remembering a pattern of answers.
  Acceptance Criteria:
  - When a quiz is accessed from the main menu, the questions and answers should be randomized each time.

- As a user who would like to be able to take breaks and get back on track afterwards, I would like for the web application to be able to save user states and be able to track how much material has been covered by each user to keep track of active data.
  Acceptance Criteria:
  - The product should keep information of flash cards and quizzes accomplished by each individual user in the database server, so progress can be tracked throughout sessions, and the user is aware of what they have done so far.

Stakeholders

Stakeholders in the project include both Students and Professors (admins), the Department of Product Design at the University of Kentucky, and future developers of the web application. Below is the contact information of the current developers of the web application:

Name	*Contact*	*Role*
Kevin Ramirez	kjra239@uky.edu	Back-End (Database)
Anthony Lopez	aclo242@uky.edu	Front-End (Graphic Design)
Julian Bottero	jbo231@uky.edu	Front-End (Web Design)
Cooper Jordan	cdjo249@uky.edu	Back-End (Database)

Constraints Overview

Contents

Web app content should be customizable so teachers can provide the class content however they wish. The code should allow for students and teachers to have different permissions, as well as allowing teachers to modify student roles to further manage the class experience.

Motivation

As this project has a limited amount of time to create a fully furnished product, we want to create an application that will allow future developers to modify and add content. At the same time, under the philosophy that this application is to aid both teachers and students, the editability of this application should extend towards these parties as well, with help through our UI.

Form

Technical	Organizational	Political

- Web Application constrained to website-friendly code
- Database accessed through MySQL
	- Any inputted information should go under current existing tables
	  - Important figures under Important Figures table
	  - Products under Products table
	  - Dates and time under Time table
		- Not permitted outside of the University of Kentucky Product Design Department (unless specially permitted)

Solution Strategy

Key Decisions

One of our main decisions is what language we sought to work with on the application. Since the start we were focused on using JavaScript, our most worked with language, to develop our application, allowing for the easiest implementation of an accessible web app. Seeking more flexibility and an easier way to implement an SQL database into our program, we decided using the flask library would help us to use easy python scripts to communicate between the MySQL server and the application.

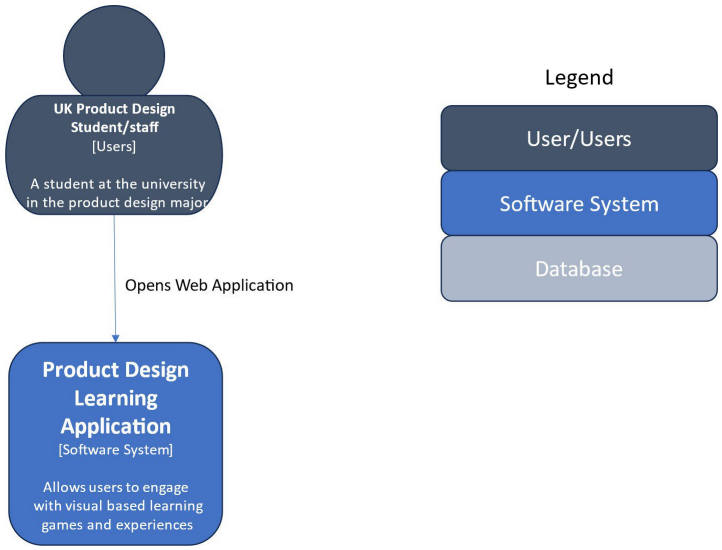
Another key decision highlighted the use of SQL to store key learning information for our application. Our customer was very insistent on being able to detect the relations between certain product design materials, products, and their inventors, so we determined a relational database system would be able to link all those pieces together. Our product will be able to use JavaScript to utilize SQL queries and interact with related entries in our databases to provide a seamless experience for our customers and any future users of the application.

Decomposition

Our application will consist of several different learning opportunities. We plan to implement a reading, flash cards, timeline, and quizzing section of our application. All sections of the application will pull information from the same source, ideally a SQL database containing vast amounts of information. This information will ideally be divided into separate sections, ie: creator, invention, and material sections, all related to each other via SQL key values.

