VicEnerG

SUPPORT DOCUMENT

TP11 – FiveS

VicEnerG

Version 4.0

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Table of Contents

1. Introduction

This report will be an administrative and supportive document to the VicEnerG application. The document not only defines the responsibilities of the administrators but also contains relevant information to facilitate their management. It will provide future sponsors with a day-to-day procedure to look after the website, training plan, preparation for future expansion, data management, security and privacy, and testing information. This document is directed to administrators, especially database managers, to manage the VicEnerG website.

2. Fundamentals of the proposed system

Our website VicEnerG targets all sexual Victorian who pay the electricity bills in Victoria, mainly aged 30 to 45 and are family members. The web application provides users with information about solar panels and water recycling systems. Users can use calculators to get the possible electricity-saving data or the water calculator to calculate how much rainfall they can recycle.

3. Regular Management

3.1 Day-to-day procedure

To ensure the web application can work properly in the future, or help the administrator to get information about how to make sure the application is up to date, this section is provided:

3.1.1 Daily works:
Verify that the web application is up to date.
Check whether the status of the server is healthy.

3.1.2 Weekly works:
Backup application files and database.
Check application performance and application access log to detect any malicious intrusion.
Generate weekly applications accessing reports.

3.1.3 Back-Up Procedure
The application Back-up procedures mainly contains two parts:
- Web Application backups
- SQL Database backups

3.1.3.1 Web Application backups
Since the web application is hosted on the VM, there must be a backup option from the service provider. For example, the web application is hosted in Azure VM, there is a backup section for Azure VM, as shown in the image below:
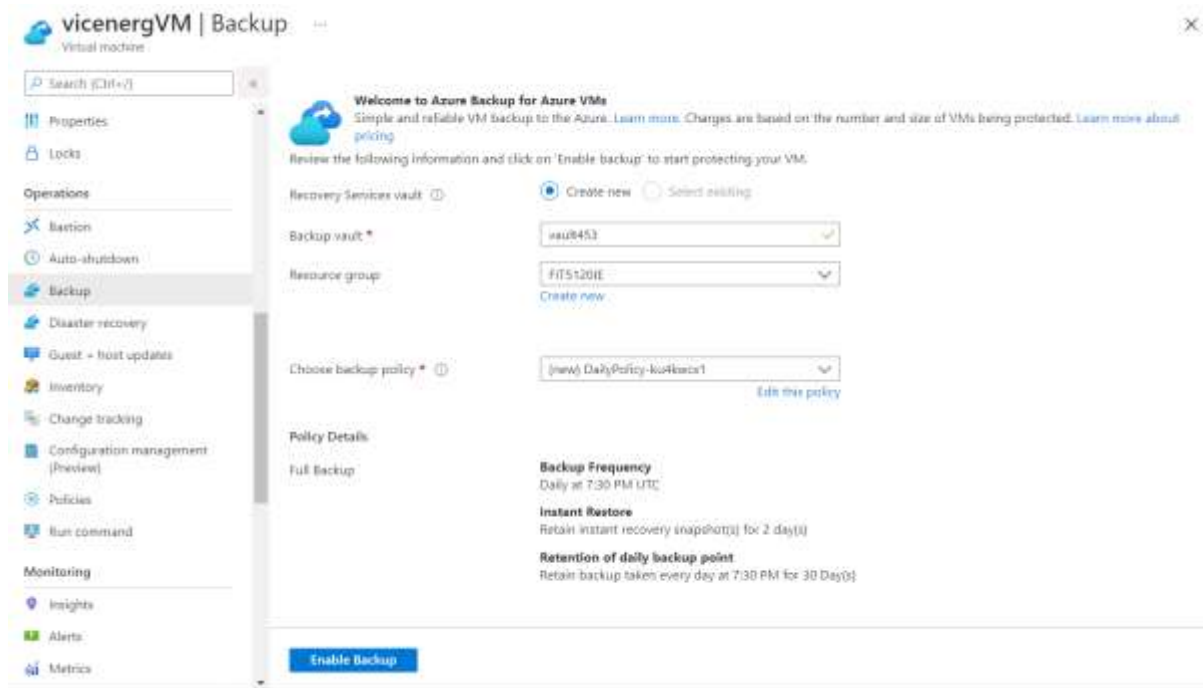
3.1.3.2 SQL Database backups

