Sem.1 2023/2024

SECD 2613 System Analysis and Design
Section 08

PHASE 4:
Technical Report

Low Carbon Initiatives Community Monitoring System
<CarbonCutOffPro>

To_Be_Continued(Team 7)

Team Members:

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Table Of Content

1.0 Overview of the Project

1.1 Introduction

Phase 1 of the project discussed the Iskandar Puteri Low Carbon (IPRK) initiative, aiming to promote low carbon living in the Iskandar Puteri community. However, there are few challenges faced by the MBIP department when they are organizing the IPRK related programs such as inefficient manual processes, scattered data sources and limited resident engagement. The initiative mobilizes various stakeholders through programs such as LA21 and Drive Thru Recycling ro reduce carbon emissions and energy consumption. Due to the constraints posed by manual processes and decentralized data, this project aims to develop an enhanced platform to transform the original system into an automated system through modern technologies such as mobile apps.

Moving on to Phase 2, the focus shifts to analyzing the current MBIP carbon monitoring system. We had gathered information through interviewing and STROBE to obtain enough information to conduct in-depth analysis of the AS-IS system. Our efforts in creating context diagrams and data flow diagrams aims to create a strong fundamental analysis for proposing effective solutions in the next phase.

Phase 3 will mainly focus on proposing effective solutions to address the identified challenges within the old MBIP carbon monitoring system. This phase 3 report aims to provide a detailed roadmap for the development and implementation of the TO-BE system to achieve the goal of promoting low carbon living. The primary scope of this report is developing the Physical Data Flow Diagram for TO-BE system, constructing the structure chart to show the modules involved and writing a detailed process specification for each of the child diagrams. It also aims to provide a comprehensive understanding on how the system is going to be implemented for the users. Hence, this phase 3 report will present the roadmap for the implementation of an enhanced MBIP carbon monitoring system.

1.2 Current Issues

a. Inadequate monitoring of project implementation status

The Iskandar Puteri Low Carbon (IPRK) initiative currently lacks an effective system to monitor the implementation status of its various projects and activities on reducing carbon emission within the area. However, there is no centralized platform to track the progress of initiatives by the MBIP planning department in a systematic way. MBIP does not have visibility on whether planned environmental projects have actually been executed, are on track or delayed. Without tracking of project timelines, IPRK cannot gauge implementation rates and identify the potential bottlenecks to be addressed.

b. No centralized platform for carbon data

IPRK has limitations to store project data and outcomes in a centralized or easily accessible system. Currently, data on emissions reductions or other metrics from implemented initiatives is siloed and scattered. For instance, the data collected are all stored in separate Excel files for further analysis. There is no unified platform to gather the data from multiple sources and projects to display the outcomes. This will highly restrict the ability to demonstrate tangible processes and results to stakeholders as well as the public.

c. Limited analytics on project progress over time

While IPRK undertakes different projects aimed at reducing carbon emission, the initiative still lacks a robust system to analyze project outcomes over time. This is because the project timeline will not update in a centralized system. The project progress will only be updated based on the report and documentation from the project manager. Therefore, quantifying results from the initiatives are required to identify trends. However, the current system is unable to generate such insights by analyzing data annually. Failure to analyze the data annually will be hard in revealing progress rates and planning future strategy.

d. Labor-Intensive Carbon Emissions Computations

The IPRK initiative currently involves manual computations to derive carbon emissions reductions from various projects. Calculation of carbon emissions metrics based on the water bill and electrical bill relies on manual aggregation of data points on water and waste. This will involve manual calculation based on a large quantity of data collected. They need to perform extensive mathematical calculations by using the formula in order to quantify carbon impacts. This hands-on computations process is time-consuming, inefficient and prone to human errors that might influence the data accuracy.

e. Limited User Awareness in Sustainability Efforts

While IPRK aims to promote low carbon practices across communities, there appears to be limited awareness and engagement among end users. For instance, the residents's unfamiliarity with using tools like Google Forms to participate in data collection. This indicates that many of them lack understanding of how to track their own carbon footprints in their household. Some of them might make some mistakes when filling up some important information in the Google Form due to there being no restriction in limiting the answer from the residents. Without proper knowledge, it seems to be hard for them, especially the senior citizens, to contribute effectively to regional decarbonization goals.

1.3 Overall Physical TO-BE System

1.3.1 Parent Diagram (Level 0)

For the parent diagram, we had created 5 main processes which are categorized into automated and manual processes. The automated process is generating competition reports, analyzing carbon consumption data and managing community data. On the other hand, the manual process is submitting competition data which is done by the Iskandar Puteri Residents. Next, we also create temporary data stores for storing the data during the data flows. The temporary data stores created are Temporary competition data file, and Temporary Competition File. On the other hand, the name of the data stores has been specified to show the actual data that will be stored in that particular data store.

