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1. Overview

Scenario

As a freelance full-stack web developer, you have been awarded the prestigious contract to design and develop a modern web application for a distinguished health charity. This organization is dedicated to making a significant impact in the community by supporting vulnerable groups through innovative technology solutions. Your expertise and innovative approach to web development have set you apart, making you the developer of choice for this critical project.

Client Overview

The client is a renowned health charity focused on improving the health and well-being of underrepresented communities. They provide crucial resources, support, and education to **one of the following groups of your choice**:

- Indigenous communities
- Migrant communities
- Elderly populations
- Individuals facing mental health challenges
- Low-income populations
- [Or another group of your choice that you believe needs this support]

This charity is looking to leverage technology to expand their reach, enhance their services, and streamline their operations to better serve their target audience. The success of this initiative heavily relies on the user experience (UX) of the web application, as it serves as a critical driver for their business success and community impact.

The rest of this specification is organised into two parts:

1) the business requirements, and

2) the instructions how you should approach this task and grading method.

2. Business Requirements

The new Web Application must be able to meet the following Functional and Non- Functional Business requirements.

In Assignment 2, you will address Business Requirements A to C.

In Assignment 3, you will address Business Requirements D to F.

BUSINESS REQUIREMENT (A):

BR (A.1): Development Stack

The new Web Application must be developed using ASP.NET MVC C# framework.

BR (A.2): Responsiveness

The new Web Application must have responsiveness capability to be compatible with various devices.

`Hint: Responsiveness can be achieved using Bootstrap, Materialize CSS or any other Framework`

BUSINESS REQUIREMENT (B):

BR (B.1): Validations

The new Web Application must implement user input validations with minimum two types of validations.

BR (B.2): Dynamic Data

The new Web Application must be able to dynamically fetch and display values from the underlying data structures.

BUSINESS REQUIREMENT (C):

BR (C.1): Authentication

The new Web Application must have basic authentication mechanism (user accounts and login/register functionality) to provide confidentiality.

BR (C.2): Role based authentication

The new Web Application must have role-based authentication mechanism (supporting different types of users) with minimum two roles to facilitate CRUD (*Create, Read, Update and Delete*).

BR (C.3): Rating

The new Web Application must implement an aggregated rating score feature. Users can rate and see the average rating from all users for a particular aspect.

BR (C.4): Security

The new Web Application must implement basic security to protect from online attacks (such as XSS). Also needs to follow basic security practices (e.g. not storing any API keys in client-side code).

BUSINESS REQUIREMENT (D):

BR (D.1): External Authentication

The new Web Application must have an external authentication mechanism (such as Firebase Auth).

BR (D.2): Email

The new Web Application must be able to send email with an attachment.

BR (C.3): Interactive Table Data

The new Web Application must display interactive table data with minimum two tables. The table needs to support: sort, search and limit to 10 rows per page.

`Hint: DataTables supports pagination features. Mock data can be generated using Mockaroo`

BR (D.4): Accessibility

The application must meet WCAG 2.1 accessibility standards at the AA level to ensure usability by people with a range of disabilities. Provide accessibility features such as keyboard navigability in forms and provide text alternatives for non-text content.

`Hint: See this website for standard accessibility checks: https://www.accessibilitychecker.org/`

BUSINESS REQUIREMENT (E):

BR (E.1): Cloud Functions

The new Web Application must use serverless functions to execute server-side functionality.

`Hint: this can be done by using cloud functions feature in Google Cloud Platform.`

BR (E.2): Geo Location

The new Web Application must display a map with minimum two features. These need to be non-trivial features such as: search place of interest, navigate between places and trip information etc. “Background will be blue” is not a feature and won’t be accepted.

`Hints: Displaying features on a Map such as search, routing and geocoding etc. can be done using MapBox, Mapify or similar API`

BR (E.3): Chart

The new Web Application must display an interactive chart or graph using data from Local MS SQL Database or any other Cloud Databases.

BR (E.4): Export

The new Web Application must be able to export data.

