**BSc (Honours) Data Analytics and Cyber Security**

**Team Project & Group Dynamics Module**

***The effects of weather on the power and water consumption in the college.***

Proposal, Technical Project

to be presented on *Wednesday 26th October at 12:40*

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# INTRODUction

## PURPOSE

*Outline the purpose of the project, with a high level description of the product to be delivered, and the expected benefits.*

We are going to develop software that would analyse the energy and water consumed by the college over many years and relate that to the weather in the past. These findings will then be used for machine learning purposes in order to allow our software to make predictions on the energy and water consumption based on the current weather. With that, we would also document potential security issues surrounding access to the system collecting the data, and, build a web based front-end in order to more easily access the data using a Graphical User Interface (GUI).

## Background

*Describe the background information about the project, including a description of comparable competitive/existing products You should include any research you have done to date on the market area, for instance if the product was a game, you might discuss type of genre, major titles in that genre, market moves away/to the same.*

Water meters and Energy meters already exist, the project that we’re using that was made by previous students collects the raw data in real time and records them. Our project then is to make a web front-end to connect to this interface but also to make a prediction algorithm to predict what the likely amount of water and electricity that will be used based on the current or predicted weather. We have seen other companies and organisations do local prediction algorithms, like ours, for predicting energy usage based on the weather. When it comes to the water usage side of things, we have seen prediction algorithms for water usage, but we personally have not seen any that use the weather to predict water usage.

## Needs STATEMENT

*Provide a brief statement of the business or system needs, and state short-comings apparent in current organization/systems/products available in the marketplace which will be addressed by the project.*

Have access to the software which records data from the sensors.

Have the data given to us from the previous years of recorded data.

## scope

*Outline the scope of the project, and identified what is to be included, and what is excluded*

Included in the project scope should be the front-end website, the back-end database, the data visualization and the predictive A.I. Not included in our project scope will be self-hosting the website, we will use third party services to host our website online. We will also not be hashing/encrypting user's data ourselves, instead we will also be using a third party secure service.

## Project Members

*In a table provide information on the team members and their agreed roles within the project. The list should contain any information that properly identifies the person, their role within the project, how to reach them and what are their responsibilities.*

| **Team Member** | **Role** | **Contact Information** | **Responsibilities** |
| --- | --- | --- | --- |
| Arnas Magilevicius | Champion | [K00255824@student.lit.ie](mailto:K00255824@student.lit.ie) | Liaising with the supervisor to discuss the project and provide updates. |
| Arnas Magilevicius  Vinicius Parzanini  Eoin Delaney | Stakeholder | [K00255824@student.lit.ie](mailto:K00255824@student.lit.ie)  [K00263592@student.lit.ie](mailto:K00263592@student.lit.ie)  [K00256954@student.lit.ie](mailto:K00256954@student.lit.ie) | Testing out the project and ironing out any bugs or glitches with the web front-end, the prediction algorithm and the software. |
| Arnas Magilevicius | Project Manager | [K00255824@student.lit.ie](mailto:K00255824@student.lit.ie) | Set up and manage the team and the repository. |
| Vinicius Parzanini | Architect | [K00263592@student.lit.ie](mailto:K00263592@student.lit.ie) | Work on the design and styling of the software. |
| Eoin Delaney | Analyst | [K00256954@student.lit.ie](mailto:K00256954@student.lit.ie) | Does the majority of the Data Cleaning and sorting to then build the prediction algorithm off of. |
| Arnas Magilevicius  Vinicius Parzanini  Eoin Delaney | Developer | [K00255824@student.lit.ie](mailto:K00255824@student.lit.ie)  [K00263592@student.lit.ie](mailto:K00263592@student.lit.ie)  [K00256954@student.lit.ie](mailto:K00256954@student.lit.ie) | Writes the code develop the web site, database and machine learning elements of the project. |

*If this project is being developed for a client, outline in a new subheading confidentiality and copyright issues*

# Proposed TECHNICAL APPROACH

## Requirements

*Present the requirements as understood at this time. The requirements should consider user (features to be implemented) and system requirements. Include a high-level diagram such as a use case system diagram or block diagram to capture the situation being addressed if appropriate.*

The requirements as of this stage are to have a website built that contains multiple pages, a login page, a create account page, a main dashboard that shows a summery of recent readings, a graphs page that contains data visualization based on previous readings, and a predict page that implements an A.I. to predict the power and water usage based on the weather. The A.I. would have to be coded and trained in order for it to work on the website and predict the usage. We need to have a back-end database built, to store the login info of users as well as some prepared statements to access certain data. We would need to perform Data Visualization and Extrapolation techniques beforehand so we can incorporate that feature into our graphs page and to help teach the A.I. to predict usage.