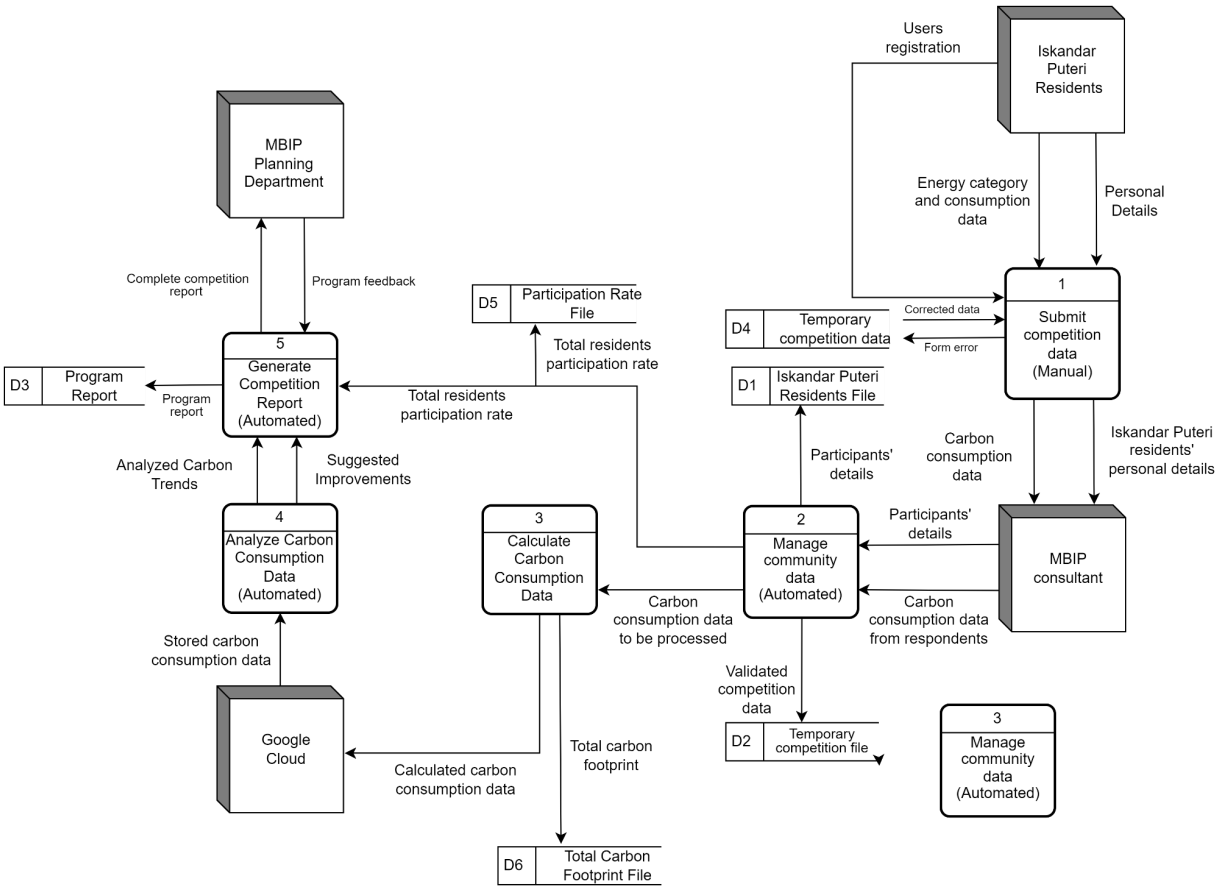


Figure 1.2.1 Parent Diagram DFD Level 0

1.3.2 Parent Diagram Partitioning (Level 1)

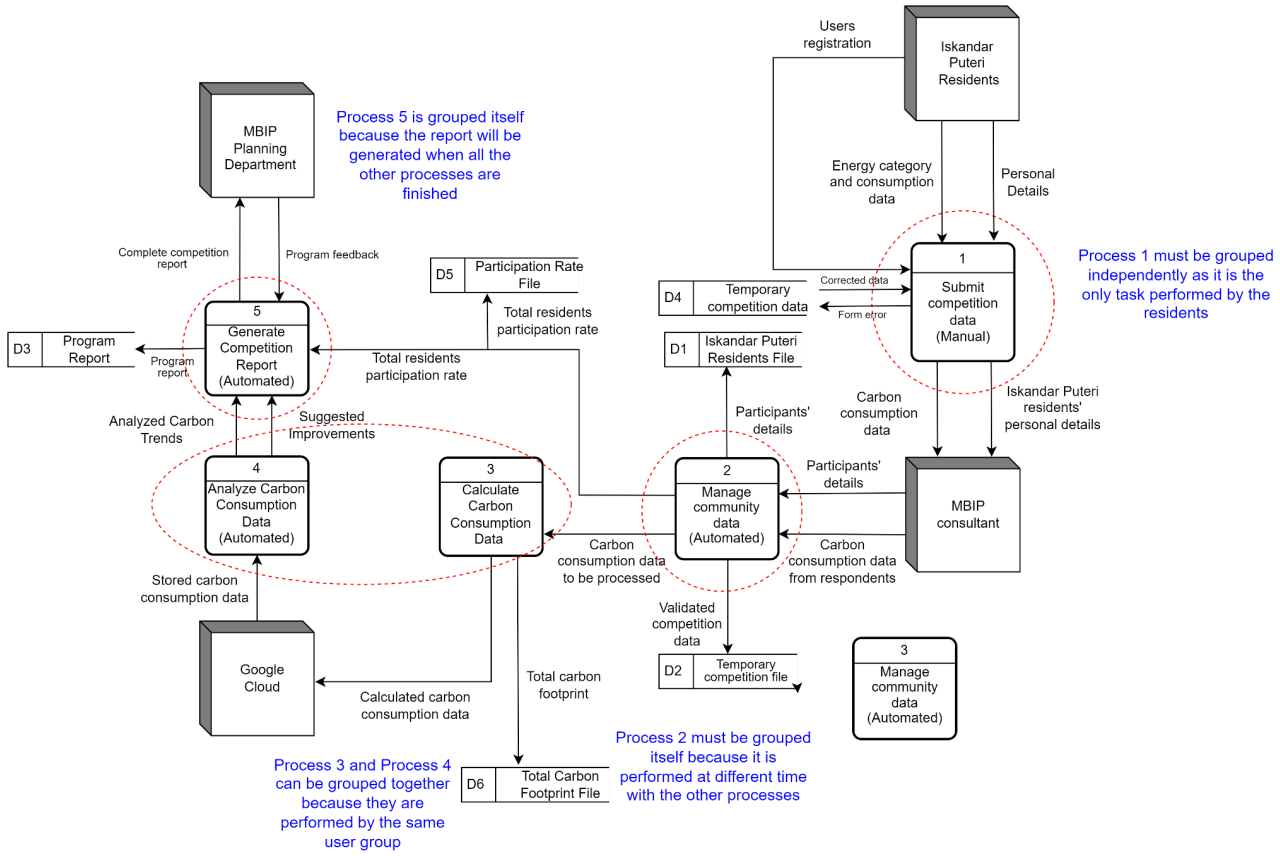


Figure 1.2.2 Partition DFD for Parent Diagram with Justification

1.3.3 Child Diagram For Process 1 : Submit Competition Data

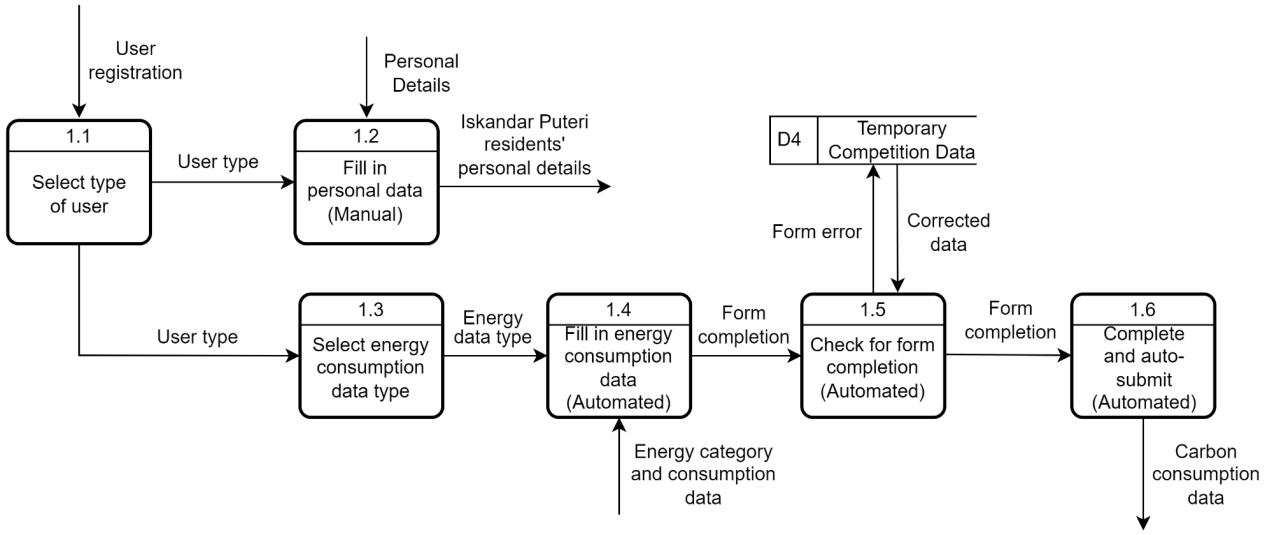


Figure 1.3.3 Child Diagram for Process 1

Description That Highlight The Issue :

This process enables the user to fill all the carbon consumption data easily. The user interface will ask the user to **choose the carbon category (1.3)** and fill information for that particular category automatically by **using electric bill ID or scanning the bill (1.4)** . Then, it will help the user to **check for completion (1.5)** and prompt them to fill in all the necessary fields. The data will auto save every time to prevent data loss.

