DOE Interim Report 1

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CSC-450/650
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1. Client info

1.1 Who is the client?

Client Information:

Our client is (cascading down):

United States Department of Energy (DOE)
Office of Energy Efficiency and Renewable Energy (EERE)
Building Energy Research & Development
Building Technology Office

For succinctness, the client is referred to as “the client” or “DOE” in the rest of this document.

DOE Contacts:

Dr. Wyatt Merrill
Company: Department of Energy Building Technologies Office
Website: https://www.energy.gov/eere/buildings/building-technologies-office

1.2 What do they want? (Product Vision)

A searchable database of spectral power distributions (SPD) from commercial LEDs that has the ability to derive lighting qualities (TM30, CRI, color temperature, etc.) directly from the SPD and the ability to export the data unlike private sector firms and general energy companies or databases technology firms who might charge too much for such a product. The product should undergo user testing to ensure import/export capabilities as well as correct and accurate SPD calculations.

1.3 Example personas and user stories:

Example personas and user stories that are used to derive product features:

- **Government energy organizations**

Persona and Scenario: Bob, age 34, works for the Building Technologies office at the Department of Energy in Washington D.C and has a background in Chemistry. His team has been tasked with working with thousands of lines of SPD lighting data values and their goal is to find the Gambot of the light (RG) and Fidelity (RF) metrics as well as an SPD graph displaying the color spectrum based on the inputted data values. Bob has the experience with deriving and collecting the data but is unfamiliar with the techniques used to find TM-30 metrics based on those values.. Bob and his team do not have an experienced background in calculating these TM-30 metrics and are a bit unfamiliar in inputting the wavelength and intensity values into equations to correctly calculate the metrics they are looking for. Bob and his team are aiming to just be able to take their file's worth of data, input it into a calculator, and receive the outputted metrics they desire.

User Story: As a Chemist I want to be able to plug in collected data to the software and be able to clearly and easily obtain accurate calculated SPD data metrics displayed on my screen.

- **Lighting manufacturers**

Persona and Scenario: Brian, age 45, is a lead manufacturing project manager at General Electric and oversees hundreds of different products that General Electric manufactures from LED retrofit lighting kits to incandescent garage bulbs to simple halogen floodlights. Brian in his earlier college years received a degree in physics along with mastering in electrical engineering and his early work experience included various engineering and manufacturing jobs of similar lighting products to what he currently oversees today. Brian is the first point of contact when asked about the specific metrics, data and progress in development about the General Electric products being manufactured. Brian hopes to update his current system of keeping all of this product information either on paper or on his company computer so that the information can be more easily accessible as opposed to going through him every time for it. With SpectraSearch, Brian wants to be able to utilise an upload feature so that he can input various TM-30 SPD metrics about GEs products, manufacturing information and product names into the easily accessible database so that both him and his clients can access this information with a simple search.

User Story: As a manufacturer project manager I want the ability to upload lighting product information for my company so it can be easily accessed for later use.

- **Electrical engineers/scientists**

Persona and Scenario: Alice, age 29, is a Senior Electrical Engineer working at a large lighting company and finds her main work with deriving lighting qualities from the lighting products she works with. Alice has had ample experience working in various labs running experiments pertaining to both deriving Fidelity and Gambot of light metrics and studying the effects on the human eye versus the effect of the light on a plant. She continuously runs tests to compare the SPD spectrums across many lighting qualities that she works with. While having much experience in working with these metrics and calculations Alice wants to be able to use her work and put it on a platform for the data to be more readily available. Using SpectraSearch Alice

hopes to run her tests and calculations through the software and also run those comparisons between the effect of color and light on the human eye versus a plant or the eye of an animal.

User Story: As an electrical engineer I hope to take my studies and data and input it on the SpectraSearch software and use the outputted metrics to study the varying values between different mediums.

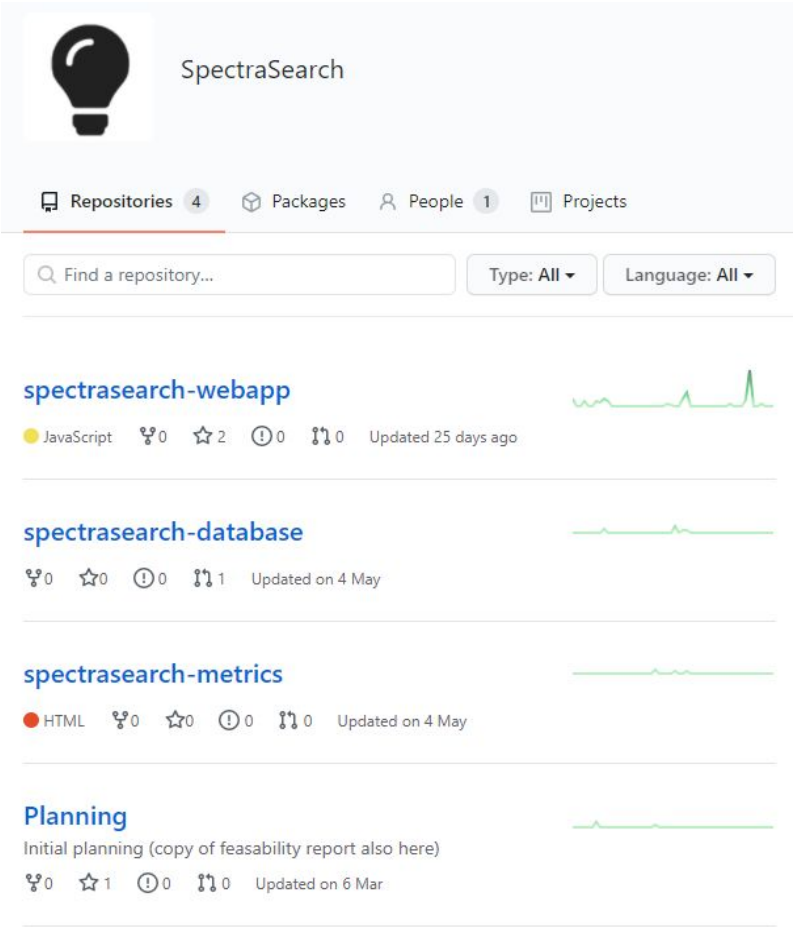
- **Light Bulb companies/company employees**

Persona and Scenario: Zack, age 26, is a data analytics specialist working in the lighting products department at FEIT electric. Zack graduated from American university with a statistics and information technology degree and has had various opportunities with accounting and law firms to collect and create insightful data recommendations. Now with a full time opportunity at his current company FEIT electric, he works mainly to supply the company with data based on their lighting products. Zack mainly works with engineering and manipulating data with his Python and R competencies but is not knowledgeable about the lighting data he currently works with. His recent project assigned to him is to gather specific lighting metrics about FEIT electric's LED lighting products. Without this information readily available to him Zack is looking for a software product or database where he can easily access the uncommon LED bulb lighting metrics that he needs to supply his company with relevant information for his project. Zack can utilize the SpectraSearch searchable database to access all of the relevant information about the lighting products he needs with a simple search.

User Story: As a data analytics specialist, I want to be able to easily access information I am not knowledgeable about from a readily available database containing said specific lighting metrics and be able to use this data for my company..

