Tech Feasibility

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Team IQ

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Introduction

Overview

Having easily accessible, free information doesn't seem to be a priority anymore. Everything these days, even news, seems to be behind a paywall. With RedPen, our mission is to make this completely free for both students and professors. We are also working to make this completely customizable for the professor, meaning what students learn in class is what they'll see on these quizzes. With this being under the professors' complete control, they'll be able to see what the students struggled with the most, meaning they can shift their lesson plans based on what the students need help with. And, unlike the New York Times version, the students wouldn't be able to max out on how many quizzes they take, allowing them to retake the quizzes as practice to study.

Problem

Our client, a professor here at Northern Arizona University, Dr. Erika Konrad, has taken a look at the current solutions that are available on the market and has found that there are some major problems with the current solutions to her problem. The main software that she has been using has been the New York Times "Copyedit This" quizzes, but these quizzes have a few problems, such as:

1. Having limited quizzes available and the content of the quizzes not matching what the students will do after graduation.
2. Not all quizzes are free on the New York Times, with some requiring the student to subscribe to the New York Times.
3. The students have to submit a screenshot of their results on the New York Times website, which makes it nearly impossible for the professor to sort the results effectively.

Our client has been managing to make it by with some of the free quizzes that are offered on the New York Times, but those quizzes are very few in number. For our project, we do not have a direct sponsor, with our client being not related with a

business in this project. If we consider our client as our sponsor as well, their business is teaching technical writing at NAU.

Solution Vision

Our solution to these problems is a custom web application similar to the New York Times version, but with an NAU feel. RedPen will fix the above problems by:

1. Allowing the professor to make their own quizzes that can be made an unlimited number of times while also being tailored to the course.
2. Our website will be free for all NAU students to use.
3. Our client will be able to generate a table that allows for her to see the results of all of the students who took the quiz on the website.

RedPen will also use the NAU login to allow for there to be different webpages for students and for administrators.

Now that we have established some of the issues that our client has been having with the current solutions to her problem, we can begin to discuss some more technical issues with our planned solution. At this early point in the product development, we are mainly focusing on some of the technical issues that we will be having throughout the semester. To begin, we will start by outlining some of the major challenges that we will need to address over the course of the development of this product. After that, we will get into the Technological Analysis, which will give some more information about each challenge, some desired characteristics for the end product, as well as some information about our planned technologies. Then, we will discuss some information about our technology, such as Alternatives for some technologies we discussed, an Analysis of each technology, our chosen approach for which technology we will use, as well as how we will prove how feasible the technology will be. After the technological discussion, we will talk about how we will integrate all of our technologies together, before giving a brief conclusion.

Technological Challenges

In the pursuit of creating an effective and comprehensive educational platform, our project faces multiple crucial technological challenges. These challenges cover a broad area from granting essential privileges to our educators, enabling efficient administrative functionalities, facilitating quiz creation and management, and ensuring the seamless interaction between students and the system. Listed below are the major technological challenges that will need to be resolved during the development phase of the project.

- **Website Design:**
  - Privileges to allow the professor to make quizzes.
  - Administrator front end web page to allow for the professor to perform administrator tasks such as seeing students' quiz results.
  - Editing panel in order to allow the professor to make and edit quizzes on RedPen.
  - Student quiz results to be available to the professor, in terms of how many attempts and completion.
  - Data analysis for the professor between different mediums, such as tables.
  - Allow the professor to be able to tag quiz items.
  - User authentication to allow a student's account to be secure.
  - Allow storage of previous semester information and current semester information.
  - Student page that shows what they have done wrong in a quiz.
- **Website Hosting:**
  - Ensure components like web server, database management, etc. can be maintained.
  - Ensure that there will be enough storage space (0-10GB) to hold the dataset.

- **Data Acquisition and Storage:**
  - Keep data (documentation, access control/permission, regular backups, etc.) readily accessible.

Technology Analysis

3.1 Introduction

To create an interactive, user-friendly interface, this website application will require implementation of several features. For this section, we have decided to break it down for each challenge to describe the issue in more detail.

Website Design:

→ **We will need privileges to allow the professor to make quizzes.**

This is so the professor can make quizzes without allowing students to make quizzes.

→ **We will need an administrator web page to allow for the professor to perform administrator tasks.**

This is so that the professor has a way to see the student results, the quizzes they've created and create new quizzes.

→ **We will need an editing panel in order to allow the professor to make and edit quizzes on RedPen.**

This is so that the professor can actually make new quizzes on RedPen.