1.3.4 Child Diagram For Process 2 : Manage Community Data

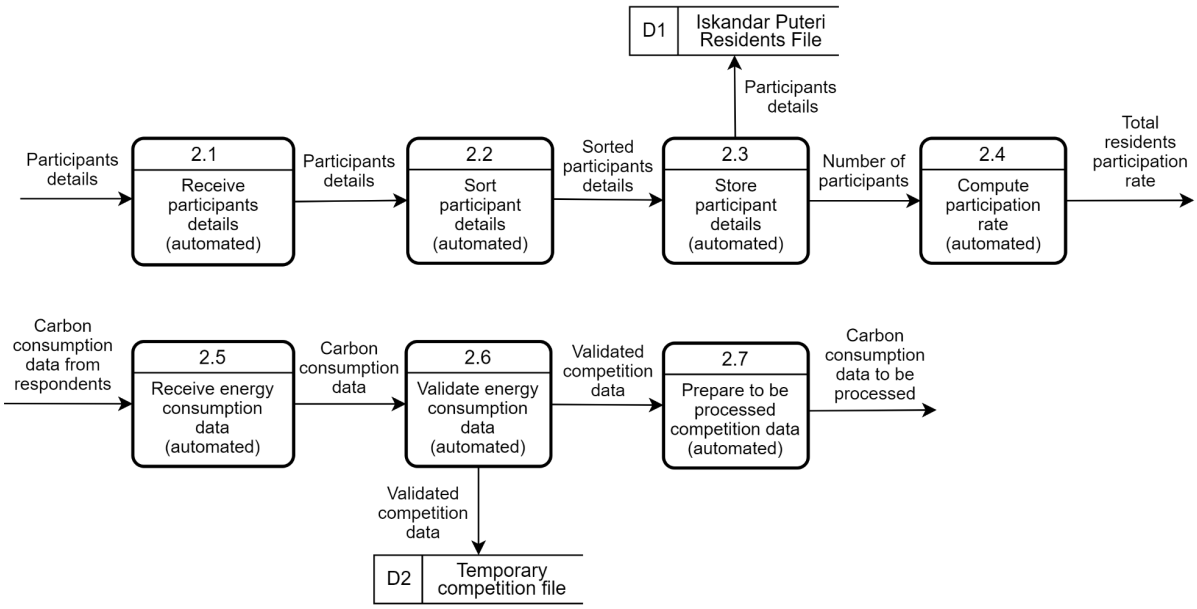


Figure 1.2.4 Child Diagram for Process 2

Description That Highlight The Issue :

This process is mainly used to separate the data from the participants for further generating process. The MBIP consultant can help to separate the data into carbon consumption data and resident data so it will be easier for the calculation process for total carbon consumption and total resident participation rate later.

1.3.5 Child Diagram For Process 3 : Calculate Carbon Consumption Data

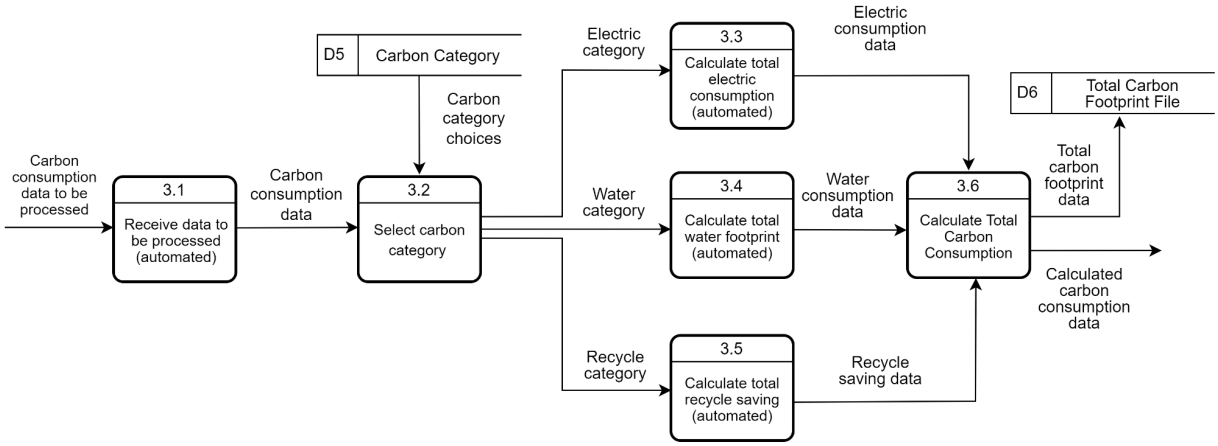


Figure 1.3.5 Child Diagram for Process 3

Description That Highlight The Issue :

This process will help the MBIP department to calculate total carbon consumption easily based on the data collected from different areas in Iskandar Puteri. It will be calculated based on the carbon category so the data will be easier for the analyzing process later.