BUSINESS REQUIREMENT (F):

BR (F.1): Innovation

The new Web Application must implement **four** extended innovative features aimed at improving User Experience (UX). A research report with details on which features have been implemented and recommendations for future upgrades **must be prepared** and submitted. Note that implemented innovations may represent enhancements to existing features. Examples of extended innovative features:

1. Appointment Booking (using Calendar): The new Web Application must implement booking constraints such as booking conflict management using Calendar. **Hint:** Displaying features on a Calendar such as event constraint can be done using FullCalendar.io API
2. Sending email to users (using Google Cloud Functions). SendGrid API can be used for Email.
3. Bulk Email: The new Web Application must be able to send bulk email to selected users.
4. Provide API access to others i.e. exposing at least 2 routes on your platform to allow third parties to fetch data using REST protocol.
5. Automated Testing
6. Deployment to the cloud - fully working public online version hosted (e.g. on Cloudflare Pages, on Google Cloud Hosting etc).

7. Incorporate GenAI such as Gemini API or OpenAI API (note: Gemini API can be used for testing free of cost, so it is recommended to use that)
8. Using **Typescript** language (logic for at least three pages is written here)
9. App with at least two offline features like: Checking if user is online/offline, use of Local File Systems etc.

3. The content of your website

Note: For the purpose of this assignment, you need to research different not-for-profit and leadership network websites to gain an understanding of some sample content that should be included on your website.

While there are no marks attached to the accuracy of your content, some basic research on the internet should reveal to you (i.e. using a search engine to look up health charities to find examples of what kind of content should be included).

When conducting content research for your health charity website, a good starting point is to review other successful health charity websites. Look for how they present their information, the types of content they prioritize (like blog posts, FAQs, resource guides), and the design choices that enhance user engagement. Analyze their approach to communicating with different audiences, especially through the use of visuals like infographics, photos, and video content.

`Hint: For this section, you might want to conduct an in-depth analysis of at least three existing health charity websites. A structured approach will sharpen your research skills and enable you to apply what you learn to your project effectively.`

4. Assignment 1 - Design Report (15%)

Instructions

Write a 5-6 page report with the following sections and contents.
Submission is due in Moodle in Week 5 Sunday, 21st July.

1. Executive Summary (300-400 words): A brief overview of the project, including the client's objectives, target audience, and the primary goals of the web application.
2. User Personas (600-800 words): Develop 2-3 detailed user personas representing typical users of the website. Include:

- Demographics
- Goals and needs
- Pain points
- How the web application will address their specific requirements

3. Site Architecture (1 page): Create a comprehensive sitemap using a tool like Draw.io or Lucidchart. Include:

1. All main sections and sub-sections of the web application

2. Clear hierarchy and relationships between pages
3. Brief descriptions of each main section's purpose

4. Wireframes (2-3 pages): Include early sketches or wireframes that show the basic layout and interface elements of the web pages. Wireframes are crucial for visualizing the structure before detailed design.

Hints: use easy to use tools like Lucidchart or Draw.io if you want to learn how to do sitemaps or wireframes. Neat hand-drawn sketches are also acceptable.
Lucidchart: https://www.lucidchart.com/pages/wireframe
Draw.io https://www.drawio.com/
Sitemap: https://www.lucidchart.com/blog/how-to-make-a-sitemap-using-lucidchart

If you want to really stretch yourself and use tools in industry, then explore tools like Figma or Balsamiq.

Submission

5. Assignment 2 - Basic Web App (20%)

Instructions

A stepped approach is mandated to implement the new Web Application. Before you move on to implement a higher-level business requirement i.e. BR (A) towards BR(C), you will need to show your tutor your work for feedback first. The following table outlines grading overview:

Grade	Marks	Deliverables for Demonstration
P → P++	50 → 59	BR (A1, A2)
C → D++	60 → 79	BR (B1, B2)
HD → HD++	80 → 100	BR (C1, C2, C3, C4) Learning Summary
Mandatory for D/HD		Demonstration

Submission

1. Submit a zip file containing
    a. Submission Declaration
    b. Learning & self-reflection Summary
    c. ASP.NET MVC C# application,
2. Submission is due in Moodle in Week 7 Sunday, 4th August.
3. All demonstration interviews should be completed in Week 8 or before.