2. Progression

2.1 What did the previous team from AU do? (Last team's progress)



Multiple AU teams previously built a foundation for both the backend(spectrasearch-database) and frontend(spectrasearsh-webapp) of this software product for the client. 2 teams composed of a backend team built an SQL database and 2 teams composed of a front end team constructed the web application. After their year of work, the product stood as a somewhat functional web application. It included a very few lighting data example values as well as a non fully functioning calculator. Reason for such incomplation was due to unfortunate events such as COVID-19. These teams created a foundation for our team to work off of and continue on their progress. With this comes challenges in understanding their previous work and having to learn and work off of it.

2.2 What does the client require from our team (Now)?

Upon the meetings that were conducted with the client the requests were as follows: An accurate (SPD) calculator to calculate certain lighting metrics and advanced light mechanics, Update the function standard into the TM30 protocol (IES Technical Memorandum), Clean the application and shaping the performance of it, Include Things like (Gambot of the light (RG) and Fidelity (RF)) into the calculator, Clean the field with in the upload page and finally there is a need to shape the website to meet accurate numbers when modeling and graphing. The challenging in that part is trying to figure out **How can we take the SPD and calculate these things that are part of the TM30 protocol in an accurate manner** since the client does not know how to

calculate these things himself, nor is an industry standard calculator available prior to us exist, so we have to learn it in order for us to transmit it to an application software standard for him.

2.3 Where are we now? (Our current progress)

Our team up to the date has done and established the following:
In current steps, we have shown the client how he can run the application and offered a manual about how to set up our software and basic usage guideline. The initial version of our software is pretty buggy, after our working, we have fixed almost major features such as upload function, login-logout function and sign up function. Additionally, we reorganized the website format and data submission forms as what the client wanted. However, since there is no one familiar with JavaScript and React in our team, we are still learning about both programs and trying to understand the previous team's software logic. Moreover, as the client mentioned that he hopes our software can follow the TM-30 protocol, we need to take time to understand TM-30 protocol and its details. Technical fixes that have been made: calculator is able to take in correctly formatted data and output the non updated metrics, upload page and login page are functional but could use work, and some small format and UI changes were made on the website (I.E upload file button added to calculator page).

2.4 What is the client's end goal with us?

Our client's essential goal is attempting to create a library that has the purpose of providing information on data concerning lighting quality metrics pertaining to SPDs, allowing easy access to specific calculations and specifications of a variety of different lighting tools. This has the potential of: Speeding up the workflow of the individuals in the industry by providing ease of data access & calculations & Providing a centralized database for individuals to access the TM - 30 standard metrics derived from SPD data. This all with a goal to have a proper SPD calculator that's able to calculate specific lighting metrics.

2.4.1Brief Summary Of The Meetings With The Client

Meeting 1 (Wednesday Sep 9th, 2020)

Establish initial contact with the client, introduce the group and have the client present their needs and goals for the product. Helped the team establish roles and create goals for the team to complete for the next milestones.

Meeting 2(Monday Sep 28th, 2020):

Going off our clients previous requests and explaining the current state of the product including showcasing how the application works and going through new tasks and updates from them. Deliverables: 20 page PDF help manual of how to install/run the application.

3. Milestone

3.1 Timeline:

Sprints 1 and 2 (Start September 3rd)

Sprint 1:(Ends September 29)

Sprint 1 Scrum 1 (Sep 12, 2020)

Sprint 1 Scrum 2 (Sep 19, 2020)

Sprint 2:(**Ends October 10th**)
Sprint 2 Scrum 1 (Sep 26, 2020)
Sprint 2 Scrum 2 (Oct 03, 2020)
Presentation 1 (Oct 06, 2020)
Interim Report 1 & Survey report 2 (Oct 08, 2020)
Sprint 3 and 4 (Start October 10th)
Sprint 3:(Ends October 24th)
Sprint 3 Scrum 1 (Oct 10, 2020)
Sprint 3 Scrum 2 (Oct 17, 2020)
Sprint 4:(Ends November 6)
Sprint 4 Scrum 1 (Oct 24, 2020)
Sprint 4 Scrum 2 (Oct 31, 2020)
Presentation 2 (Nov 03, 2020)
Interim Report 2 & Survey report 3 (Nov 06, 2020)
Sprint 5 (Start November 6th)
Sprint 5:(Ends November 28th)
Sprint 5 Scrum 1 (Nov 07, 2020)
Team assessment report (Nov 13, 2020)
Sprint 5 Scrum 2 (Nov 14, 2020)
Sprint 5 Scrum 3 (Nov 21, 2020)
Additional Feature Time (Nov 28, 2020 - Dec 05, 2020)
Additional Feature Time:(Ends December 5th)
Additional Feature Time Scrum 1 (Nov 28, 2020)
Additional Feature Time Scrum 2 (Dec 05, 2020)
Final Reports & Survey report 4 (Dec 08, 2020)

(Milestones denoted here are based on when we are meeting with the client for updates or and they are meeting the end of sprints)

Sprint 1 Ends Sep 29th:

First testing meeting with client: Fixed bugs and functionality issues to have a presentable, testable product ready to show the client. The main purpose of a meeting at this point in time was to show our client how the product currently works and receive client input on the current system. Technical progress by this point included: bringing the calculator to testing functionality (not 100 percent accurate), fix the functionality of the login page to allow users to log in and access the database information, and fix bugs with the upload page. Input we received from the client were points including changing the current metrics that are given when putting data into the calculator to the updated TM-30 metrics, specifically Fidelity and Gambot of Light, and the second major input from the client was adding the capabilities to just upload a CSV file to the calculator page and have the program run calculations based off that instead of having to manipulate the data manually to run in the calculator. These updates are to be made by the next meeting

Following sprint 2 and 3 October 26th meeting with client:

After numerous recommendations from clients, our main goals for October and the next Client

update are a fully functional Upload feature and Corrected TM-30 standard metrics that the product will output. The metrics should be a simple fix on the front end: simply changing and deleting irrelevant metrics in the output table from the calculator and adding in the new ones requested by the client. The main challenge we will face here is becoming familiar with the equations we are working with and how we are going to integrate them into the code, certainly an unexpected event we are currently facing. We have been able to make good progress on updating both the upload page and adding a file upload function on the calculator page, but are still facing technical issues to get those running, by the october 26th milestone both of the issues will need to be fixed.

End sprint 4 Nov 6:
Main product function should be in place by this point, both backend and frontend enhancements will be discussed at this point following presentation 2. If the team happens to not complete the upload and updated metrics tasks assigned to be completed by October 26th they will be the main priority here to be finished as soon as possible, by the next milestone at the latest. During either the next milestone or later in november the team will meet with the client to brush up on more inputs for the product and what enhancements should be made since the product should be ,at this point, functional. By this point the team will start brainstorming new features to be added to enhance the product such as the ability for the software to compare certain mediums and the differences in lighting qualities effect on those mediums (light on Human eye vs plant). Other ideas in mind to brainstorm by this point include an export feature for the calculations and graphs, putting the product on an open source platform like an internet explorer site, and a feature to check uploaded data to make sure it is correct. The database work will also be prioritized following the end of this sprint, the team will most likely face the challenge of becoming more familiar with the lighting data and have to integrate a lot more into the databases structure than where it currently stands.

