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Project Specification Pitch
ACC 311/CSC 315 Collaboration

Energy Supply Database Project Pitch

• Problem statement.

As of recently, TCNJ is attempting to determine if their current sustainability and economical efforts are sufficient. The college has information regarding each of their buildings such as the type of meters used and the cost, but it is not maintained using a database or a user-friendly application or system. Moreover, the majority of the information is not easily understandable at first glance, and it is difficult to search for specific details such as the cost of energy or the amount of energy usage. Overall, the issue is determining which energy source contributes the most towards a possible economic or pollution problem.

• Objective of the module.

The objective of the project is to create and supply an easy to use application and database that is meant to highlight the general categories of cost as well as amount of energy usage with its respectable types of energy, which include fuel oil and natural gas and electric-grid. Furthermore, the project plans to address a way for users to see the relationship between the costs for sustainability and the environmental impact the sources have. The end goal is to provide the college with a product that will allow them to discern the best routes of action to become more efficient and cost-effective.

• Description of the desired end product, and the part you will develop for this class.

The desired end product that will be developed includes a finalized database and application where the user is able to insert and retrieve their respective piece of information. For instance, the product will utilize a simple-to-understand map that will allow the user to compare the costs of each energy source, the total emissions of each energy source, and the total emissions at a site to source basis. All of this information will be categorized by building. Buttons will be added over each building of TCNJ, and if, for example, a user selects a button linked to Armstrong, they can see the energy usage of an energy source as well as other pertinent information. To be able to adjust information, certain users, most likely someone with admin privileges, will be able to insert or delete data on an additional page once they select a building from the map. Moreover, the product will attempt to utilize a scoring analytic, which will inform the admin users of the best time economically and environmentally to create power. The other users will be able to see the cost and emission breakdowns per building, but will be able to do the other actions aforementioned.

If the map aspect proves to be too difficult, we can also develop a different interface which will have many similar functionalities to the map where the user will be able to navigate through the application by selecting a button corresponding with an energy source that will list significant data that can be displayed on a building to building basis or as a total summative result. The buttons however will be standalone and not interact with a map in any way.

• Description of the importance and need for the module, and how it addresses the problem.

The database and application is essential to the project since TCNJ's current method of maintaining data also lacks easily accessible and readable information regarding energy usage. It will search for areas to reduce costs, and reduce pollution. It will present a way to be greener since users can look to see how they can be more economical and produce less environmental pollution by using their own power. The way the module will do this is by organizing all of the data presented in the excel spreadsheet and presenting it in a fashion that is easy to read. Seeing a breakdown of the costs and emissions by building will also help those who are interested in knowing this information determine which areas to start with first if there happens to be any buildings in particular that are creating a lot of pollution or consuming large amounts of money. The end results of the product will map TCNJ's goal to promote environmental sustainability and incorporate sustainability within its recreational and residential operations. The product will also assist in the college's energy plan to commit to renewable energy.

• Plan for how you will research the problem domain and obtain the data needed.

In order to fully understand the problem domain, our group plans on performing an analysis on the historical data to understand the trends within TCNJ energy usage. We will also look into the college's current method of power and determine areas that would be a possible alternative depending on the sustainability and cost of the energy source. To obtain additional data, we will reach out to the CSC315/ACC311 professors and Paul Romano if there is other data we will need.

• Other similar systems / approaches that exist, and how your module is different or will add to the existing system.

Other systems that function similarly to our planned product include the *Energy Star Portfolio Manager*, AASHE's *Sustainability Tracking Assessment and Ratings* System, and the *Environmental, Social, and Governance Investing* system. Our planned product is different in that the end user will be able to make an informed decision as to where environmental and economic factors may need to be improved in certain areas. Furthermore, our system is able to differentiate the cost and usage for each energy source, and it utilizes an easy-to-understand map that will show the trends of TCNJ's energy consumption as well as other information. Additionally, our system will be created with the needs of what TCNJ requires to determine the status of their sustainability and economic efforts in mind.

• Possible other applications of the system (how it could be modified and reused.)