Similarly, the backup option of the database will be provided by the service provider. For example, if the database is hosted on the Azure SQL Database, the backup option is under the SQL Server > Backup Section, as whom in the image below:
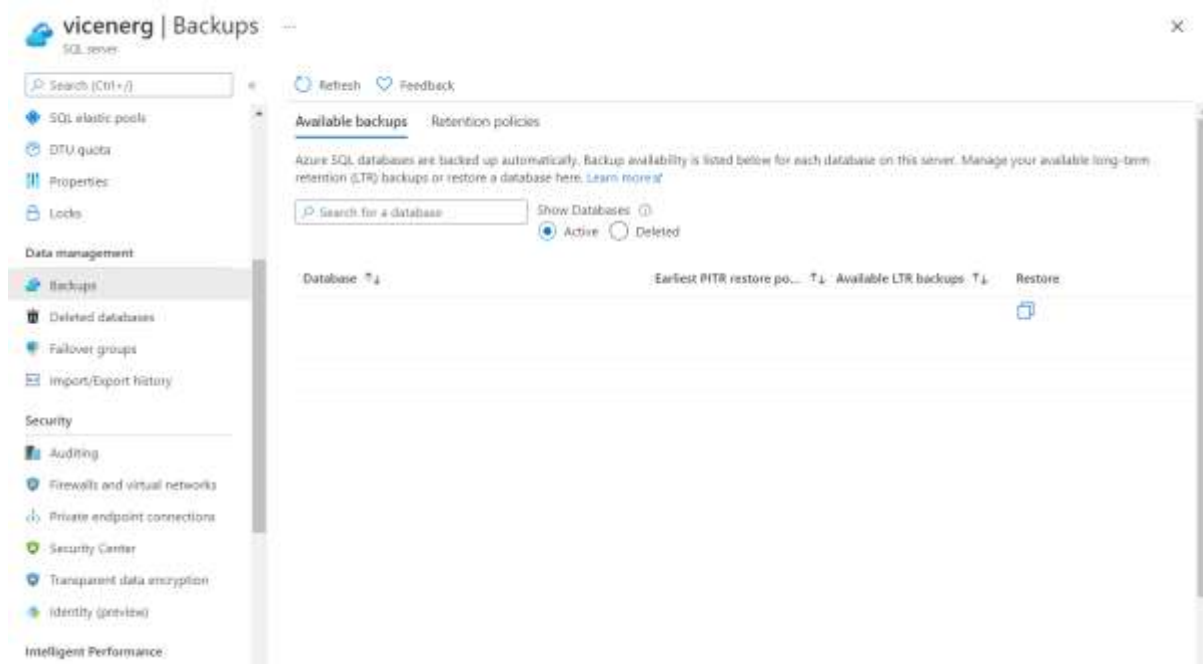
3.2 Training

For the network administrator (day-to-day runner):
- Knowing how to check the server status. Currently the system is hosted on Azure cloud VM platform. The network administrator should know how to log in into the platform

and check the status of the system. The following has provide a instruction on how to access Azure VM platform:
[Azure Virtual Machine Tutorial | Creating A Virtual Machine In Azure | Azure Training | Simplilearn](#)

- Knowing how to backup the system. As the backup procedure mentioned above, the network administrator should be able to carry out the backup weekly. The following link will be short demo for backing up the hosted application: [How to Backup Azure Virtual Machines](#)

After training the network administrator should be able to backup the system weekly and be able to keep the server status healthy.

For the data scientist (For system update)
- Be able to collect new data from the data source (Recorded in the data management plan) in an efficient way. The following link is an instruction on how to obtain data through API: [API Tutorial | LongPaddock | Queensland Government](#)
- Be able to analyse the data and update the dataset of the system. As a data scientist, it is necessary to have the ability to clean and wrangle the data in any software. The data scientist should generate new JSON files with new datasets and upload them to the system folders.
- SQL language is required for database management for the system

After training, the data scientist will be able to collect and clean the new data. Formats the data and uploads to the system.