1.3.6 Child Diagram For Process 4 : Analyze Carbon Consumption Data

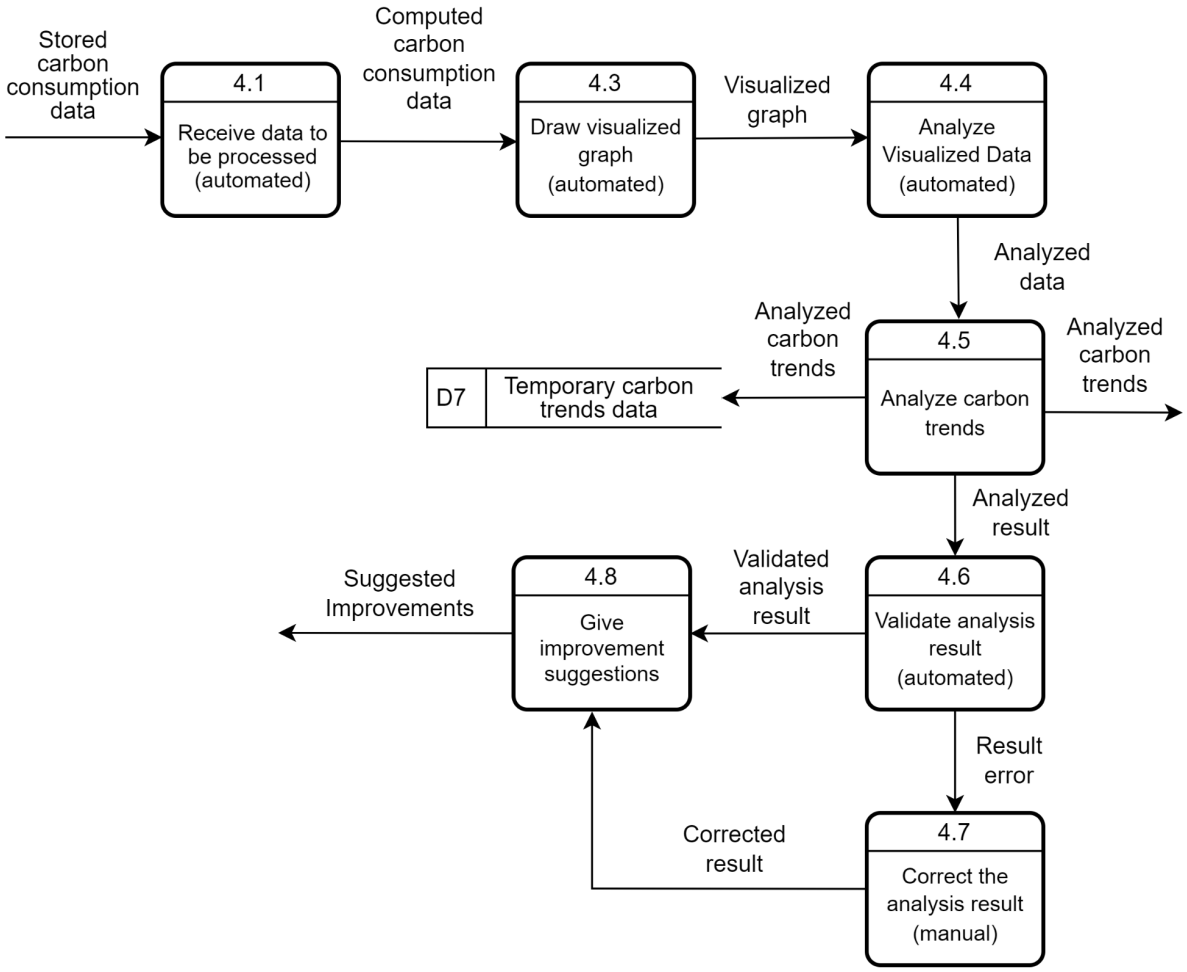


Figure 1.3.6 Child Diagram for Process 4 (Analyze Carbon Consumption Data)

Description That Highlight The Issue :

This process will draw a visualized graph to identify and analyze the carbon trends. From the graph, they can know which areas need more concern, and make suggestions on improving or reducing the carbon consumption in those particular areas.

1.3.7 Child Diagram For Process 5 : Generate Competition Report

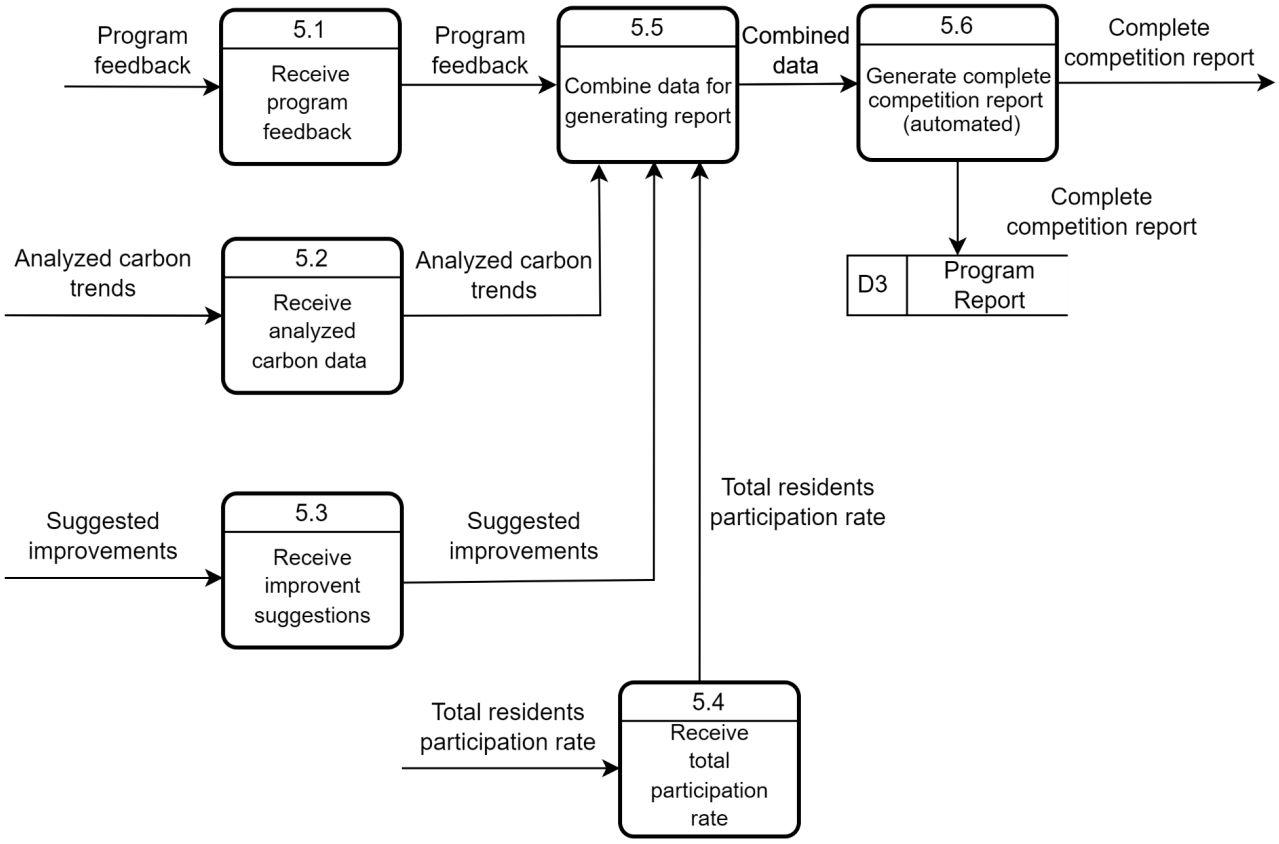


Figure 1.3.7 Child Diagram for Process 5 (Generate Competition Report)

Description That Highlight The Issue :

This process is the final process which will help in generating a full competition report. This report will display the program feedback by the MBIP planning department, the carbon trends and suggested improvements from the analysis and the total participation rate of the Iskandar Puteri residents. It will provide visibility to the MBIP department to obtain all the necessary results.