Based on historical data, we could create an expected budgeted amount of money and energy needed, and then if current actual data is provided, add a window within our dashboard to show the budgeted vs. actual. This method of analyzing data could be repurposed for other

colleges or different aspects of the college like vehicle supply, food supply, water supply, etc.. The data can also be purposed for examining economic and environmental impact with differing times of year. Additionally, the database will be able to be modified to include new years, thus allowing a possibility that new trends can be introduced as the college operates throughout different periods.

• Performance – specify how and to what extent you will address this.

We would like the database to run smoothly without any lag or crashes. One thing that would help with this is by not using any NULL attributes when establishing our data, which would use less performance overhead. Additionally, we will try to keep the amount of complex attributes to near zero since that would also limit performance due to the large amount of nesting needed to implement. Furthermore, we will attempt to implement solely binary relationships and avoid n-ary relationships.

• Security – specify how and to what extent you will provide security features.

We will not have a lot of security features to start. Github will probably be useful because of its own security features, such as the personal access token and general authentication. We'll also make sure to make our code private where it can be made private. Privileged users or administrators will be able to directly modify data per building, while the vast majority of the users will be treated as guests that will be able to see different levels of data in relation to the privilege levels that they have. As a result of this security, this will ensure that the more sensitive aspects of the financial information regarding operating costs with the college will not be leaked to the public.

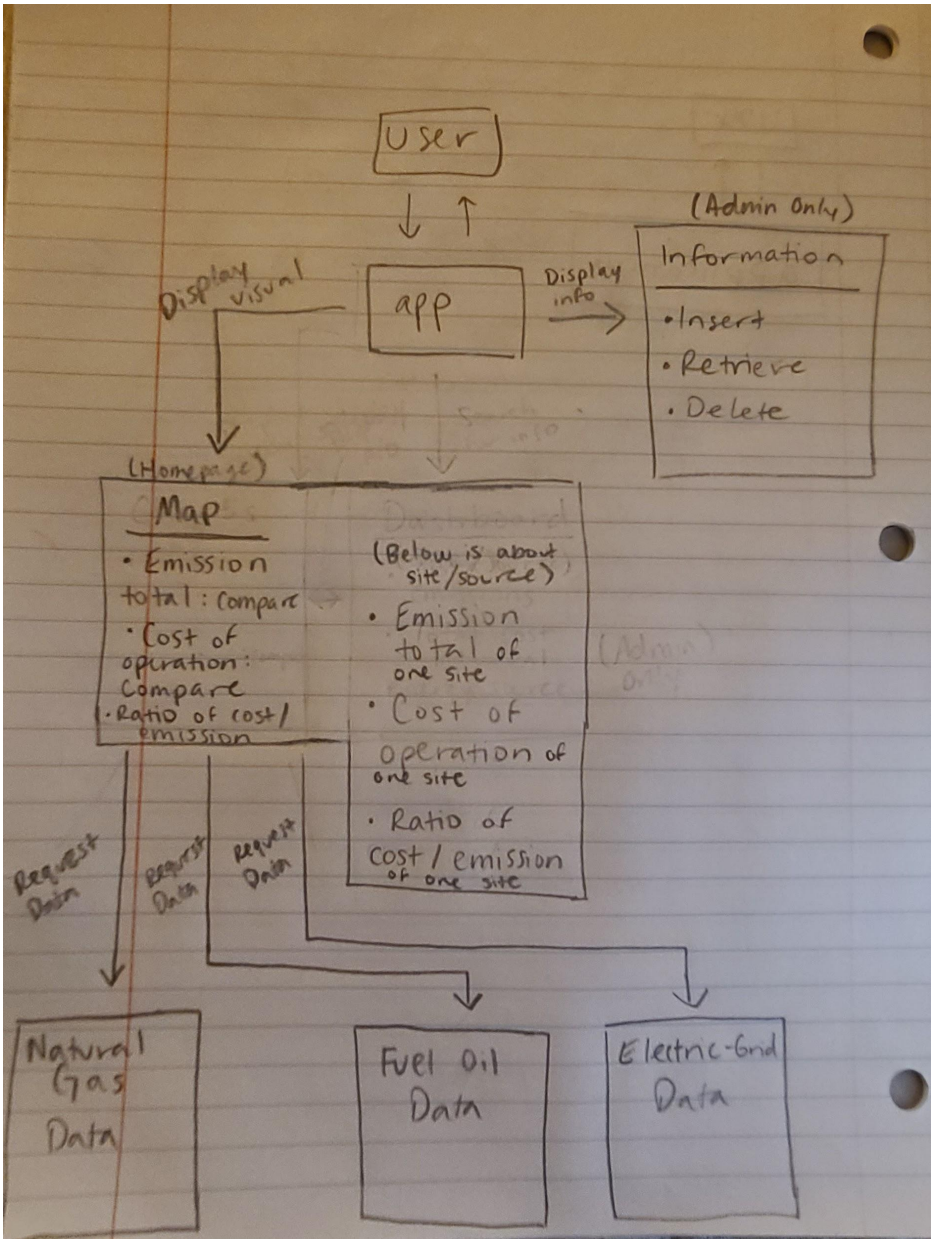
• Backup and recovery – specify how and to what extent you will implement this.