Team assessment milestone Nov 13:
With close to full functionality, The team will aim to add more advanced features such as specific spectral data output and how it might seem to different mediums i.e the human eye, plants. The team will also work on enhancing the database and the user interface. This point and milestone will be the teams main chance to start working on implementing the brainstormed ideas made earlier in November into the code, both backend and frontend, and hopefully get them up and running to be tested for the client. The simpler additions will be added following the bigger features such as the advanced features requested by the client so they can be ready for testing with them. By this milestone it will be a good point before the end of the semester to check the status of the product and decide what can and cannot be achieved realistically before the final milestone on November 28th. Since we may face issues such as unfamiliarity in the data and some technical issues to debug, the team needs to make the tough decision on what aspects we need to stop working on and which aspects need to be prioritized.

End sprint 5 Nov 28:
By this point at the end of the semester, the team will have taken the clients final input following the October 26th meeting and have done their best to add as many advancements as time allows by this point. The web app should be able to successfully take in any spectral data (Wavelength

& Intensity), both accurately & cleanly present all metrics. By this point debugging will have been done for the main product features that are already added: Calculator, upload, login, data output and exportation, database search, and hopefully by this point the requested medium comparisons and open source capabilities. The front end should be bug free and the back end database should include many more features than what had been previously coded in at the beginning of the semester. This includes adding the “data checker” to the database that will compare user uploaded data to an example lighting quality that closely matches it and allow for it to be added to the site so that irrelevant information is not just added in. The database should have easy upload capabilities with few or errors free, as it contains bugs currently.

Final Milestone December 5th:
This will be the teams final milestone to complete any additional features and also finish the prioritized tasks for the product decided in the previous two milestones. By this point the product will be ready to be presented for the final presentation as well as ready for a final test for the client

4. System

4.1 System architecture:

Interface:

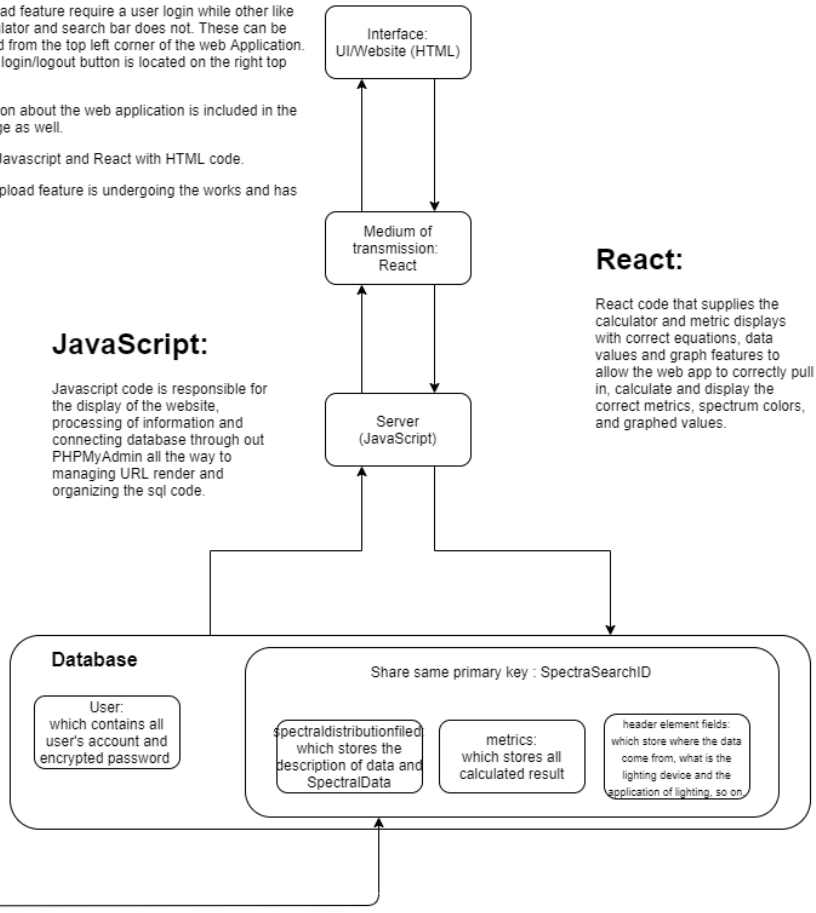
A web application including a searchable lighting quality database; A TM-30 protocol metrics calculator as well as an upload feature to input new Spectral data into the SpectraSearch database.

The upload feature require a user login while other like the calculator and search bar does not. These can be accessed from the top left corner of the web Application. Only the login/logout button is located on the right top side.

Information about the web application is included in the main page as well.

Built on Javascript and React with HTML code.

A CSV upload feature is undergoing the works and has



JavaScript:

Javascript code is responsible for the display of the website, processing of information and connecting database through out PHPMyAdmin all the way to managing URL render and organizing the sql code.

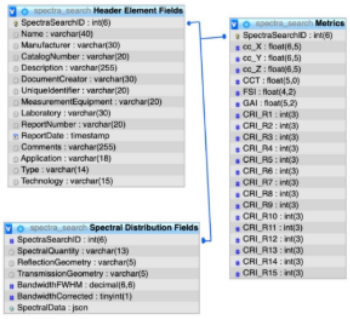
React:

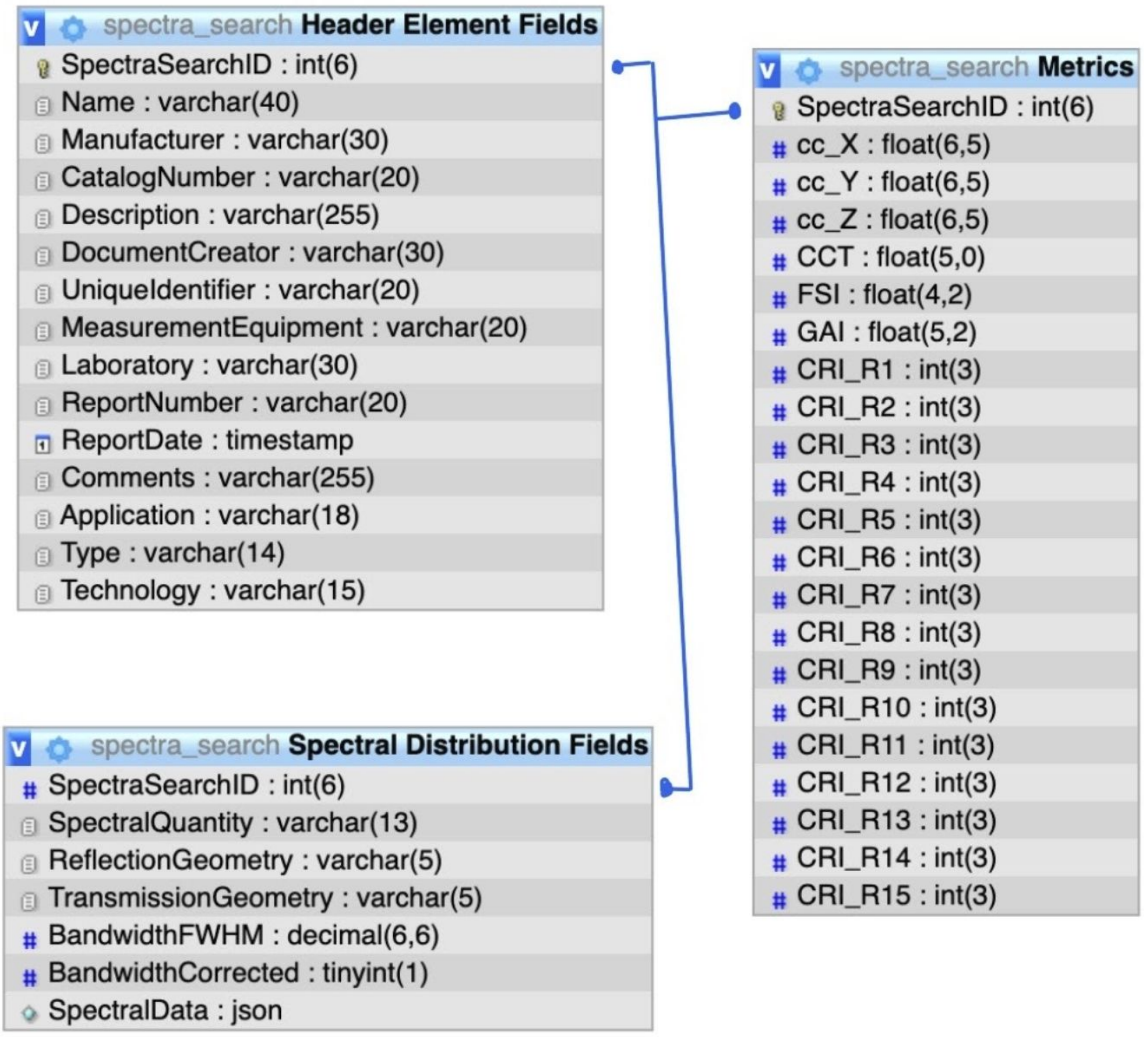
React code that supplies the calculator and metric displays with correct equations, data values and graph features to allow the web app to correctly pull in, calculate and display the correct metrics, spectrum colors, and graphed values.

Database:

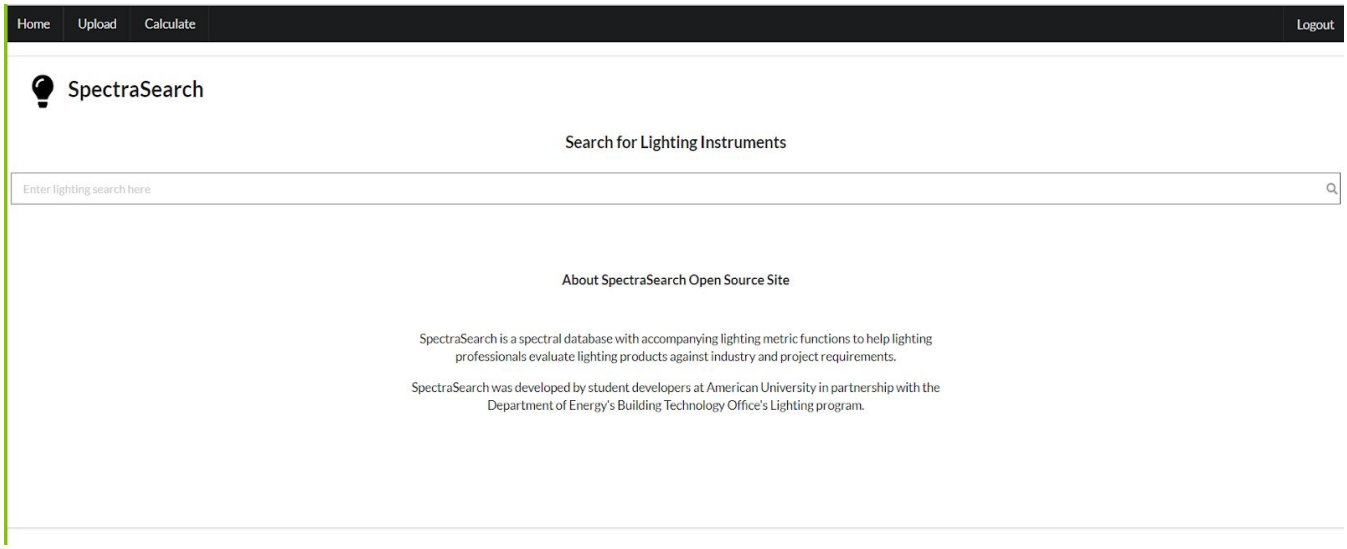
The sql code includes multiple variables that allow for the presentable SPD data on the front end. The sql code is being derived using AMPPS PHPMyAdmin.

Sql files and code that currently have example lighting metric data stored that is used to supply the web application with the correct values used to present the metrics when someone searches the database.

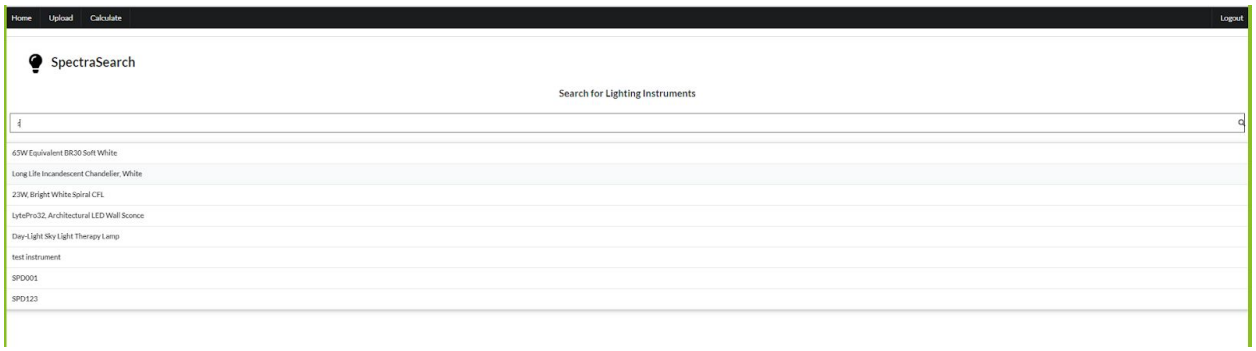



spectra_search Header Element Fields
SpectraSearchID : int(6)
Name : varchar(40)
Manufacturer : varchar(30)
CatalogNumber : varchar(20)
Description : varchar(255)
DocumentCreator : varchar(30)
UniqueIdentifier : varchar(20)
MeasurementEquipment : varchar(20)
Laboratory : varchar(30)
ReportNumber : varchar(20)
ReportDate : timestamp
Comments : varchar(255)
Application : varchar(18)
Type : varchar(14)
Technology : varchar(15)
spectra_search Metrics
SpectraSearchID : int(6)
cc_X : float(6,5)
cc_Y : float(6,5)
cc_Z : float(6,5)
CCT : float(5,0)
FSI : float(4,2)
GAI : float(5,2)
CRI_R1 : int(3)
CRI_R2 : int(3)
CRI_R3 : int(3)
CRI_R4 : int(3)
CRI_R5 : int(3)
CRI_R6 : int(3)
CRI_R7 : int(3)
CRI_R8 : int(3)
CRI_R9 : int(3)
CRI_R10 : int(3)
CRI_R11 : int(3)
CRI_R12 : int(3)
CRI_R13 : int(3)
CRI_R14 : int(3)
CRI_R15 : int(3)
spectra_search Spectral Distribution Fields
SpectraSearchID : int(6)
SpectralQuantity : varchar(13)
ReflectionGeometry : varchar(5)
TransmissionGeometry : varchar(5)
BandwidthFWHM : decimal(6,6)
BandwidthCorrected : tinyint(1)
SpectralData : json