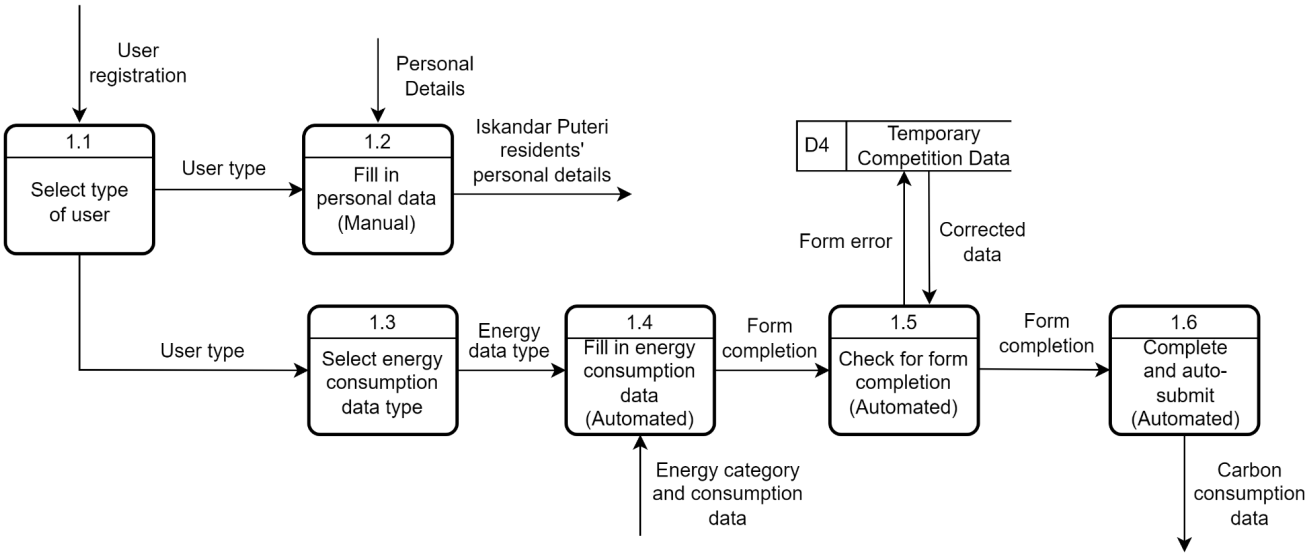
2.0 Summary of Individual Module

2.1 Individual Member Hi-Fidelity Prototype

2.1.1 Member 1 : Loh Chee Huan

Module Assigned : Submit Competition Data

Child Physical Diagram :



2.1.1.1 PROCESS SPECIFICATION FOR PROCESS 1 : Submit Competition Data

Number	1
Name	Submit Competition Data
Description	A way that enables the Iskandar Puteri to fill in their personal details and energy consumption data simultaneously within a system to organize their competition data effectively
Input Data Flow	1. Energy category and consumption data from Iskandar Puteri residents 2. Personal details from Iskandar Puteri residents 3. User registration from Iskandar Puteri residents 4. Corrected data from Data Store 6
Output Data Flow	1. Compiled energy consumption data to MBIP consultant 2. Iskandar Puteri residents' personal details to MBIP consultant 3. Google Form responses to Google Cloud and Data Store 7 4. Form error to Data Store 6
Type of Process	[ ] Online [ ] Batch [✔] Manual

Process Logic	DO WHILE User Type is Participant
	IF User Type is Participant
	THEN Prompt user to Fill In Personal Data
	THEN Select energy consumption data type
	THEN Fill In Energy Consumption Data
	WHILE form is not complete
	THEN ask user to fill in another energy data type
	END WHILE
	ELSE
	EXIT to Main Menu
	ENDIF
	IF form is complete
	THEN Submit the form automatically
	ELSE Repeat the process from WHILE
	ENDIF
	ENDDO

Refer to Name	[✔] Structured English [ ] Decision Table [ ] Decision Tree
Unresolved Issue	1. How is sensitive information protected during submission? 2. Is there any confirmation before the user submits the form?

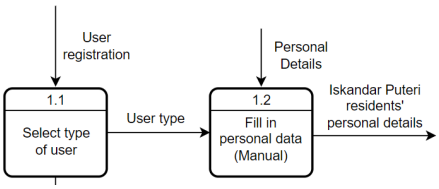
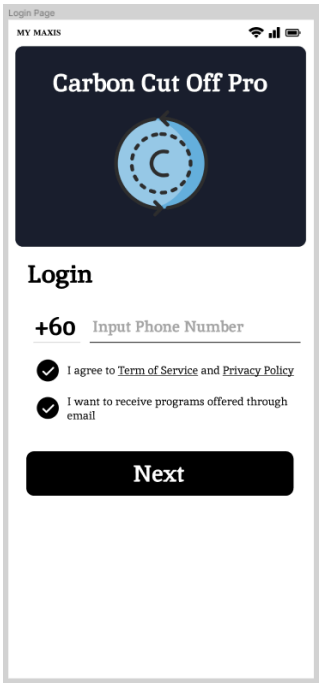
Table 1 : Process Specification for Process 1 : Submit Competition Data

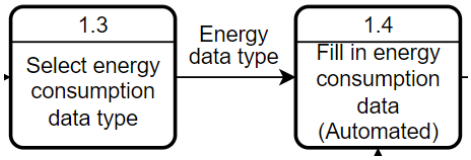
Structured English:

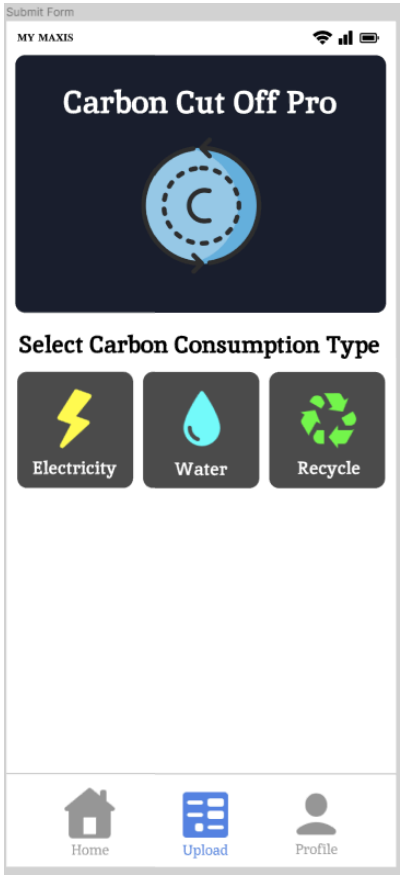
```
DO WHILE the User Type is Participant
        IF User Type is Participant
           THEN Prompt user to Fill In Personal Data
             THEN Select energy consumption data type
               THEN Fill In Energy Consumption Data
               WHILE form is not complete
                 THEN ask user to fill in another energy data type
               END WHILE
        ELSE
           EXIT to Main Menu
        ENDIF
        IF form is complete
           THEN Submit the form automatically
        ELSE Repeat the process from WHILE
        ENDIF
   ENDDO
```

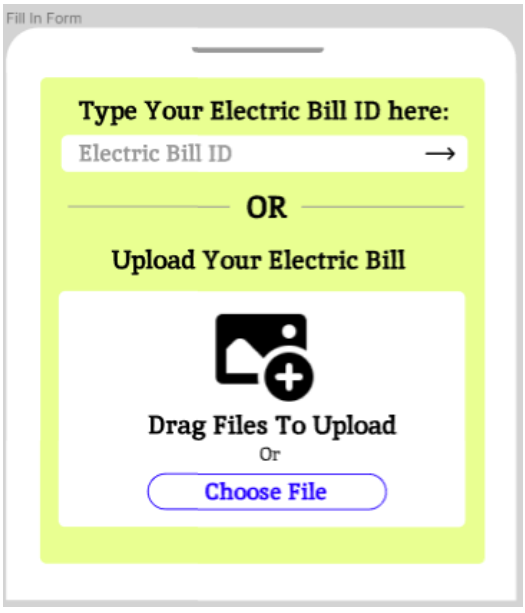
Figure 2.1.1.1 Structured English for Process 1 (Submit Competition Data)

For Process 1 (Submit Competition Data), we choose structured English as the technique of the process specification. This is because structured English is useful in this condition as we need to describe the process which involves repetition and simple structured decision.