For the web developer (For system update and urgent fix)
- Knowing the structure of ASP.NET MVC framework with 4.8 version. As not all web developer familiar with ASP.NET, the following link is an instructional video to help the web developer understand the key concepts of ASP.NET: [Step-by-step ASP.NET MVC Tutorial for Beginners | Mosh](#)
- C# language is necessary for implementation of the system
- Experience on working with Windows operating systems.

After the training, the web developer should have the ability to troubleshoot the system when bugs are found. In addition, the web developer should have the skill to improve the usability of the website and make use of new data from the database.

4. Preparation for future site

To set up the necessary server, this web application is hosted on Azure Virtual Machine using image Windows Server 2019 Datacenter. Since this web application is developed using ASP.NET Framework 4.8, Windows OS must be utilised for hosting the web application. Any VM that supports the Windows Server 2019 Datacenter image is recommended. This is a small-scale web application, hence the 1vcpus and 2GiB memory are enough for the web application.

The following link is the steps to create a VM on the Azure platform. If you decide not to use Azure services, you can also refer to your service provider website for creating a VM. The requirements of the VM are specified as below:

	Recommended Requirement	Minimum Requirement
Image	Windows Server 2019 Datacenter	Windows Server 2019 Datacenter
Size	2vcpus and 2GiB memory	1vcpus and 1GiB memory

Services Installed	Web Management Service, Windows IIS, ASP.NET 4.8, Web Deploy v3.6	Web Management Service, Windows IIS, ASP.NET 4.8, Web Deploy v3.6

Quickstart: Create a Windows server VM with the Azure Stack Hub portal
https://docs.microsoft.com/en-us/azure-stack/user/azure-stack-quick-windows-portal?view=azs-2102

The following link includes the step of setting up the VM to host ASP.NET web applications and deploying the web application from Visual Studio to the VM. If you decide not to use Azure services, you can still refer to this link for setting up the environment for Windows IIS hosting. Note that the framework used is ASP.NET 4.8, hence you should download ASP.NET Framework 4.8 components in your VM, instead of .NET 5.0 shown in the link:
Deploy a C# ASP.NET web app to a VM in Azure Stack Hub
https://docs.microsoft.com/en-us/azure-stack/user/azure-stack-dev-start-howto-vm-dotnet?view=azs-2102

Any SQL relational database could be used for this web application as long as it follows the ER diagram structure, and it is connected to the web application in the Windows IIS. It is recommended to use the Virtual Network/Subnet to include the web application and database for security purposes. Since the size of the data stored in the database is 32MB, the recommended database size is around 1GB.

You can contact your service provider for any backup option available for the web application's VM as well as the database. The backup option for Azure has been shown in section "Day to Day Procedures" > "Back-Up Procedure".

In addition, you can add a custom domain to your web application, and it is also highly recommended to install an SSL certificate for the web application for security purposes. The methods to add custom domains and set up SSL certificates vary across different service providers.

5. Data Management

5.1 Extract the data
Data Source: Request point climate data from 1889 to yesterday
https://www.longpaddock.qld.gov.au/silo/point-data/#responseTab2

Request point climate data from 1889 to yesterday

The data is an open data from the **Queensland Government** website but it shows all climate stations in Australia. The website provides two different data formats: CSV and API. You can either use an API link to update real time data or apply data analysis on csv data.
You will download CSV files from the website currently.

1. click the data source link, you can enter **Queensland Government**
2. You can select date range by clicking **Date range**
3. Under **Variables**, click 'Daily rainfall (mm)' and 'Solar radiation-total incoming downward shortwave radiation on a horizontal surface (MJ/m2)'
4. You can choose melbourne stations by clicking **Select a station**
5. Finally, you can download CSV files by clicking on 'Get data file'

5.2 Process data by script
1. Open ANACONDA NAVIGATOR 1.10.0.

If you don't have ANACONDA in your system, please download ANACONDA at https://www.anaconda.com/products/individual#Downloads

2. Launch jupyter Notebook 6.1.4
   Anaconda is a Python prepackaged distribution of Python which contains a number of Python modules and packages. Jupyter notebook is one of the tools inside the ANACONDA that allows users to combine code, images, plots, notes, etc.