We will probably not need to use a backup and recovery system because Github most likely has redundancies and copies of the code. We most likely will not need anything else for backup.

• Technologies and database concepts the group will need to learn, and a plan for learning these.

Some technologies and database concepts that the group will need to learn include Python, Flask, and PostgreSQL. In order to learn more about these languages, we will be utilizing LinkedIn Learning on our own time. We plan to use these languages in order to create our interactive application. For the mathematical calculations and to organize any essential data, we will utilize tools from Microsoft Excel.

• A diagrammatic representation of the system boundary that specifies what data you will model and which queries you will implement.



• **1-page quad chart:**

TCNJ THE COLLEGE OF NEW JERSEY

Energy Supply Database

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Need

- Efficient and easy to understand database and application regarding energy consumption and pollution
- Cost effective analysis to decide where and when to use power from campus or sustainable energy
- Determine which energy source is causing the most pollution

Approach

- To separate the four types of meters and analyze historical trends (cost and usage)
- Find a common measurement to compare usage rate to cost.
- Analyze the results to come up with efficient and environmental friendly solution.

Benefit

- High performance and secure database access to energy use on campus
- Clear analysis on which energy sources should be used to save the most money and reduce pollution
- Comfort knowing that TCNJ will have the greenest and economically efficient solution for powering campus

Competition

- Includes ability to differentiate cost and usage between the four types of meters.
- Utilizes a visually appealing and easy to understand map to understand trends of the TCNJ's energy usage.
- Tailored to the needs of what TCNJ requires to determine the status of their sustainability and economical efforts.

02/06/22

GOAL/FIXES TO MAKE:

- Have more consideration for use case
- Less adjective, more nouns
- Must include User Interface (Filter), Output UI (actual output of the table), square to represent the database (how the database interacts w/ the data)
    - Database → queries
    - Use case → pseudocode (ideal scenario for a user interacts w/ the app, steps in detail)
- **Where to put the UI for a filter/output and database explanation as well as use cases?**
- Questions to answer:
    - **How can the two energy sources, electric-grid and elements from the power plant, differ in terms of its energy supply efficiency?**
        - **Kbtu / cost**
        - Show usage (kWh) on average per year for each energy source
        - Show cost/ (but don't make it an option) depending on electric-grid and powerplant
            - Show how much we could be saving if we switched to an energy source
        - Convert kBtu
            - Contrast w/ both
        - Power plant supply: natural gas/fuel oil
        - Observe differences in energy usage efficiency per energy source
    - **How can each energy source vary in energy supply depending on the dates and seasonal aspects?**
        - **Kbtu / season**
        - **Seasonal aspects by year: side-by-side (separate table) (Btu)**
        - **Dates by year: side-by-side (separate table)**
        - Show dates w/ energy supply
            - Separate by year
        - Observe differences in energy usage fluctuation (reliability) by seasons
- Focus on the energy supply, type of energy source, dates (months) and seasonal,
    - Show cost
- Create a table that shows above data
- Use filters that use buttons, text boxes, check boxes, etc.
- If more time is available, utilize bar charts, graphs (similar to what Matt included in the slides)
- Only 2 types of buildings - fully electric and part from grid part power plant
- **Email: where to find power plant data in the excel sheet**

According to grade comment by Degood:

- **Add a discussion about security and backup/recovery after your project departs GitHub and is delivered to TCNJ Facilities.**