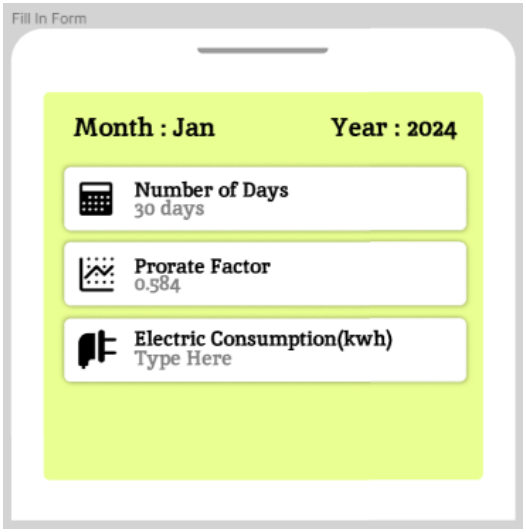
Portion of Child Diagram	UI Representation	Description
	 	If the user is Iskandar Puteri Residents, then he/she can choose the user in the first screen. In this demo, we assume that the user has been registered to the system, so the user only needs to fill in the phone number to login to the app.

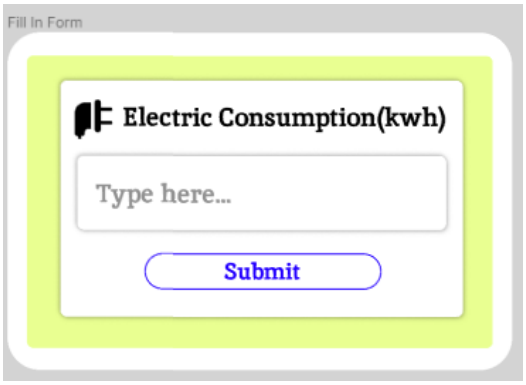


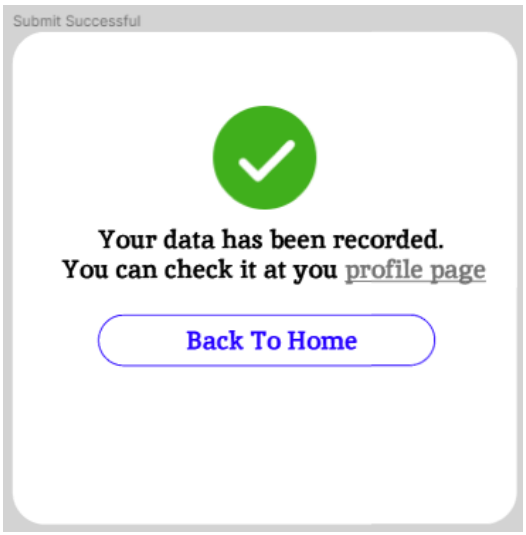


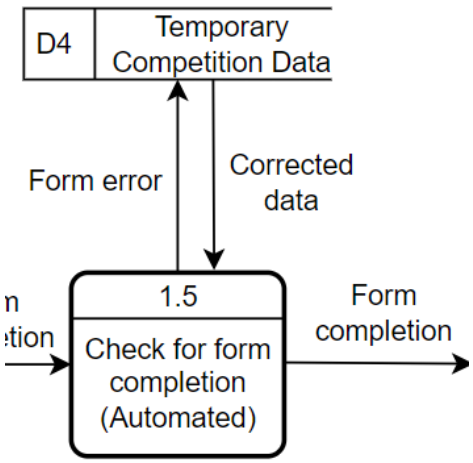
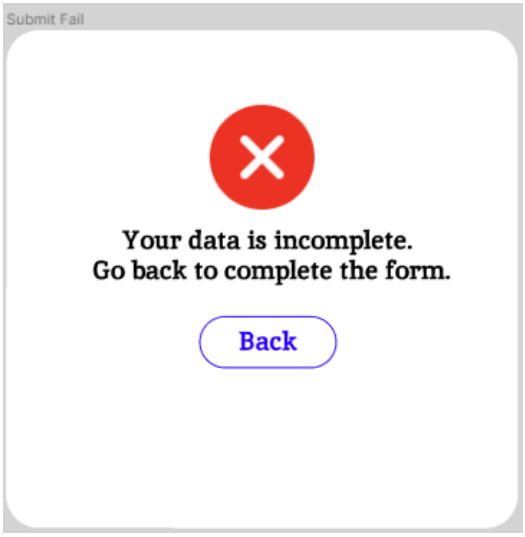


The user can choose the carbon consumption type to fill in the first screen. In this example, I use "Electricity" as the carbon consumption type. Then, the user can fill in the electric bill ID and the system will automatically detect the year and month for that bill. Therefore, the user just needs to fill in the energy consumption value and click submit. After submitting, a message will pop out to indicate that the data has been submitted successfully or not.


Fill In Form
Month : Jan
Year : 2024
Number of Days
30 days
Prorate Factor
0.584
Electric Consumption(kwh)
Type Here


Fill In Form
Electric Consumption(kwh)
Type here...
Submit

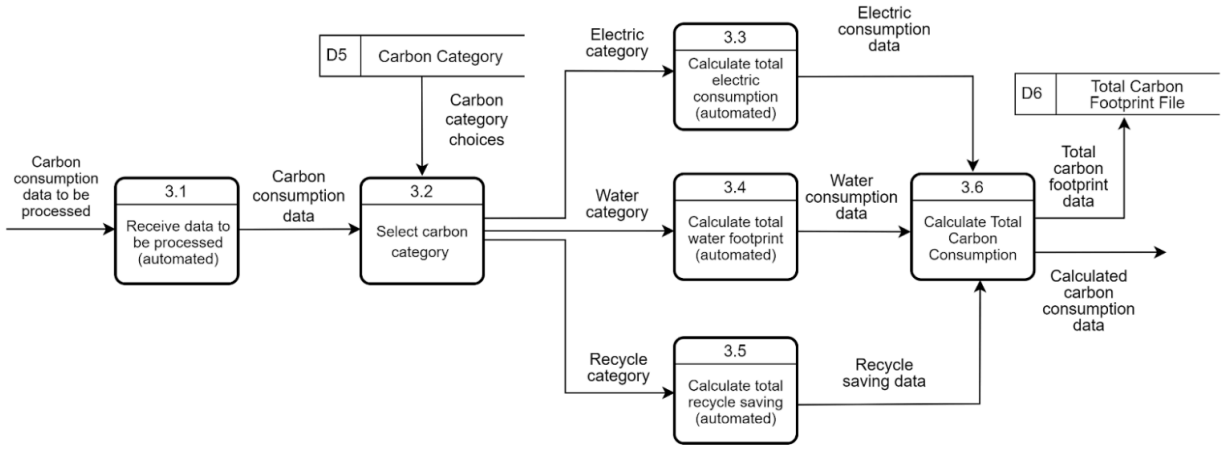

Submit Successful
Your data has been recorded.
You can check it at you profile page
Back To Home

		This message will pop out if the user submits an incomplete form. This will prevent the user from submitting incomplete forms which will cause conflict in the calculating process later.