If you haven't installed jupyter notebook in your Anaconda, please directly click **install**.
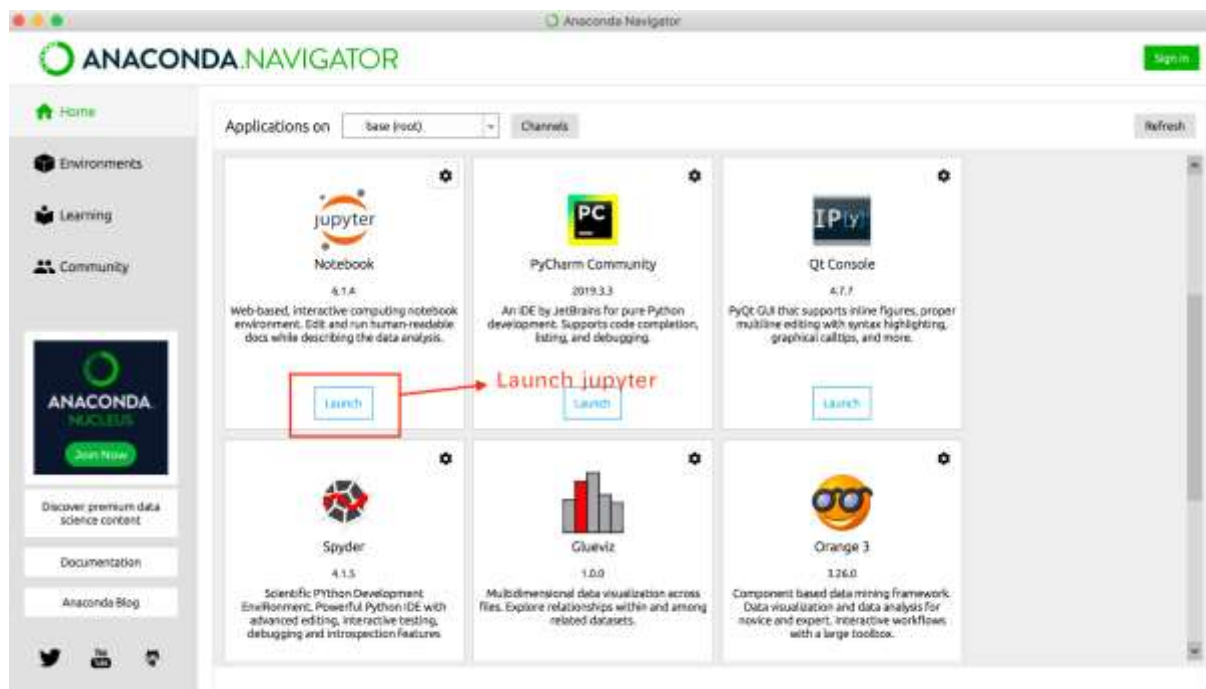

If you have the jupyter Notebook, you can directly click **launch** to start the tool.

3. You should put all data (CSV files downloaded from **Queensland Government**) and scripts in the same folder, so you can directly run the script. The data should be put in Desktop>data_processing. If you don't have a **data_processing** folder, please create a **data_processing** folder in your Desktop.