→ **We will need student quiz results to be available to the professor in different mediums, such as a table.**

This is so that the professor can easily review the results of the students and adjust her curriculum accordingly, without needing to manually look at each student

→ **We will need to allow the professor to be able to tag quiz items.**

This is so that the professor can tag specific questions in quizzes that seem to be troublesome to students.

→ **We will need user authentication to allow a student's account to be secure.**

This is so that no student will need to worry about any other student getting into their account. We will be doing this through the NAU system.

→ **We will need to allow storage of previous semester information and current semester information.**

This is so the professor can see trends in certain questions over the course of multiple semesters.

→ **We will need a student page that shows how many attempts they had for each quiz.**

This is so that the student can track their progress and see where they are struggling.

Website Hosting:

→ **Ensure components like web server, database management, etc. can be maintained.**

This is so that after the capstone project ends and the project is live, it can be updated by other people so that the project will remain functional.

→ **Ensure that there will be enough storage space (0-10GB) to hold the dataset.**

This is so that the professor will be able to store all of the quizzes that she makes, as well as the ability to store the results of the quizzes that the students take.

Data Acquisition and Storage:

→ **Keep data (documentation, access control/permission, regular backups, etc.) readily accessible.**

This is so that if anything needs to be changed, there is an easy way to do so with the documentation that we used to create the item that is being changed, as well as a backup of the data in case anything goes wrong during development.

3.2 Desired Characteristics

→ **Low Cost**
This is important because it is a requirement that this site remains free, so being able to keep the cost low makes the net loss minimal.

→ **Easily Maintainable and Manageable**
Because we most likely will not be the ones there to handle maintenance after the project is finished, making it easy to understand and maintain is important for the future managers.

→ **Login Page**
This is needed because we want users and admins to be able to have their individual databases protected. To do this, we'll have a login page that requires an username and password.

→ **Personalized User Page and Databases**
Users need to be able to see their own work. They need to see what quizzes they have and haven't done and they need to see how many times they have taken a quiz, being able to check the data for each attempt to keep track of their progress in how many tries it took to get the right answer.

→ **Administrator Database and Page**
The administrator needs to be able to add and edit quizzes, assign quizzes to users, give users tags to sort them into classes, give the quizzes tags to keep them organized, assign quizzes to specific groups of users, and see individual and group results. This page also needs to have a way to view the results in many different formats, and the administrator should be able to sort results.

→ Quiz Editor Page

We need a page where quizzes can be created and edited, giving the administrator full customizability over what the sentence is, what is incorrect about the sentence, what the pop-up message says when they get it correct, and be able to change all these things for quizzes that have already been created and posted.

→ Quiz Display Page

When the user decides to take the quiz, there needs to be a quiz display page that does not allow editing from a user side, but does highlight what's available to click when the user hovers over it. When the user gets the answer wrong, a message pops up saying they're wrong and counting their attempts. When they get the answer right, the correct pop-up message pops-up and explains the reasoning, along with another note that pops up saying they can leave any questions on canvas.

3.3 Alternatives

What kind of programming language should we use?

→ JavaScript

JavaScript shines in front-end web development. It is the go-go language for creating interactive and dynamic websites. It works directly in web browsers, manipulating the Document Object Model (DOM) and handles user interactions on the client side.

→ TypeScript

TypeScript is often used alongside JavaScript for front-end development. It enhances code quality and maintainability, catching errors at compile time. This is very beneficial for complex web applications.

→ *PHP*

PHP is primarily a back-end scripting language. It is mainly used for server-side development, creating dynamic web pages, processes forms, interacts with databases (like MySQL), and manages server-side logic. PHP is commonly used with front-end technologies like HTML and JavaScript to build web applications.

What kind of server provider is desired?

→ Amazon Web Services (AWS)

AWS is the big shot of the cloud world. It has a wide range of services and can handle projects of all shapes and sizes. It is often considered the leader in the cloud services industry.

→ Hostwinds

Hostwinds is more like a friendly neighborhood hosting provider. It is known for being user-friendly and offering top-notch customer support. Hostwinds is often chosen by small organizations that require cost-effective hosting solutions.

→ NAU ITS Server

We are currently working with NAU ITS to create a server to host this website. This ensures the success and reliability of RedPen because we have the expertise and support, server selection they provide us, scalability, and cost-efficiency.

What kind of database language should be used?

→ Structured Query Language (SQL)

SQL is a standard query language used for managing and manipulating relational databases. It is a versatile and well-established language, offering multiple capabilities for data storage and retrieval. When a project requires organized data management, data relationships, and transactional consistency, SQL is a dependable choice.