2.1.2 Member 2 : Adam Ismail Hasan Amer Abouraya

Module Assigned : Calculate Carbon Consumption Data

Child Physical Diagram :



2.1.2.1 PROCESS SPECIFICATION FOR PROCESS 3 : Calculate Carbon Consumption Data

Number	3
Name	Calculate Carbon Consumption Data
Description	A process that is used to calculate the total carbon consumption data in a particular area in Iskandar Puteri
Input Data Flow	1. Carbon consumption data to be processed
Output Data Flow	1. Total carbon footprint data 2. Calculated carbon consumption data
Type of Process	[ ] Online [✔] Batch [ ] Manual
Process Logic	DO WHILE Carbon Consumption Data from residents is received THEN Select Carbon Category IF category is Electric Calculate total electric consumption ELSE IF category is Water Calculate total water consumption

	ELSE
	Calculate total recycle saving
	ENDIF
	THEN Calculate Total Carbon Consumption Data
	ENDDO

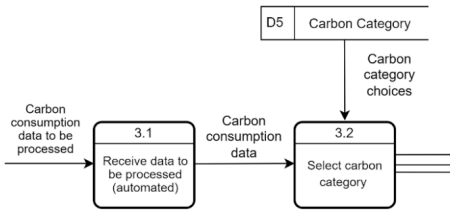
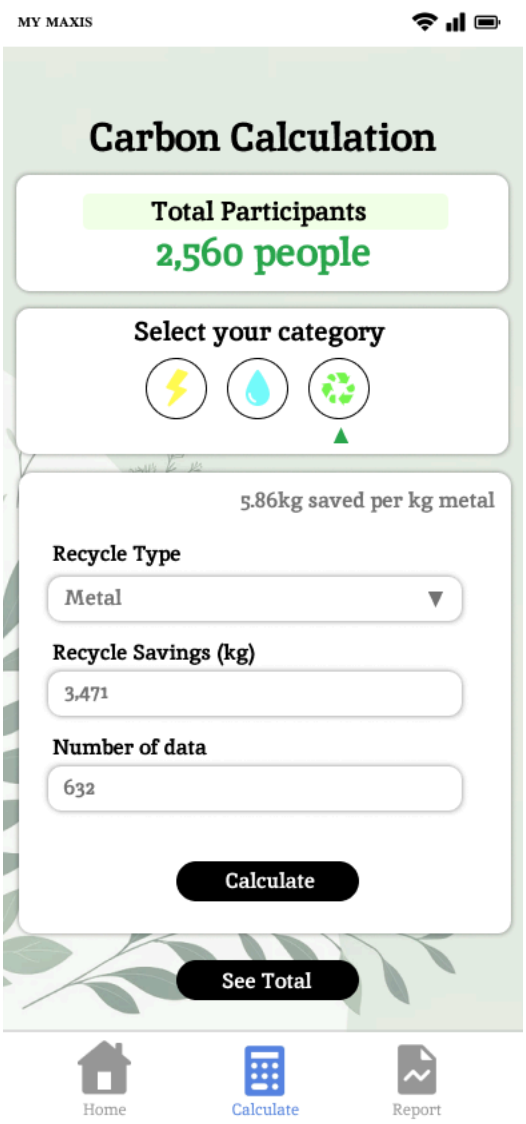
Refer to Name	[✔] Structured English [ ] Decision Table [ ] Decision Tree
Unresolved Issue	1. Is there any standardized format to compute recycle saving? 2. Is there any standardized formula to calculate the carbon consumption for each category?

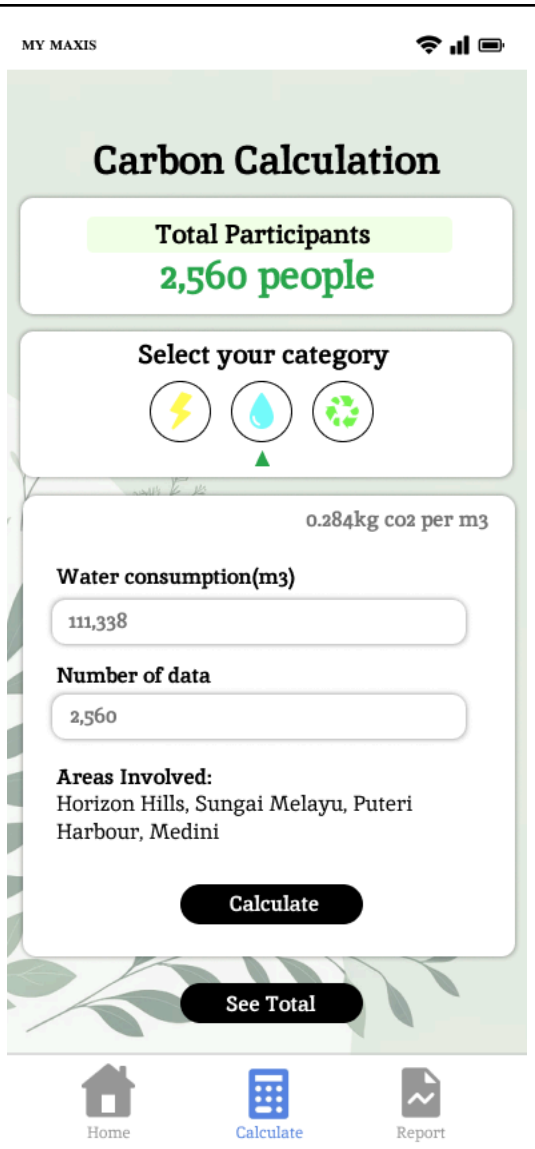
Structured English :