6. Assignment 3 - Advanced Web App + Report (35%)

Advanced Web App (25%)

Complete Business Requirements D, E and F.

Research Report (10%)

3-4 pages, 1000 words maximum

The research report offers you an opportunity to explore cutting-edge intersections of AI and web development while demonstrating your ability to critically analyze and reflect on emerging technologies in the field.

For this component of the assignment, you are required to write a research report on one of the following topics:

1. **Opportunities and Challenges of Using GenAI for Designing Data Models and Database Structures**: Reflect on **five** key aspects of using Generative AI tools in the context of database design and data modeling for software applications.
2. **Strategies for Using GenAI in JavaScript Debugging**: Explore and analyze **five** strategies for leveraging Generative AI to enhance the debugging process in JavaScript development.

Suggested Report Structure

- Introduction (100-150 words):
    - Briefly introduce your chosen topic
    - Explain why this topic is relevant to modern web development
- Main Body (700-750 words)
    - Discuss five distinct points related to your chosen topic
    - For each point:
        - Provide a clear explanation
        - Include relevant examples or use cases
        - Analyze potential benefits and drawbacks
- Reflection (100-150 words)
    - Synthesize your findings
    - Discuss the overall impact of GenAI on the chosen area of web development
    - Consider ethical implications or future trends
- Conclusion (50-100 words)
    - Summarize key takeaways
    - Suggest areas for further research or development
- Acknowledge of AI use
    - Include clear documentation of how you used AI
- References (IEEE Style)

Additional advice

Using GenAI:

1. You may use AI tools to generate initial ideas, database designs, or assist with debugging.
2. Clearly document which parts of your work were AI-assisted.
3. The reflection component must be your original work **without AI assistance**.

Documentation:

1. Include screenshots of the prompts you used with GenAI tools.
    a. If choosing topic 2, include screenshots of your own experiments using GenAI or database design.
    b. If choosing topic 2, include screenshots of your own debugging process using GenAI
2. Explain how you refined or modified the AI-generated content.

Critical Analysis:

1. Evaluate the effectiveness of the AI-generated content.
2. Discuss any limitations or inaccuracies you encountered.

Instructions

A stepped approach is mandated to implement the new Web Application. Before you move on to implement a higher-level business requirement i.e. BR (D) towards BR(F), you will need to show your tutor your work for feedback first. The following table outlines grading overview:

Grade	Marks	Deliverables for Demonstration
P → C++	50 → 69	BR (D1, D2, D3, D4)
D → D+	70 → 79	BR (E1, E2, E3, E4)
HD → HD++	80 → 100	BR (F1)
Mandatory for D/HD		Final Demonstration
Mandatory for D/HD		Research Report

Submission

4. Submit a zip file containing
    a. Submission Declaration
    b. Learning Summary
    c. ASP.NET MVC C# application,
    d. Research Report
5. Submission is due in Moodle in Week 9 Sunday, 18th August.
6. All demonstration interviews should be completed in Week 10 or before.

5. Submission and Demonstration

You will be given the opportunity to show your interim work to your tutor during the lab sessions or during the consultation times. This will give you an opportunity to fix issues and improve. These lab sessions will serve as progress milestones.

Procedure

7. Submit a zip file containing
    a. Submission Declaration
    b. Learning Summary
    c. ASP.NET MVC C# application,
    d. Research Report
8. Submission is due in Moodle in Week 9.
9. All demonstration interviews should be completed in Week 10 or before.

6. Frequently asked questions

Q: What real-world skills am I learning through this assignment?

1. Design and develop a full-stack web application using ASP.NET MVC framework
2. Implement responsive design for multi-device compatibility
3. Apply user authentication and role-based access control
4. Integrate external APIs (e.g., geolocation, email functionality)
5. Implement web accessibility standards (WCAG 2.1 AA)
6. Develop interactive data visualizations (charts, maps)
7. Apply security best practices against common web vulnerabilities
8. Utilize cloud services for authentication, data storage, and serverless functions
9. Conduct user research and apply findings to improve UX
10. Implement email functionality, including bulk emailing
11. Develop and integrate RESTful APIs
12. Apply version control using Git
13. Deploy a web application to a cloud hosting platform

Q: So by doing this assignment well, I can boast about this in interviews?

