Initial Plan - Developing a web application to Visualise IoT Data for Abacws Building

CM3203 – Individual Project
40 Credits

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Project GitHub: https://github.com/randomman552/Abacws-Data-Vis

1 - Description

The aim of this project is to develop a web application to visualise data gathered from IoT sensors in the Abacws building. To do this I will be displaying the sensors' locations within a 3D model of the building. Alongside this, the web application will provide the ability to import, export, and visualise the stored data on graphs.

While developing this application I will follow an agile development methodology during the creation of the final product. To aid this I will use a Kanban style Trello board to separate the development into individual tasks, I will then prioritise the tasks based on their importance to the project.

This project will involve me creating a front end application using a JavaScript framework and a back end API to facilitate interacting with the data (which will be stored with a MongoDB database).

New data can be added to the system via the use of specific API endpoints, which will then store the new data within the database for later use. The API will implement some authentication features so that not everyone can upload data, but everyone is able to view the data.

The front end and back end will act as separate components, and I am planning to place the two components in a docker container to make the program portable and to enhance the ease of setup. This docker container will not include a database, as such the administrator of the deployment is free to set up a database for their program with a tool such as docker-compose (which I personally utilise in the administration of my own server).

Below is a screenshot from a similar program found online here: https://3d.usb.urbanobservatory.ac.uk/

2 - Ethics

As part of this project, it would be beneficial to run a survey on the final prototype to help with the evaluation in the final report. As such I will need to consider the ethics of running such a study and adhere to Cardiff University regulations. As such any data I collect will be anonymised and stored according to GDPR regulations.

3 - Aims and Objectives

3.1 - Aims

- The aim of this project is to create an IoT data visualiser tool for the Abacws building.
- This application should be easily accessible and intuitive to use.
- It will display the data provided by sensors across the building as nodes within a 3D model.
- It will provide graphing utilities to enable the user of the application to see trends in the data over time.
- A back end API will allow other applications to request data from this one for their own uses.

3.2 - Objectives

3.2.1 - Study existing applications

Objectives
- Search online for any existing applications (such as the one shown in the description)
- Investigate how they have approached the problem
- Investigate the requirements of their application
- Look into 3D framework such as three-js
- Investigate front end JavaScript frameworks
- Investigate TypeScript vs JavaScript
- Investigate Flask vs Node for the back end

Duration
- 1 week

Deliverables
- Documented use cases and requirements
- Finalised what frameworks and programming language I am using

3.2.2 - Low fidelity

Objectives
- Create basic layout as paper prototype

Duration
- 1 week

Deliverables
- Basic UI layout

3.2.3 – Medium fidelity

Objectives
- Basic application implemented
- No back end functionality
- Limited front end functionality (only navigation)
- Deployable in docker environment (same as final deployment)
- Uses same framework as the later high-fidelity prototype (allows for initial layout to be easily expanded)
- Components within this medium-fidelity prototype can then be expanded in subsequent stages
- Simple layout with components

Duration
- 1 week

Deliverables
- Basic application UI built in React
- Design can be easily expanded by building up react components
- Docker deployment setup

3.2.4 - High fidelity functional prototype

Objectives
- Application fully implemented
- Back end fully functional with database
- Mostly complete front end with functionality to view the 3D Abacws model
- Able to select nodes on the model and view data provided by these nodes
- Run survey on the prototype to determine how closely we have met our initial use cases
- Stretch objectives:
    - Collate data for multiple sensors (display on one graph)
    - Filter results by field values
    - Filter results by date range
    - Additional render modes for 3D model
    - Additional camera types for 3D model
    - Import/export data from web interface

Duration
- 5 weeks

Deliverables
- High fidelity prototype of final application
- Prototype will function as the final application, but may require some further polishing to the interface

3.2.5 - Final report

Objectives
- Evaluate design
- Produce final report
- Proof-read final report
- Submit final report

Duration
- 3 weeks

Deliverables
- Final report

4 - Work Plan

4.1 - Gantt Chart

No.	Task	Depends on	Duration (weeks)	Start week	ETA week	Week														
						1	2	3	4	5	6	7	8	9	H1	H2	H3	10	11	12
1	Initial Plan	-	1	1	2															
2	Web application	1	8	2	H1															
2.1	Study existing apps	1	1	2	3															
2.2	Low-fidelity prototype	2.1	1	3	4															
2.3	Medium-fidelity prototype	2.2	1	4	5															
2.4	High-fidelity prototype	2.3	5	5	H1															
3	Final report	2	3	10	END															
3.1	High-fidelity prototype evaluation survey	2	1	10	11															
3.2	Finalise final report	3.1	2	11	END															

4.2 - Supervisor meetings

I will be meeting with my supervisor once every 2 weeks to discuss any progress I have made, and any problems I have encountered. I may increase the frequency of these meetings if any unforeseen problems are encountered.

4.3 - Risk assessment

Risk identified	Likelihood (1-5)	Impact (1-5)	Mitigation	Mitigated likelihood (1-5)	Mitigated impact (1-5)
Fall behind schedule	2	3	3 weeks H1, H2, and H3 allow me to overrun somewhat and still have time to catch up before the final 3 weeks in which I will be finishing off the final report	2	1
Data loss	1	5	Source code for this project will be stored in a Git repository hosted by GitHub, as well as stored on my local machine and a cloud server. This means that data loss would need to occur on all platforms at once to affect the project.	1	1
Additional lockdowns	4	2	Work remotely on project wherever possible so that physical location does not limit my productivity.	4	1