Using the SQL keys to create relations between each of these aspects, we plan to create a consistent, intuitive, and educational environment for the users, as they can easily see how certain aspects of product design are related to each other.

System Scope and Context



System Context – Product Design History App

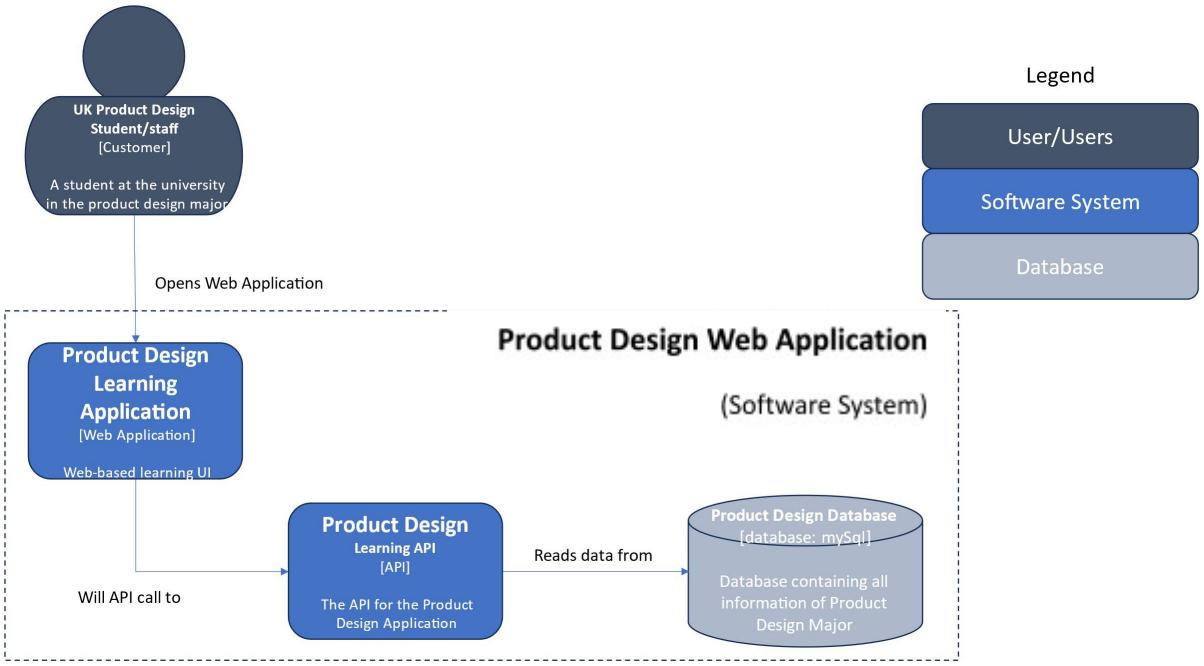
Contents

The context diagram illustrates the relationship between the users of the Product Design History App and the main application system. All user interactions will be done through the Product Design Learning Application, with users opening the application of their technological device of choice. The experiences and games that users will interact with will be entirely through the application, being accessible to users all through one UI which will guide players through the options they have to learn (all options will be presented and visible in the first screen the user sees).

Motivation

The system itself is to be suited for user customizability including cross-device compatibility, visual aid + user accessibility options. The way these user experiences will occur, and how they will be getting their information will be explained in the container diagram section, going over the technical aspects of the Application.