Yes, in short you will be developing the following skills which are a pre-requisite for *most* full-stack web development jobs in 2024.

1. Front-end Development (40%)
    - ASP.NET MVC C# framework
    - Responsive design (CSS frameworks)
    - Dynamic data rendering and state management
    - Accessibility implementation
    - Interactive UI components (charts, maps, tables)
2. Back-end Development (30%)
    - Authentication and authorization
    - API development and integration
    - Email functionality
    - Security implementation
    - Server-side data processing
3. Database and Cloud Services (20%)
    - Data modeling with cloud databases

    - Cloud functions implementation
    - External authentication services
    - Data export and bulk operations
4. DevOps and Deployment (10%)
    - Version control with Git
    - Cloud deployment
    - Basic CI/CD practices

Q: What happens in an assignment demonstration?

These will happen in-person during the lab but if that is not possible, then they will be scheduled by your tutor. Be prepared to explain your technical choices and demonstrate understanding of core concepts.
Practice your demonstration to ensure you cover all key points within the time limit.

Q1: How much time should I allocate for this project?
A1: You should plan to spend approximately 40-60 hours on this project across the semester. This includes research, design, development, testing, and preparing for the demonstration.

Q2: Can I use additional libraries or frameworks beyond ASP.NET MVC C#?
A2: Yes, you can use additional libraries that complement ASP.NET MVC C#. However, the core of your application must be built with ASP.NET MVC C#. Always justify your choice of additional technologies in your documentation.

Q3: Do I need to implement all features for every grade level?
A3: You should aim to implement all features up to your target grade level. For example, if you're aiming for a Distinction, you need to complete all features up to and including the D-level requirements.

Q4: How detailed should my user personas be?
A4: Your user personas should be detailed enough to guide your design decisions. Include demographics, goals, pain points, and specific scenarios of how they might use your application. Aim for 200-300 words per persona.

Q5: What if I can't implement one of the required features?
A5: If you're struggling with a particular feature, consult with your tutor early. They can provide guidance or suggest alternatives. Document any significant challenges and your attempts to overcome them in your learning summary.

Q6: How will the project be assessed?
A6: Assessment is based on your submitted code, documentation, and the demonstration interview. We evaluate the quality of your code, the user experience of your application, how well you've met the business requirements, and your understanding of the concepts as demonstrated in the interview.

Q7: Can I choose any health-related charity for my project?
A7: Yes, you can choose any health-related charity or create a fictional one. Ensure your choice allows you to demonstrate all required features effectively.

Q8: What level of design skills are expected for the wireframes?

A8: We're looking for clear, functional wireframes rather than high-fidelity designs. Focus on layout, user flow, and key interface elements. Tools like Balsamiq or even hand-drawn sketches are acceptable if they're neat and comprehensible.

Q9: How should I handle data storage for the project?
A9: You're expected to use MS SQL Database or any other cloud databases for data storage as mentioned in the business requirements. Ensure you structure your data efficiently and securely.

Q10: What if I want to implement additional features beyond the requirements?
A10: Additional features are welcome, especially for higher grades. However, ensure you meet all core requirements first. Document any extra features in your report, explaining how they enhance the user experience or functionality of your application.

Q11: How important is the accessibility requirement?
A11: Accessibility is crucial. Your application must meet WCAG 2.1 AA standards. This will be checked during assessment, so familiarize yourself with these standards and test your application accordingly.

Q12: Can I get feedback on my work before the final submission?
A12: Yes, you're encouraged to show your work-in-progress to your tutor during lab sessions or consultation times. This allows you to get feedback and improve your project before final submission.

How will my research report by evaluated?
Your research report will be evaluated based on:

1. depth of your analysis and reflection to see how critically you have evaluated your chosen topic.
2. The quality and relevance of the examples you include and how they effectively support your arguments and insights.
3. The structure and clarity of your writing will be assessed to make sure your report is well-organized and easy to understand.
4. Declaration and use of AI tools through clear documentation