→ MongoDB

MongoDB is a popular NoSQL database. It is known for its flexibility, scalability, and ability to handle semi-structured and unstructured data. It is the first choice for applications evolving data structures, unstructured data, and need for flexibility.

3.4 Analysis

<u>Performance</u>

When it comes to performance, the choice between JavaScript, TypeScript, and PHP can significantly impact the web application's efficiency. JavaScript is a go-to for creating interactive and dynamic websites. TypeScript is often used with JavaScript and its ability to catch errors at compile time can enhance performance, especially for web applications. PHP efficiently manages tasks like interacting with databases, executing server-side logic, etc and is the best option for performance for server-side operations.

<u>Codebase</u>

Codebase is very important because it directly affects the maintainability, reusability, and complexity of the web application. JavaScript has multiple libraries and frameworks, like React, Angular, and Vue.js, which makes it easier for developers to build web applications. TypeScript is beneficial when code quality and maintainability are priorities because of its support for static typing. PHP provides a solid foundation for building web applications especially when it is paired with front-end technologies like HTML or JavaScript.

<u>Feature Access</u>

Determining how well a programming language can leverage the capabilities of the environment in which it operates is very important. JavaScript provides comprehensive feature access, especially in the context of browser capabilities since it is able to operate directly within web browsers. TypeScript inherits JavaScript's feature access like API's and this makes it a strong choice. PHPs feature access pertains more to server-side operations. The NAU ITS server would have feature access of having the students login with their UID and password.

3.5 Chosen Approach

Based on our ranking chart, our chosen approaches are JavaScript, PHP, the NAU ITS Server / Amazon Web Services (AWS), and Structured Query Language.

Criteria	Performance	Feature access	Codebase	Weighted Total
JavaScript	5	5	4	14
PHP	4	4	5	13
NAU ITS Server	4	3	3	10
AWS	3	4	4	11
SQL	3	3	4	10

→ **JavaScript**

This language is a versatile and widely used language with a significant presence in web development. This will be able to operate directly in the web browser and manipulate the DOM while facilitating user interactions on the client side.

→ **PHP**

PHP is a server-side scripting language which is what we need since it has a strong presence in web development. PHP excels in creating dynamic web pages, processing forms, interacting databases, and managing server-side logic. This language will be needed for the back-end scripting.

→ **NAU ITS Server / Amazon Web Services (AWS)**

Our main priority is to use the NAU ITS Server. With their help and resources, the server would be in NAU and is costless. AWS is popular for its versatility and scalability. It offers a comprehensive suite of cloud services that can accommodate our project. This will be able to handle our workload as well. AWS is our second choice if the NAU ITS Server does not work out correctly.

→ **Structured Query Language (SQL)**

SQL is used for managing and maintaining relational databases. This is a reliable choice due to the organization between data management, relationships, and transactional consistency. This is a strong framework for storing and retrieving data.

3.6 Proving Feasibility

To close this out, addressing our biggest challenges will show how feasible this project is. So, starting with the NAU ITS server will be crucial to making this project, getting a simple web server/web page setup will prove with a simple web page that can be run reliably. From there, we will need to show that a database can be created/manipulated, storing all past/present data. This will be done by combining SQL and PHP to make the database and allow the web application to communicate with it. Finally, we need to create separate privileges of both the administrator and students. To achieve this, we need a log-in/user authentication page, and from there provide the logged-in user with their respective pages/permissions through working with the database and JavaScript. These points will create a base program to use when adding the main functionality of the web application.