Get solar_script under 3.0 Code and Database Folder > Data Processing Scripts > solar_script.ipynb and choose your download path: Desktop>data_processing.
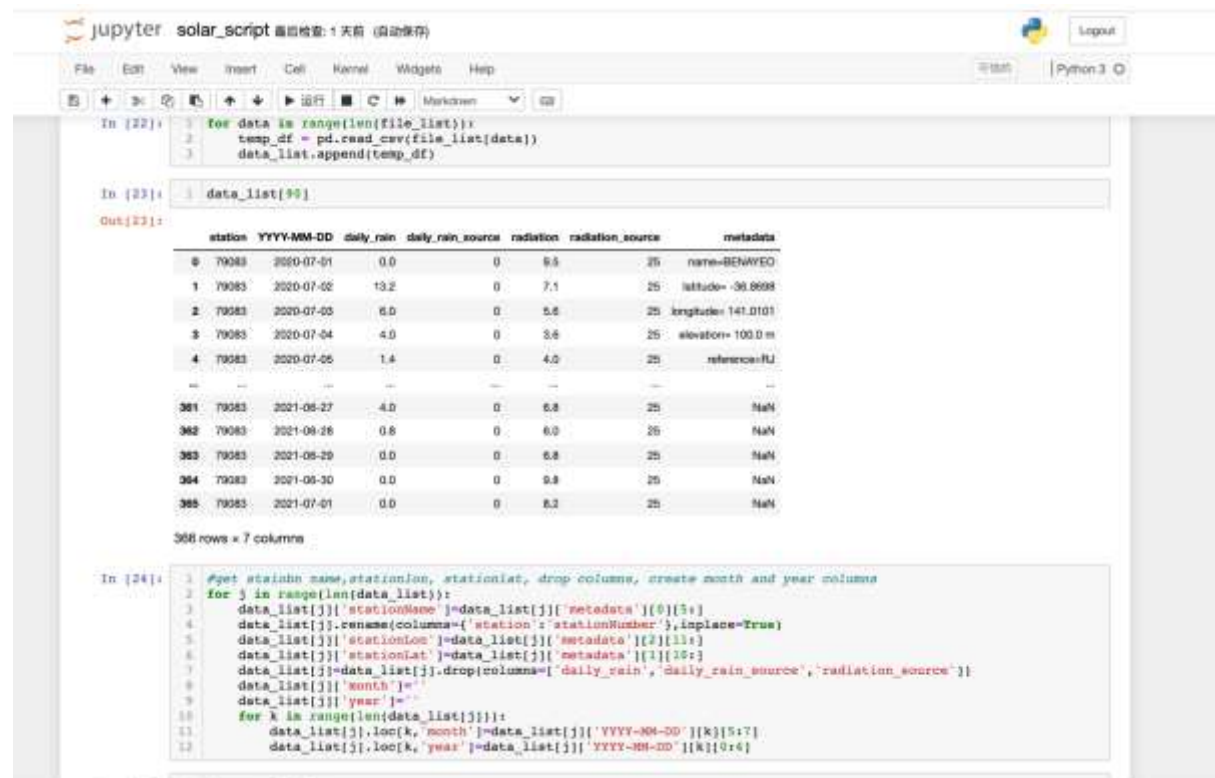
4. Run the solar_script file , you can get **Station.csv** and **StationData.csv**

Get rainfall script under 3.0 Code and Database Folder > Data Processing Scripts > rainfall_script.ipynb and choose your download path: Desktop>data_processing.

5. Run the rainfall_scrip, you can get **postcodeData.csv**
6. Now you can get all output files in your Desktop>data_processing folder. If you don't want to run scripts, you can directly download all output files from 3.0 Code and Database Folder >Website Data Source and store them in Desktop>data_processing folder.