As can be seen in figure 1 below, the user will log into the website, their login attempt will be validated by the system to make sure that they’re a valid user. They will then be taken to the Dashboard, from which they can choose to go to the Predict Page or the Graphs Page. The three main pages in the website will be accessible at all times through the use of a navbar. If the user decides to go to the Predict page, they will be met with some fields to enter information. Once the user enters the required details, a prediction will be made and displayed to the user.

Diagram

Description automatically generated

Figure 1: Use Case Diagram

## prototype/storyboard

*Provide screenshots of your prototype (built in Construct 2), or the storyboard.*

## Architecture Design

*Explain the technology to be used in the project. Describe hardware, software, or network components as relevant and as understood at this time. Draw a high-level architecture diagram to illustrate the proposed system components and the relationships between them. Outline any alternatives considered, and state your reasons for choosing these particular components*

A screenshot of a video game

Description automatically generated with medium confidence

Figure 2: Login Page

The starter page is quite straightforward. When you first open the page, there will be a picture that presents a nature related background which ties in with the very nature of the project itself which will be to measure water and electricity in relation to the weather. Whitin this starter page there will be a box where the user will input their login information. This box will be composed of a dark color and a little bit of opacity as we don’t want to lose the attraction that the picture provides.

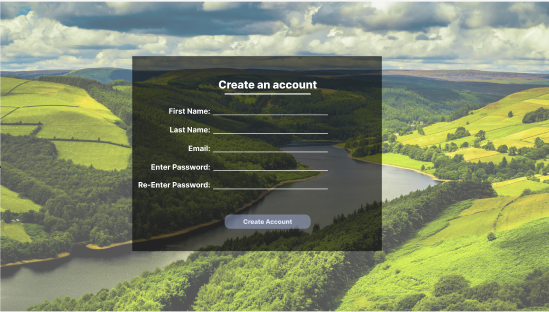


Figure 3: Create an Account Page

The create an account section will be almost identical to the login page. However, the black box will be bigger, but still not big enough to obscure the background picture. The dark color used to distinguish where the user will input their detail is to show the user that this section or this box is an important part of the page. While the white letters that will be used are a great, neutral option to contrast against the black.

Graphical user interface, application, website

Description automatically generated

Figure 4: Dashboard Page

Once the user creates their account or log-in, it will bring them to the page above. The box is bigger here in order to attract the users attention to the most important part of this project; the measurements. The colors chosen are green with the font in black. This is an obvious choice as you can’t go wrong with that. This shade of green was chosen to combine with the different shades of green that the background image brings, and the navigation is a little bit darker with a touch of yellow to bring more colors to our webpage. This page will show the real time consumption of water and electricity, and will also show the current temperature

Graphical user interface, website

Description automatically generated

Figure 5: Graphs Page

The Graphs page does not differentiate much from the Dashboard. In addition to keeping the same shade of green as the previous page, we add another color that will continue our “nature” related theme; blue. The color was well chosen, first because it is a color that combine very well with green and secondly it will also keep us focused to the fact that at the end of the day we are also measuring water and the color blue will help give us this perception. The last part is the button, it is the blue with a touch of purple. It is a heavier shade than the green in the box and shows the user that’s where they should go.

A screenshot of a computer

Description automatically generated with medium confidence

Figure : Prediction Page

Predict page is the last part of this proposal, although not less important. In this part the user inputs a date that they want to predict the total consumption from until the present day. Notice how there are two icons that explain everything and can also be found in the Dashboard section. The lightning icon would be the energy consumed and the water drop the water consumed.

We then created a basic ERD to give us a database starting point to help determine the requirements for the back-end of this project.

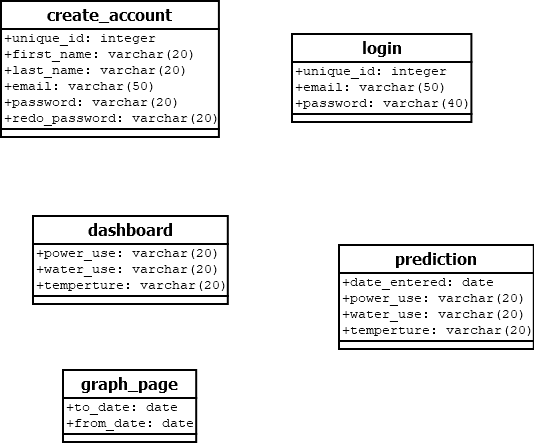


Figure : Entity Relation Diagram (ERD)

## Quality Assurance Plan

*Describe the potential risks related to the software quality. Outline how you intend to manage these risks.*

The data might be more difficult to access or to record from than we initially think. To help with this, we will try to find the documentation that describes how the software linked to the sensors works and also contact at least one of the original creators (three former students of the college) of the software to see if they can give us any tips or insight into the project that they made originally.