Technology Integration

As we put together RedPen, we want to make sure we solve all of the individual challenges we have but we also want to make sure that we form all of our solutions into a fully working system that allows the satisfaction for all of the requirements. We can visualize the diagram below so that we have a better understanding on how everything is going to work.
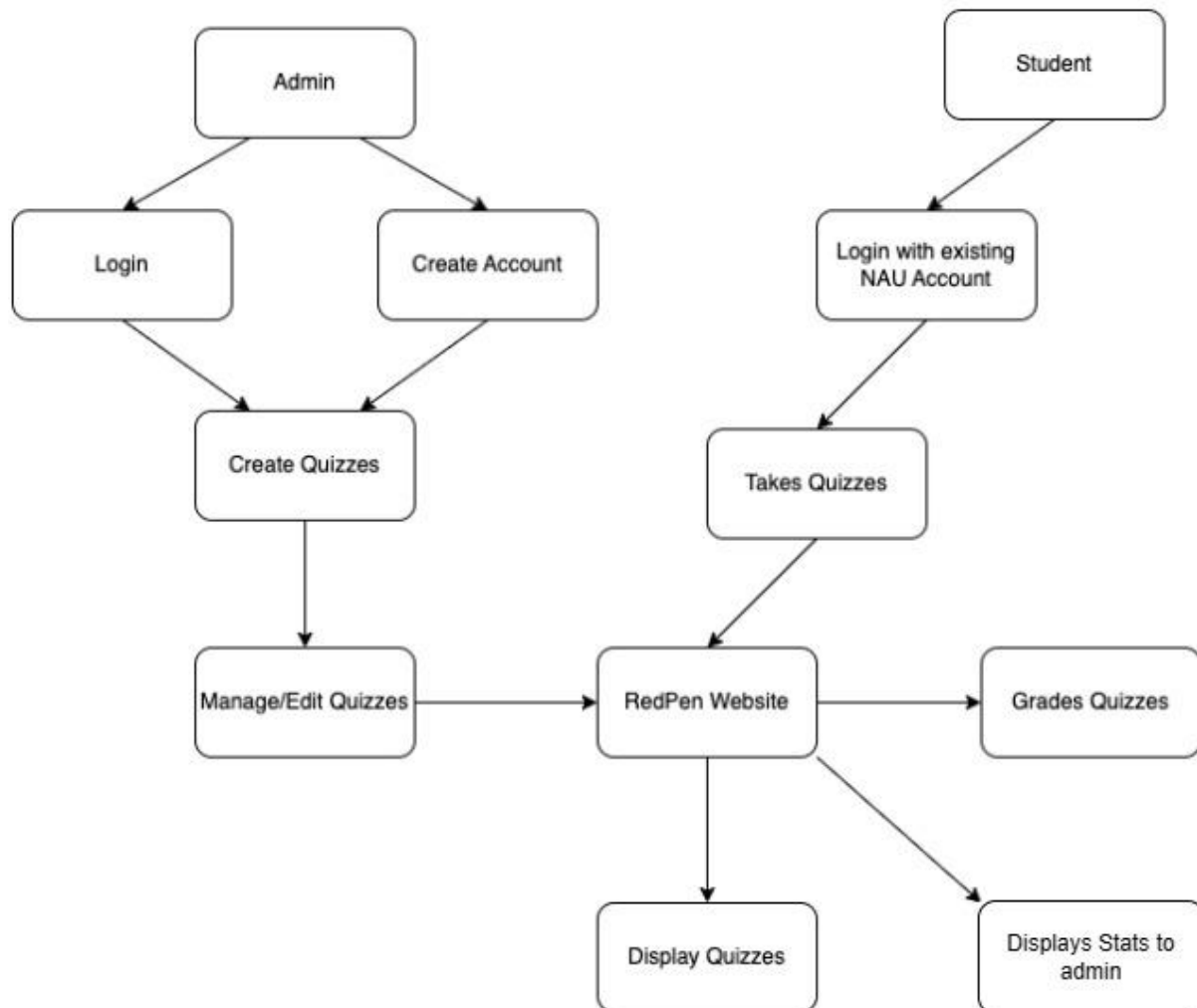
How this Works

An administrator who in this case would be our sponsor, would log into the site and will have the capability to create or edit quizzes, allow students to take those quizzes and view the results all from the web application. On the other end a student will also be able to go on RedPen and take the quizzes provided by the instructor. As well as submit the quiz, view the results and the amount of attempts made in a certain quiz. Our website as a whole will be able to work together as one to bring the best experience for both the administrators and students while working with a database and storing all of the data in real time.

Conclusion

Throughout the course of this document, we have shown how quizzes for our client is a problem, no matter what solution she turns to, and that the quizzes need to be in the right format for our client to teach her courses more effectively. We have covered all of the technical challenges that we anticipate facing during the development of this product, such as having a quiz editor for our client. Additionally, we have covered why each of these problems need to be addressed, some of our desired characteristics of our final product, some options for languages that we could use for this product, as well as an analysis of why each would be valuable in our project. Finally, we have covered the languages and technologies that we plan to use, such as AWS and PHP, as well as how we will prove that they are feasible, and finally showing how we will integrate all of our technologies together. With all of these problems in mind, we can start moving onto looking at requirements and what kind of tech demo our team wishes to make.

References

[1] LongEarDev. (2023, October 19). *Programming fundamentals: Web-focused languages: PHP, JavaScript, typescript*. Medium. https://medium.com/@longeardev/programming-fundamentals-web-focused-languages-php-javascript-typescript-d604cd81a522