5.3 Upload data into server

1. Open the Visual Studio 2019 (Tips: Require Windows system).

You can directly copy the link to clone a repository
https://github.com/Hin97/FIT5120-VicEnerG.git
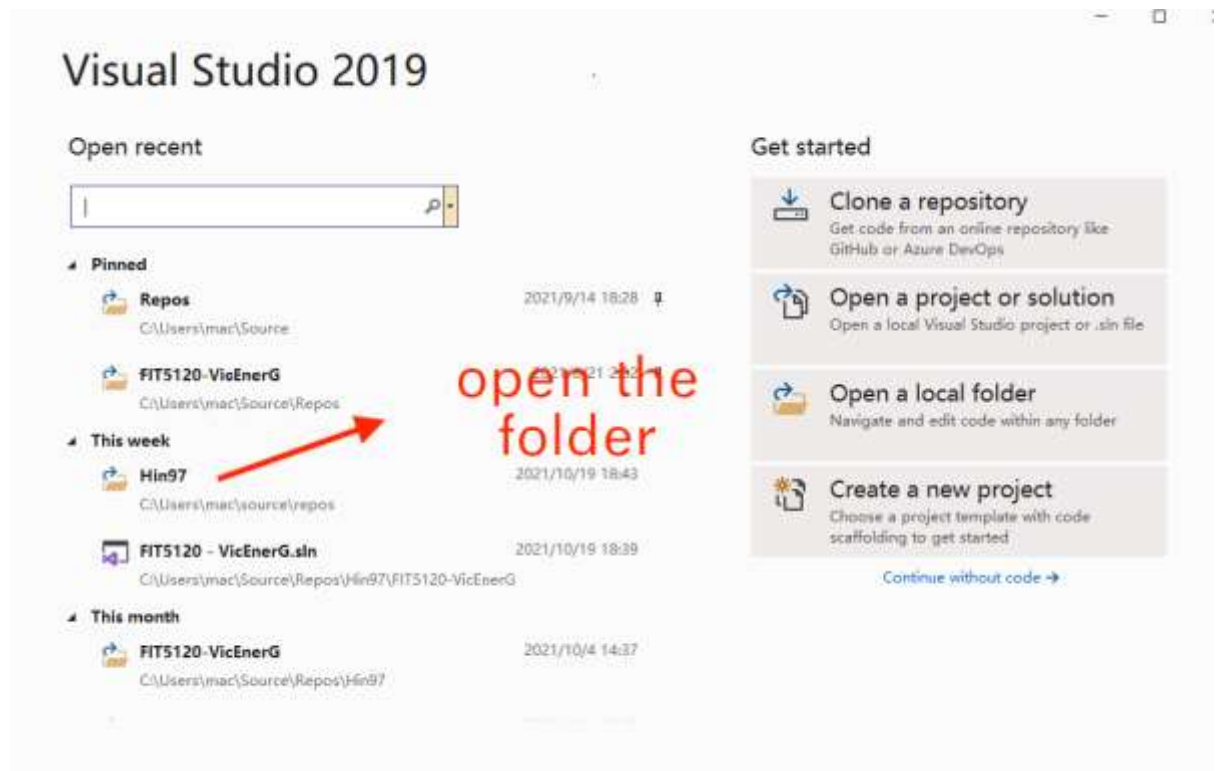
2. If you want to update your database or import data to your database, you need to copy code in 'VicEnerG_Model.edmx.sql'(link refer below). Then, **open a new sql file** and paste the code. Now, you only need to run the sql file to upgrade/generate tables in the database.

3. Open "Data import query.sql" (link refer below) the file and run the code. Then, you can import the data into the database.
Tips: You may need to change your file path to Desktop:\data_processing\Station.csv (the same with StationData, Appliance, and PostcodeData).