Containers



Container Diagram – Product Design History App

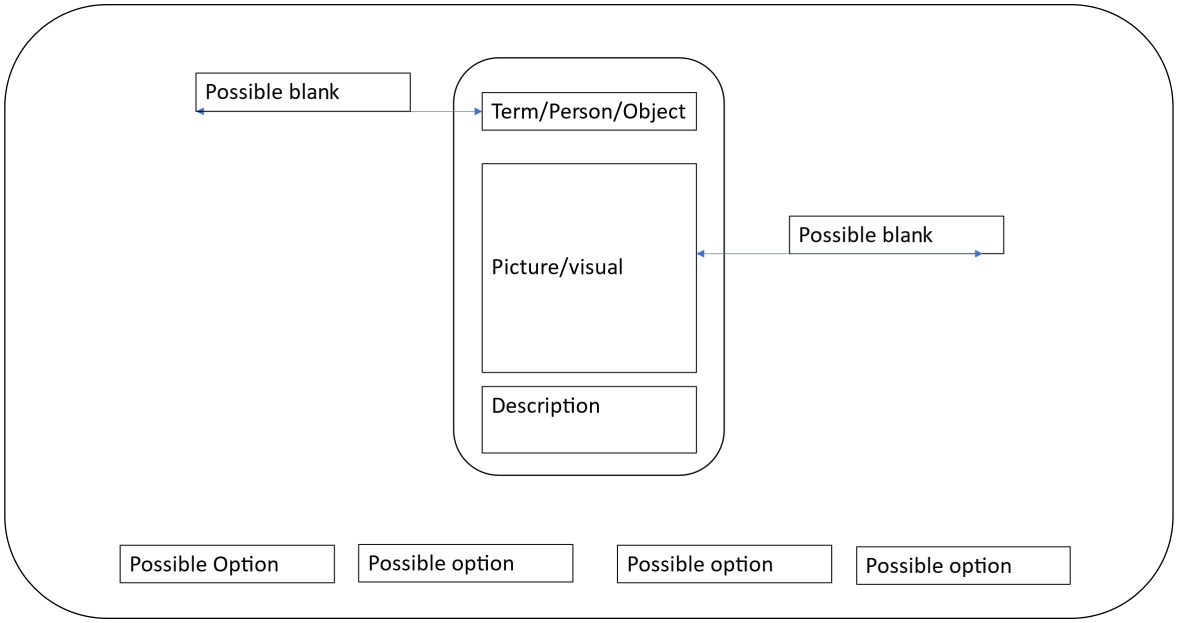
Narrative

The container diagram follows up from the context-diagram by providing a flowchart for how information will be communicated into our user application to be displayed and used for our Product Design History Application. The Product Design History Application, Product Design Learning API, and Product Design database work together to create the experiences we want for the user. Our users interact with the application, clicking on an activity they want to do, leading to the application to call to the Product Design Learning API to pull information that is queried from the database to the user's preferences that are asserted at the Learning Application before the API call. The web application will follow a Responsive Web Design approach, allowing for multi-device usage, basing the code in HTML using Bootstrap and CSS elements for styling. The development of learning games/experiences will use JavaScript application and possible react implementation to allow for experiences to have a variety of functionality.an overview diagram.

Runtime Scenarios

Runtime Scenario 1

Runtime Diagram: Fill in Blank Card Game



Narrative

The user can see the term or focus of the card, a visual accompanied by it, and a short description. These cards can have blanks or additional information that is presented that must be filled out by the user given the other information, the possible options are presented below as clickable buttons to select answers.

Solution Architecture

Architecture Decisions

Some of the important technical decisions for the application are:

1. Was chosen was the main web framework, as it helped to make communication between the back-end and front-end easy to use with python code.
2. Bootstrap 5 is used for web app styling, and jinja libraries are used to create templates to keep a consistent feel throughout the application.
3. MySQL was chosen as the database management system because it is simple and easy to set up through a digital ocean host.
4. Python utility functions are used to retrieve and write information to and from the database.

Quality Requirements

Important quality requirements for our application include:

1. **Performance:**
   Our application should be able to load all operations within 2-5 seconds, ensuring a smooth user experience.

2. **Usability:**
   Our application should be responsive and flexible to ensure accessibility across various devices, including laptops, desktops, tablets, and smartphones.
3. **Reliability:**
   Our application should have an almost permanent uptime, allowing the users to access it at any time.
4. **Maneuverability:**
   Our application should be easy to navigate, and have an intuitive UI, allowing users to use it with no issue.

Risks and Technical Decisions

- There are potential risks when it comes to developing a web application with a large reliance on third-party libraries and frameworks for many of its core functions. If certain dependencies are out of date or discontinued, the various aspects of the application fail to be compatible with each other and cease to function.

  Solution: regular audits and updates to each of the third-party dependencies will be implemented to make sure the application stays up to date and compatible.

- As with any application that involves user accounts and user information stored in a database server, information security is of utmost importance.

  Solution: regular security scans and assessments will have to be made, and proper encryption of user information will be used.