4.2 Feature description:

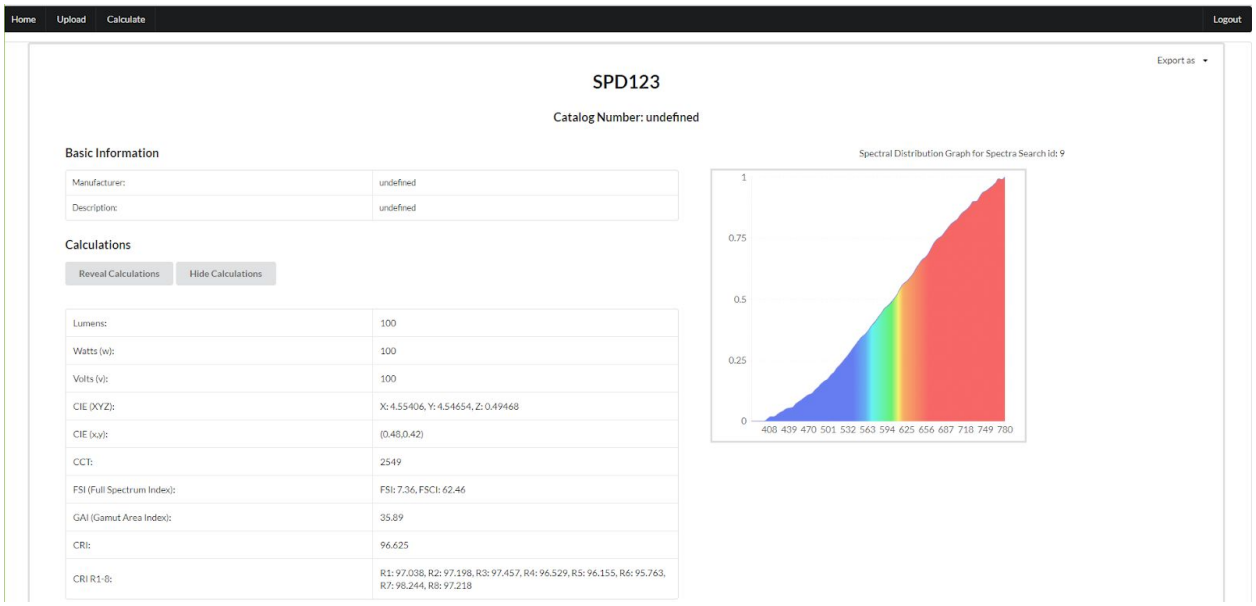


The main features of the application in this page (starting from the left to right are):
The home button which will direct you to the main page. The upload button which will direct to the upload page and will take you to where the open community and the users of the website can upload information regarding the lighting instrument and contribute to the website data. Then we have the calculate button which will take you to a calculator that will showcase an interactive graph upon entering the needed information to reflect better understanding of the data provided. Finally we have the login page that will allow the user to login so that they are able to upload information as needed in the upload page. In addition the page include a search bar to search for different instrument, the bar will interact with the text as needed just as seen here:



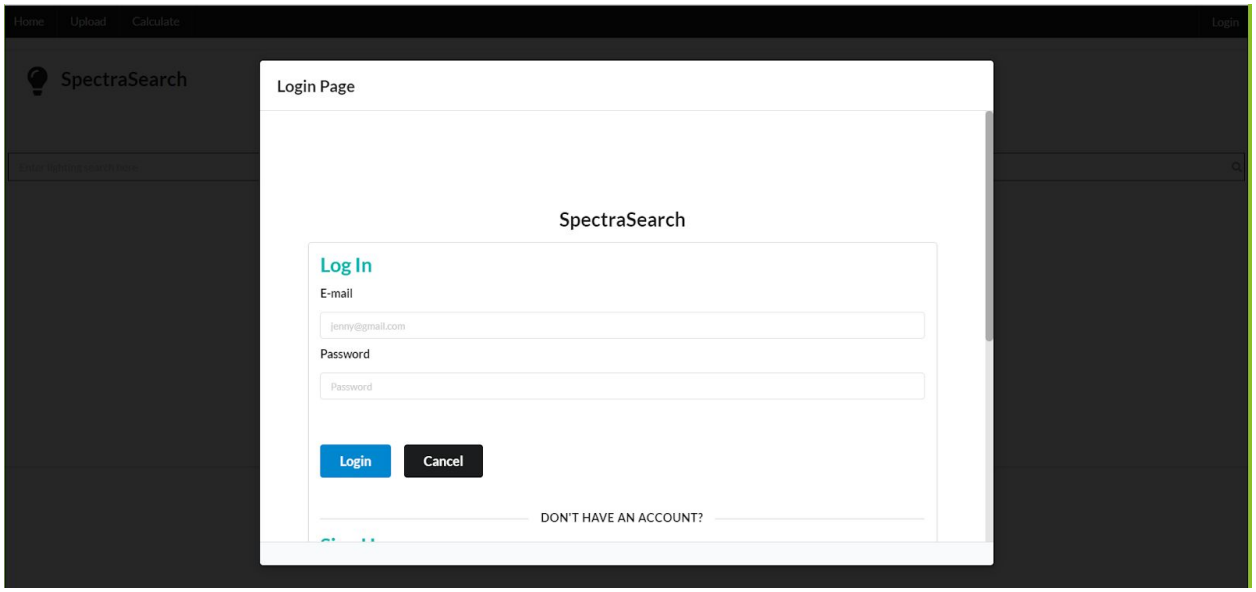
The page also has a simple about us section to introduce the application and the goal of it.

Upon choosing a result from the search bar, information regarding the instrument will pop up:

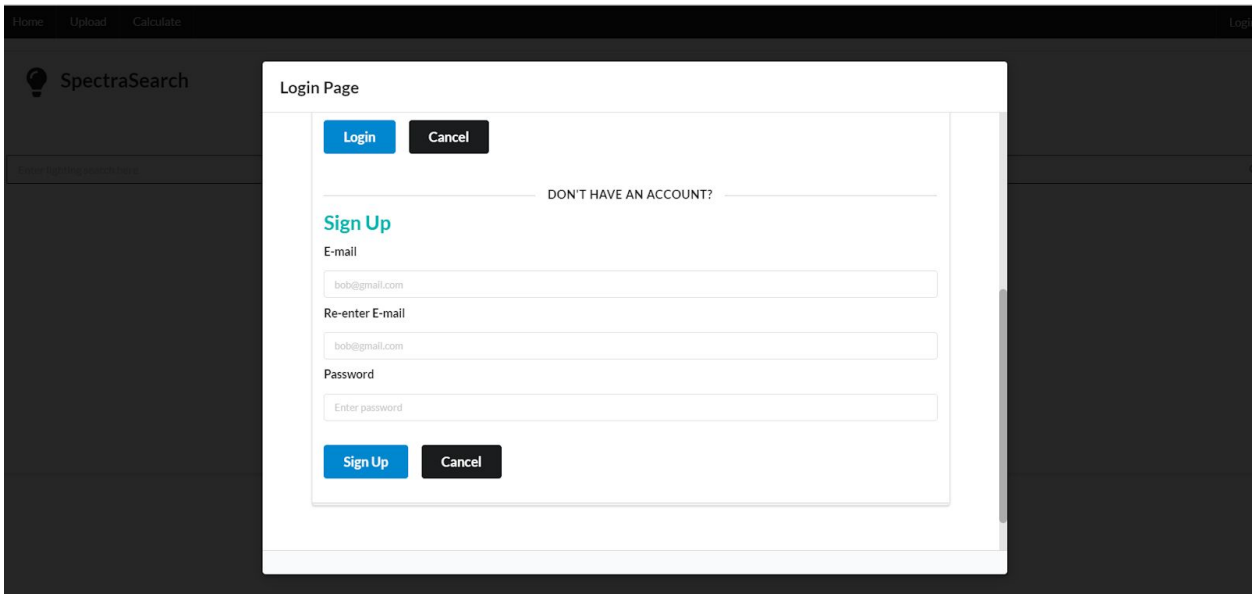


The page containing information about the given and needed light instrument will be showcased. The information shown include: Basic Information (Manufacturer & Description), Calculations (Lumens, Watts, Volts, CIE, CCT, FSI, GAI, CRI & CRI R1-8) & the interactive Graph.

Then we have the login page:

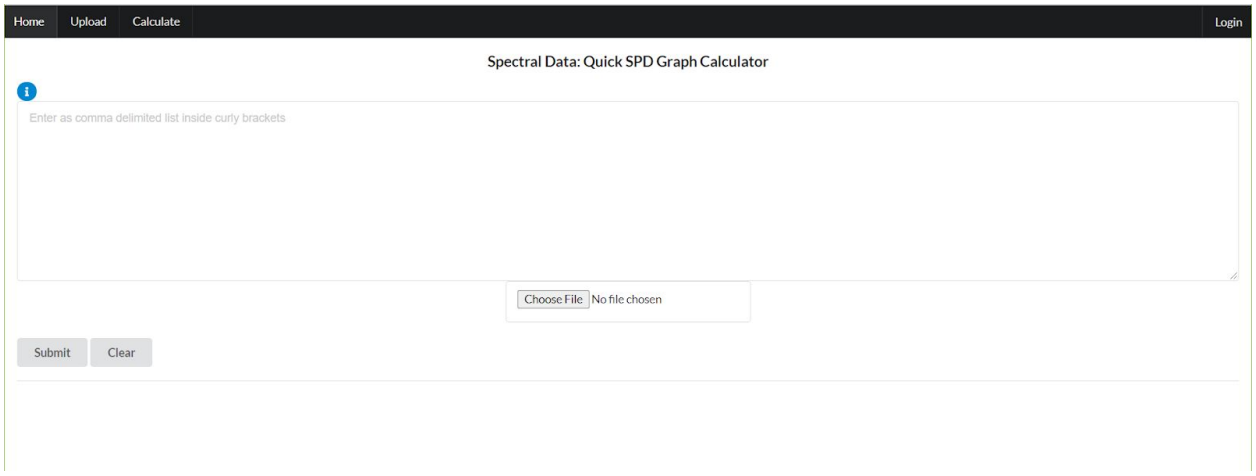


And if you don't have a user then you must sign up:



There is still a need to work on the security as the application is not considered to be with in the highest of the security standard but more over the minimum required to have a functional base "foundation".

Then we have the Calculate page:

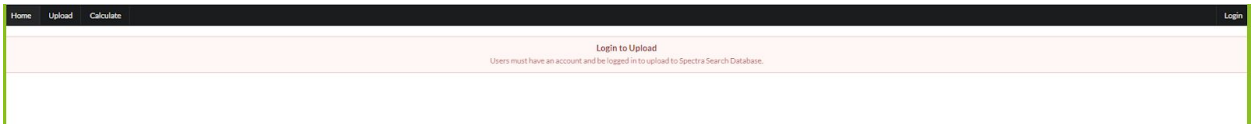


This page allows the user to have a reflection draw of how the data is and the graph of it. The application will take data points from the user and reflect a graph that is aimed to show the spectral distribution of power lights. The application will process all of that automatically and as needed. It will calculate the lightning metrics automatically as well. There is two feature that are still in the works on this page:

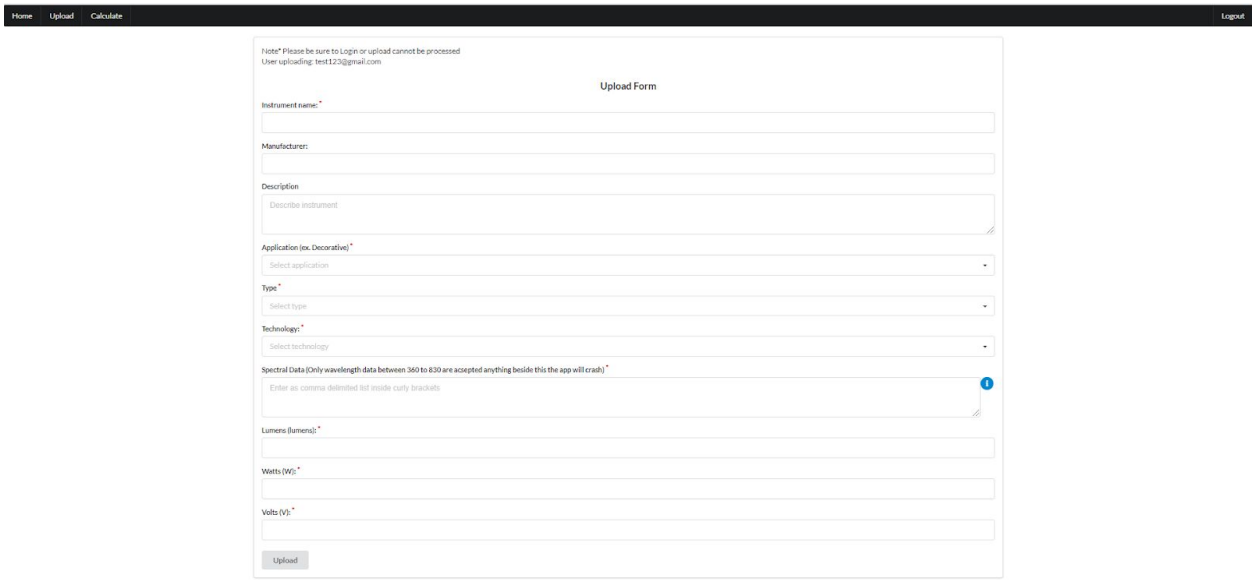
1- Is the upload feature which will allow the user to upload a CSV file that will be fed to the box to provide the needed output of the calculation and graphs.