If you don't want to run the jupyter notebook, you can download the data from 3.0 Code and Database Folder > Website Data Source
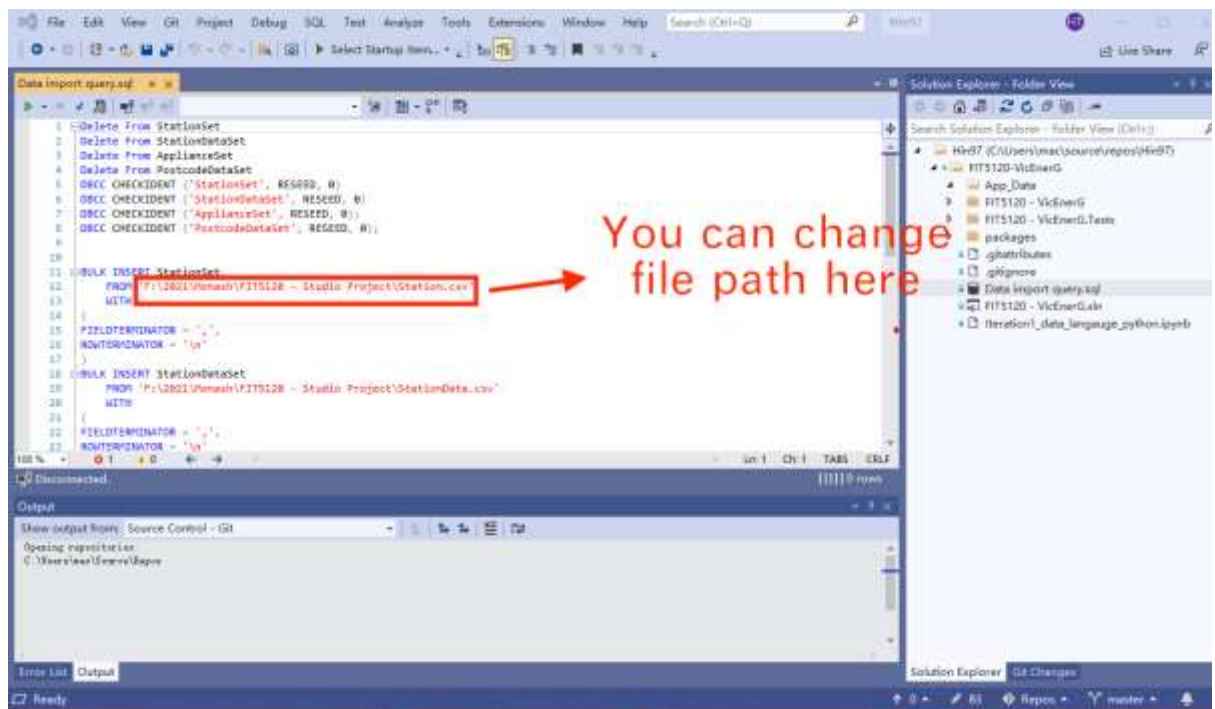
Future Changes & Upgrade data

At present, the data scientist manually downloads the files that refer to the specified date. But if you need to update and upload new data in the future, you can download the data and run the script. You can also get the API key from the API Guide, which has a specific date and specific station number. Then you will run the script to access the newest data. So it's easy to refresh the newest data once a year.

Data Source:
Request point climate data from 1889 to yesterday
https://www.longpaddock.qld.gov.au/silo/point-data/#responseTab2

Australia Postcode:
https://www.matthewproctor.com/australian_postcodes

Generate table from database model (SQL):
3.0 Code and Database Folder > Website Database Modeling > Database modeling.sql

Import data to database (SQL):
3.0 Code and Database Folder > Website Database Modeling > Data import query.sql

6. Security and Privacy

6.1 Communication Encryption

The communication between web server and client is protected by SSL/TLS encryption. This is very important for the security of web applications, and thus, you must implement the SSL/TLS certificate for the web application if you want to reimplement the web application for the company.

The following link is the steps to setup the SSL/TLS certificate in the VM using KeyVault:

Tutorial: Secure a web server on a Windows virtual machine in Azure with TLS/SSL certificates stored in Key Vault
https://docs.microsoft.com/en-us/azure/virtual-machines/windows/tutorial-secure-web-server

If you already had a certificate, you can refer to this link to understand how to import the certificates into KeyVault:
Import-AzKeyVaultCertificate
https://docs.microsoft.com/en-us/powershell/module/az.keyvault/import-azkeyvaultcertificate?view=azps-6.4.0&viewFallbackFrom=azps-4.8.0

If you don't want to use KeyVault to store the certificates, you can refer to these links to manually setup the certificate:
How to install an SSL certificate on IIS10
https://www.ssls.com/knowledgebase/how-to-install-an-ssl-certificate-on-iis-10/

How to Install an SSL/TLS Certificate on Microsoft IIS
https://www.youtube.com/watch?v=nB3TFDkDkcU