Our A.I. may not be able to accurately predict the usage of power and water based on weather to a reasonable degree. We may need to try and only focus on one aspect of the prediction to get a more accurate result e.g. weather might have more of an affect on water usage than power

We may have trouble incorporating everything that we want to in one website as we have many different functions in our project. We plan to manage this by researching as many different ways as we can of how to incorporate the individual elements of the project into our website.

# Expected Project Results

List deliverables expected to be produced for the project

A Web Front-end connecting to the sensor software to give easy access to live data feed from the sensors through a website being hosted online. A page displaying graphs based on the previous data collected using data extrapolation techniques. A prediction page where an A.I. uses its prediction algorithm to predict water and power usage in the college based on current or predicted weather.

## MEASURES of SUCCESS

*Describe an assessment plan that will identify the success/suitability of the project. List a measure and an acceptable value range. A measure should also correspond to the stated objectives of the project, for example one of your objectives is a “highly responsive game”, you need to consider whether to use 30fps or 60fps, and a suitable measure of success would be 3/60th.*

We may not be able to fully implement the A.I. as we want to but a reasonable measure of success for us would be that the A.I. at least is able to make small correlations between the weather and the water and power usage of the college.

# project management

## DEVELOPMENT METHODOLOGY

*Identify the development methodology to be used to deliver on the project – traditional/agile, justifying your choice.*

Agile, as we want to be able to work on small parts of the project a little bit at a time until the work and keep moving on until we have basic functionality for the whole web site and database. We then want to be able to take each page further and incorporate more in-depth graphing and representation of energy and water consumption based on weather. Finally, we want to be able to have a fully functional A.I. that has a reasonable degree of accuracy in predicting what the power and water usage will be based on what we taught it in the previous step when making the graphs.

## schedule

*Attach a project plan (in Gantt chart format) for the project. Identify the major components/tasks/milestones that will need to be met, and the deadline date for the same.*

*Here, we are looking to see that you have thought through your project and have a handle of what will be involved in your project and are being realistic in allocating time to achieve this.*

*If you are choosing Agile development, the primary purpose of this methodology is to enable developers to react to changing requirements faster, and updating a Gantt chart will slow this process down. However you should still include a timeline that identifies any pre-sprint work, and includes deadlines/milestones dates. Sprints can be shown as ‘phase’ bar. You should however include your prioritized Feature Breakdown Structure.*

The Gantt Chart below represents the tasks that need to be done as well as the dates for when they should be started and finished. The images below are split up so that they’re readable on word but a full version can be viewed using this link: [Gantt\_Chart.xlsm](https://studentlit-my.sharepoint.com/:x:/g/personal/k00255824_student_lit_ie/EaQLly43Xb5IoBRl7kPLFp4BtEk05xafl8J3dDlnczc2Hw?e=UQNYgE).

The Progress Bar can be edited to signify progress with the particular task at which point the cell is filled with purple to the same percentage as the task is complete e.g. If a task is 75% done, then the cell will fill 75% of the way with purple as can be seen in the figure 7 below.

We have also incorporated a feature where any time we load it up, there are vertical red lines that indicate the day that it is, making it easier to see which day it is and what tasks need to be worked on that day.

On top of that, scrolling through the Excel worksheet normally would be a hassle as we’d have to scroll to what day it is, then scroll back to see what the names of the tasks are, so we’ve included a “Display Week” cell that allows us to choose the week number so that the table containing the dates will automatically update and start showing the week from that number. This is also linked to a scroll bar above the table containing the dates to make it even easier by allowing us to use the horizontal scroll bar to scroll through the table instead of having to scroll through the whole worksheet.



Figure 8: Gantt Chart (1/5)



Figure 9: Gantt Chart (2/5)



Figure 10: Gantt Chart (3/5)



Figure 11: Gantt Chart (4/5)



Figure 12: Gantt Chart (5/5)

## Budget

*Unless there are budget considerations beyond using your own or department resources, enter “No budget required.” Otherwise include needed items.*

No budget required

## communication & collaboration plan

*Provide a synopsis of your communication plan. How often will you meet? How will you delegate tasks to be completed? How will you share information? What collaboration tools will you use?*

We have a group on Discord where we will discuss the project and any ideas we have for it. We will also be using Discord for online meetings for the project. We have a Github Repository set up which we will use to upload and edit code and documents. When it comes to documents such as Word and Excel, we will share them with the other group members to allow us to edit the same file instead of having to send one back and forth to each other. We will be meeting weekly on a video call on Discord between the times of 19:00pm and 21:00pm on Saturdays.

# References

YouTube video used to help make Gantt chart <https://youtu.be/un8j6QqpYa0>