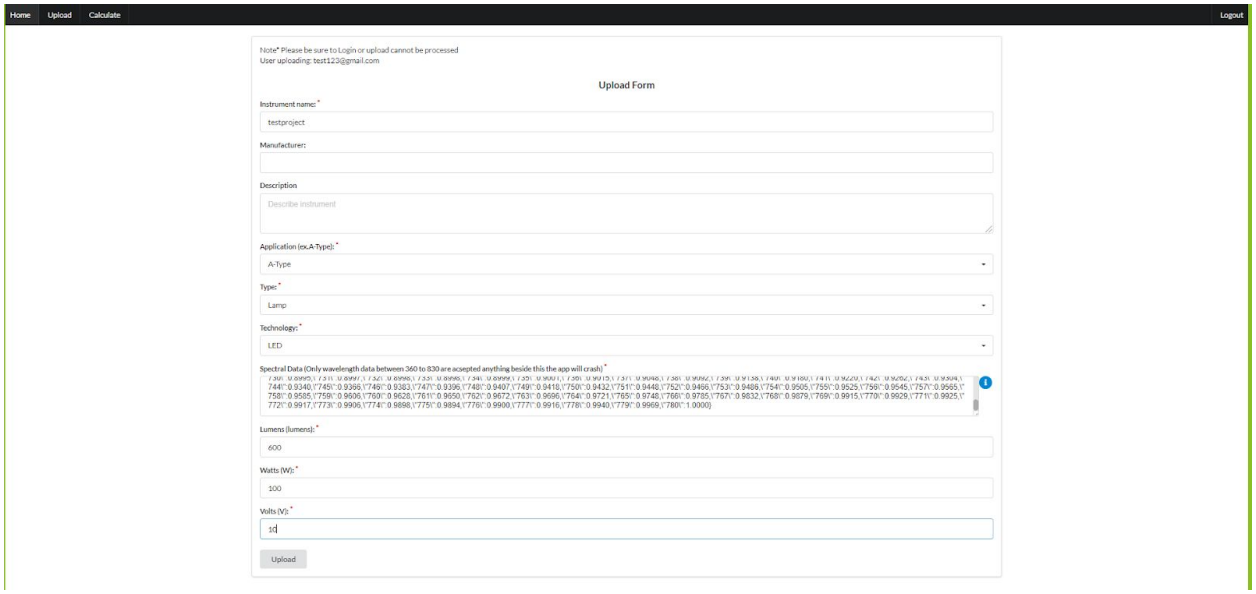
2- Another is the export of the information and graph as a PDF.

To be able to go to the upload page you will have to login in into the application with the right credential or sign up if you don't have any. Else you will be met with this warning:

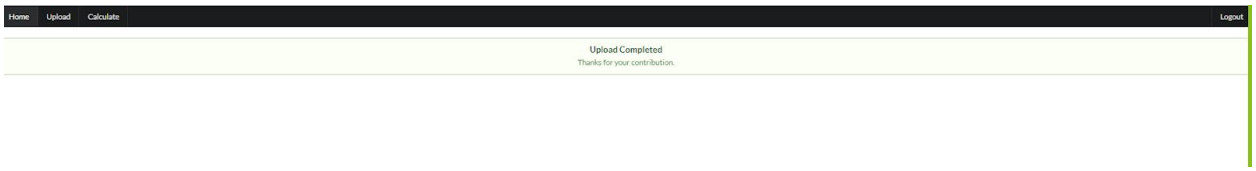


The upload page allows the contribution of the public and the open community to lighting information and instruments. They must fill in the information required as this: instrument name, manufacturer, description, application, Type, Technology. Spectral Data, Lumens, Watts and Volts. Then the user will have to press on the upload button to submit.

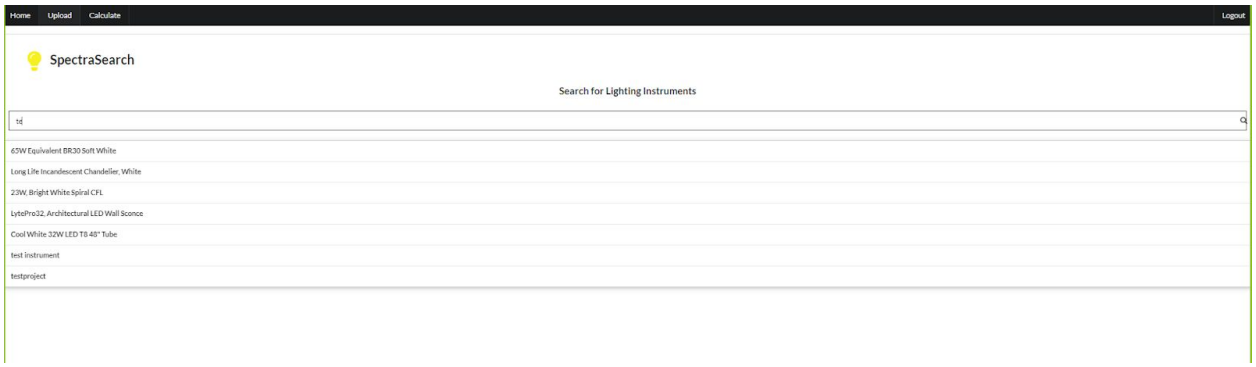




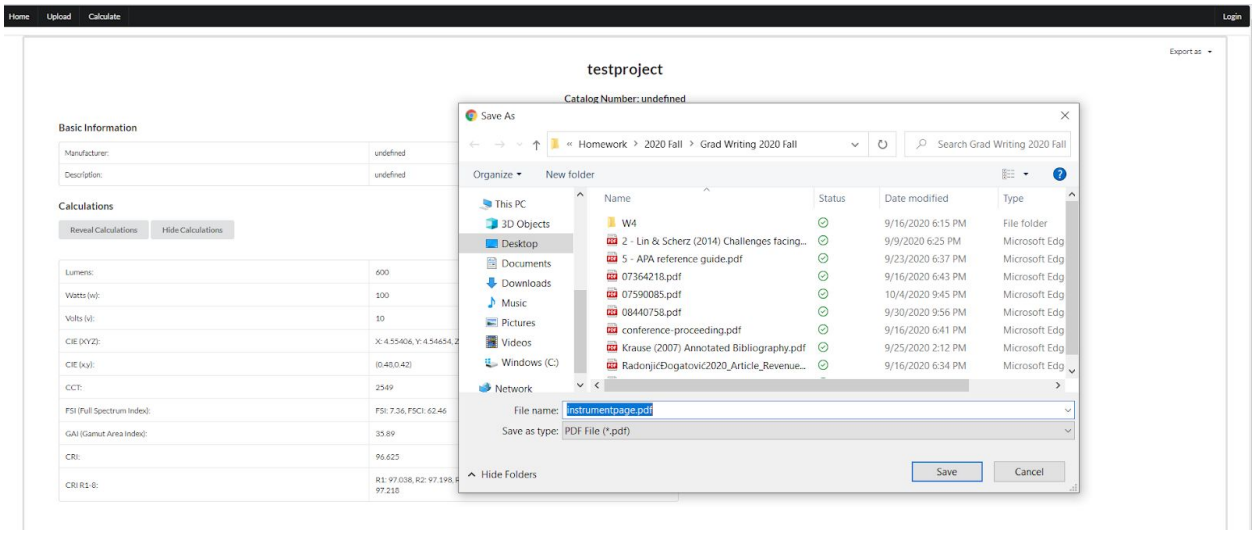
After clicking the upload button, the user will be met with this message:

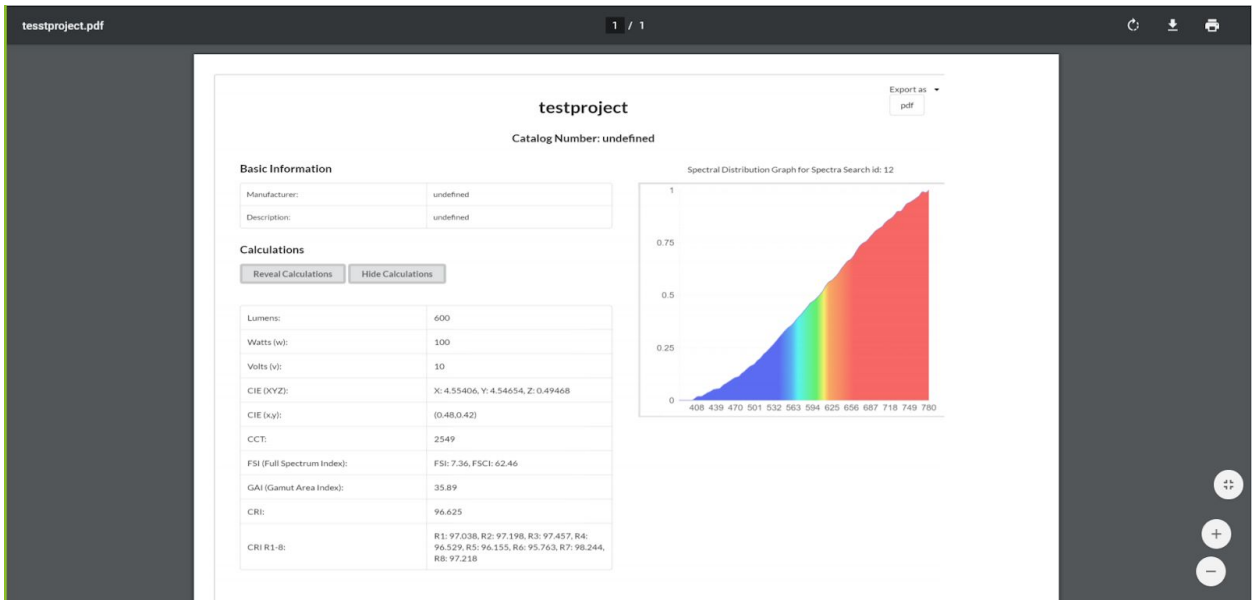


And then he can go and search for the result in the search bar:



At the moment if you want to export you can click on the export button and it will help you to export the information as PDF.
It should be mentioned that a future feature can be a review of the information so that bogos data cannot be entered.





4.3 Preliminary Documentation (Technical According To The Rubric)

What a user need to know to use our application:

A basic setup and implementation manual was offered to the client and they can give it to anyone they desire to start using the application designed according to what is in the disposal and hand of the repo that holds the most up to date application. As for the browsing of the application by any typical user, the only requirement is to have basic information about how to use the computer and working browser such as Google Chrome or Firefox.

Skills that other developers need to know before jumping into the design or maintenance of our application:

- Fundamental skills of Javascript and React.
- Fundamental knowledge of SQL/PHPMyAdmin.
- Familiar with HTML & Programing Structure.

How will your customer maintain what you have?

For that we need to visit the AU Fall 2019 client's requirements and legal concerns(Business Consideration):

(1) This product will be considered as an open-source software that can be freely used, modified, and shared;

(2) Once delivered, our team will be hands off regarding warranty for this product and will not be liable for its maintenance, security, distribution and performance

(3) (Restrictive) GNU General Public License, version 3 (GPLv3) will be in effect:

(a) All source code must be public;

(b) Modifications of the software must be released under the same license;

(c) Changes to the source code must be documented;
(d) This program is free software: you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation, either version 3 of the License, or (at your option) any later version. This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details. For a copy of the GNU General Public Licenses see (http://www.gnu.org/licenses/).

5. Encountered issue and risks

A. **Issue:** Communication issues due to pandemic and social distancing
Fallback: With increased mandates pushing social distancing due to the Coronavirus pandemic mostly all of group communication and client communication is now digital. With this in mind group members must work harder and smarter to increase communication to decrease loss of efficiency and communication errors that may come with this issue. Weekly meetings and deadlines will be set up at least a week ahead of time and contact with clients will also be set up in a timely manner to ensure nothing is lost in digital communication.
Incidents & Encounters: None

B. **Issue:** Team issues
Fallback: If problems arise either with team members not being able to finish their part before the next sprint or team members are falling behind in keeping up with project work we will, as a group all work together to help the group member catch up and finish their part because the team cannot be successful if we are all at different points in our progress. This may include issues in pushing/pulling new code, solving code problems or other issues regarding team communication and progress. These problems will all be addressed as a team and solved as a team. If a team member leaves the team or does not come to any meetings all work from their end will be redistributed among the rest of the current team members
Incidents & Encounters: On multiple occasions the team felt that some members were left behind due to life circumstances or other things. The team tried to work together and around this by transmitting the needed knowledge and skill required to advance in this project and catching the needed members with what was going on and up.

C. **Issue:** Time zone issues
Fallback: With multiple group members being in various time zones we will implement strict but reasonable timelines for submitting work to keep progress on track and set meetings ahead of time.

Incidents & Encounters: Due to the different time zones, it is hard for us (as students & workers) to schedule a meeting in our own available time. There are many attempts to schedule meetings on specific websites (such as "timeanddate.com" as suggested) which help us ease & check the right time in other time zones (for all members) and find the suitable slots. Sadly this is still challenging for some of us especially those that are in different time zones than Washington DC to meet some of the critical meetings and deadlines required.

D. **Issue:** Learning curve of the technical aspects and practicality of the project requirement
Fallback: There have been various technical aspects that have been required of us to complete the project. For instance, some of us are not familiar with Javascript as we would like to be which has proven to be a setback when it comes to dealing with time. It seems that there is much to learn for all of us, and we would need to know the language, in order for the project to move as smoothly as we'd expected. Javascript is a difficult language and it will be a timely process to learn and convey.
Incidents & Encounters: Although the previous team covered most of the code and the build regarding React, there is still much to work with especially when it comes to the logic of Javascript and the relation to it. As this is a project that requires all moving parts, we would all be required to help in the building and debugging of the code so that we are able to meet our goals.

E. **Issue:** Software issues such as lost code, slow runtimes or/and version control issues
Fallback: If any code is lost we will have the last updated piece of code from github as all of our progress will be continually updated through their, if any slow run times are found with the code we will work as a group to either determine if the problem is with the hardware it is run on or if its a bug in the code itself.
Incidents & Encounters: We encountered this problem (unexpectedly) at the beginning of the project development in the old team repo because the previous team didn't update their latest version and software on github. Due to that reason, we took a lot of time trying to fix the functionalities and search for the bugs. For now, we are still frequently checking out our software version on github and making sure every change has been completely noted and as needed has been amended.