Install an SSL/TLS Certificate in Windows IIS 10
https://www.ssl.com/how-to/install-an-ssl-tls-certificate-in-iis-10/

6.2 Security Implementation

The security vulnerabilities that are considered in this web application are Security Misconfiguration, Using Components with Known Vulnerabilities, Man-In-The-Middle Attack (MITM) and Injection (SQL, XSS). The actions implemented to prevent/reduce the vulnerabilities are establishing a communication encryption which is the SSL/TLS Certificate, implementing a firewall in the web application, user input filtering and sanitization, error page minimizes information shown., and configure the security correctly based on the list provided in "Security Misconfiguration Response Strategies" section. For more detailed information, you can refer to the "Security Aspect" document.

The inputs required by the client are the postcode, roof size and number of panels required. Hence, input validation has been performed using the ASP.NET AntiForgeryToken feature to prevent the input injection such as SQL and XSS injection. Moreover, the ViewModel has been utilized with the use of model annotation validation to limit the input of components, hence strengthening the security of the web application by limiting the input of users. In addition, the web application has no login session in the system, no cookies and no sensitive information saved in the system, hence no privacy issue for the web application.

The username and password for the VM as well as SQL database must be kept safely to prevent the database or VM breaching. It is recommended not to write the username and password in plaintext form in the code, such as in the Web.config, to increase the security of the web application. In the firewall settings, it is also recommended to open the required ports only for the VM and database to reduce the attack surface of the web application. Do not open all ports for your own convenience.

If there is a need to restore the web application or database, you can refer to the section above "Day to Day Procedures" > "Back-Up Procedure". In the above section, follow the steps to the backup page and then restore the backup if required.

If there is any intrusion detected, our team encourages you to contact your security team or IT department as soon as possible to reduce the damages. Please follow your company's orders for this issue.

7. Future changes

The detailed information of maintenance could be found in the maintenance doc, the following points are the brief summary.
Skills needed.
Linux basics
- Basic operating commands: Google, such as Linux command cheat sheet
- Familiar with at least one built-in editor: vi, nano

The internet
- Detailed TCP/IP protocol
- Proficiency in using tcpdump and other packet capture tools

Safety
- Firewall configuration, such as iptables, ipset
- Have capacity to use encryption tools for storage. For example, truecrypt, 1password
- Based on local storage. Have capacity to use lastpass, etc.
- ssh private key add password

Git version control
- Will create different branches
- Have the ability to understand the code written at the same time

8. Testing

8.1 Testing Information

For the postal code in the solar calculator page, the input should be a four-digit value. In order to ensure the reasonableness of the data input, I checked the relevant literature and found that the postal code range of Victoria, Australia is 3000 to 3999. Therefore, the valid value of the test is a four-digit integer in the interval, and the illegal value is a thinking integer outside the interval, as well as a negative number.

For page jumps, Epic 6 Carbon Footprint General Information and other functions will undergo usability UX/UX tests. Mainly uses black and white box testing technology. Among them, the black box only checks whether the program functions are used normally in accordance with the requirements specification, and whether the program can properly receive input data and generate correct output information. At the same time, the white box test tests all logical paths.

For website security, there are many free evaluation websites on the Internet. This web application uses Pentest_tools as a tool to test the web security. After using it, a website security assessment report will be generated.

8.2 Document Testing carried out

Integrity (Acceptance Testing):
All input content, including zip code input, selection of electrical appliances, and carbon emission output indicators, have all gone through the following steps.
1. Develop test plans, test items, test strategies and acceptance criteria, and pass the plan review with customer participation.
2. Establish a test environment, design test cases, and review them.

3. Prepare test data, execute test cases, and record test results.
4. Analyze the test results, analyze the test results according to the acceptance criteria, and make the acceptance and test evaluation. The test project passed; the test project failed, and there is no workaround, which requires great modification; the test project did not pass, but there are workarounds, which will be improved in the later maintenance period or the next version; the test project cannot be evaluated or cannot be given a complete Evaluate. The reason must be given at this time. If it is because the test item is not clearly stated, the test plan should be modified.
5. Submit the test report.