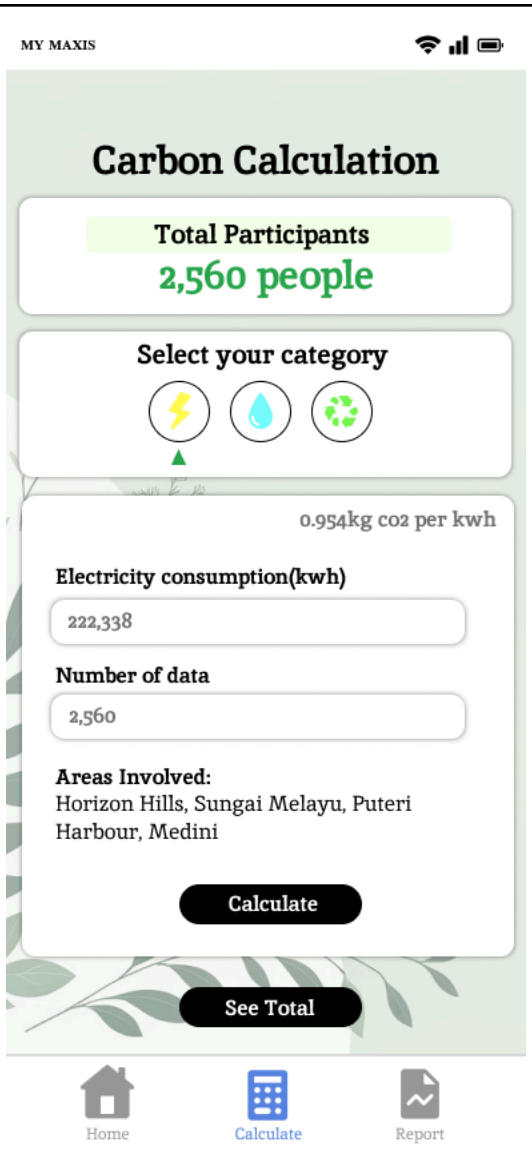
DO WHILE Carbon Consumption Data from residents is received
THEN Select Carbon Category
IF category is Electric
Calculate total electric consumption
ELSE IF category is Water
Calculate total water consumption
ELSE
Calculate total recycle saving
ENDIF
THEN Calculate Total Carbon Consumption Data
ENDDO

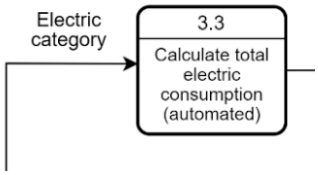
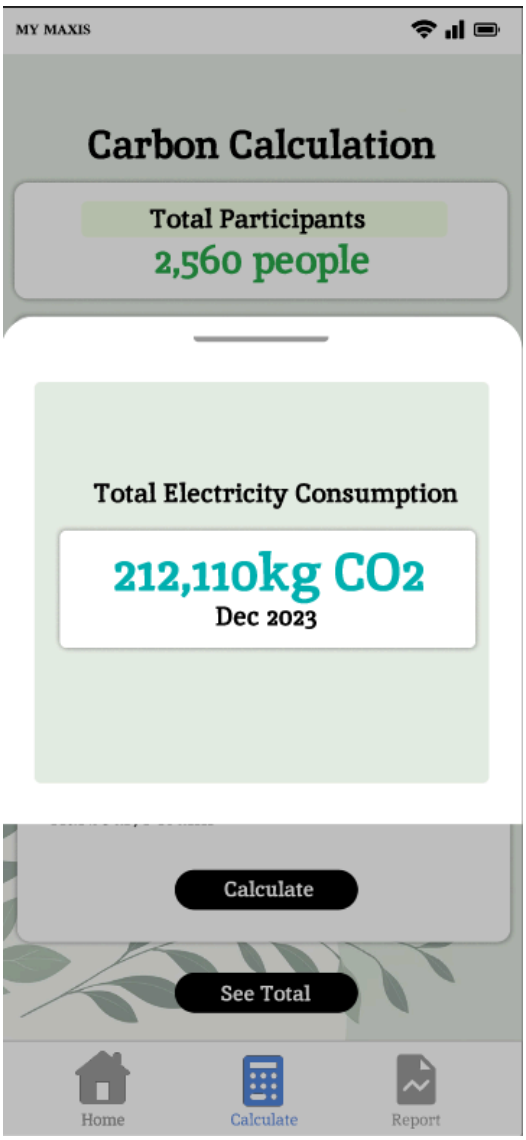
Figure 2.1.2.1 Structured English for Process 3 (Calculate Carbon Consumption Data)

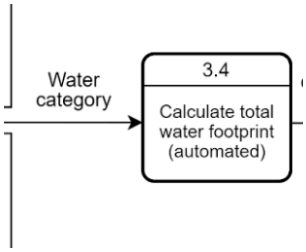
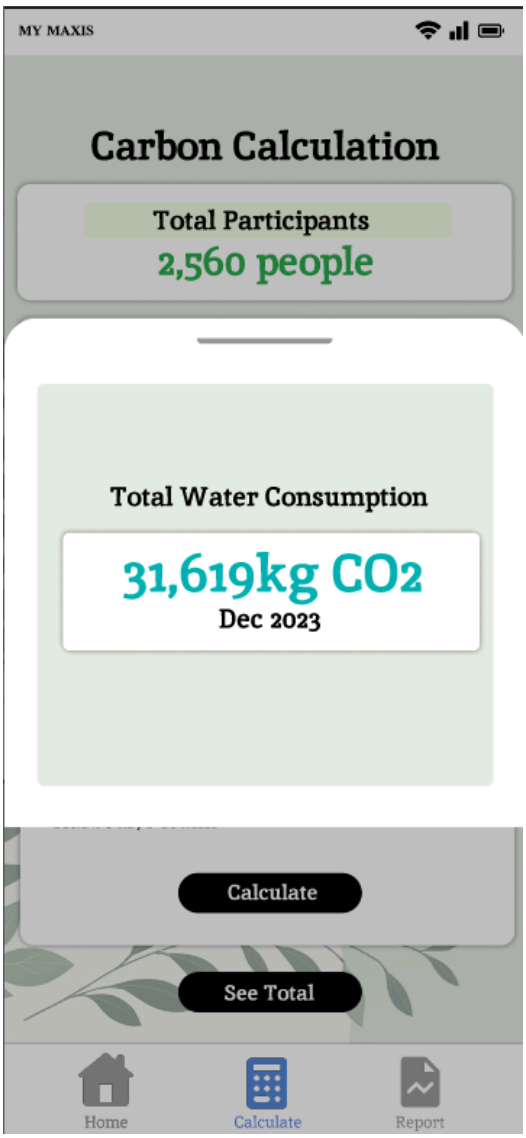
For Process 3, we will use Structured English as our process specification format. This is because the sub processes involved are step-by-step. Moreover there will be IF conditions to check the data received and loops to monitor the data validation. Therefore, Structured English is suitable to be used in Process 3 to show the processes.

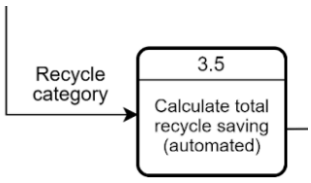
Portion of Child Diagram	UI Representation	Description
		In this menu you can choose the category that you want to calculate for. Your options are: 1. Electricity consumption 2. Water consumption 3. Recycle savings For each category you will see relevant data for the category like: • the cost/saving per unit • number of data • Areas involved

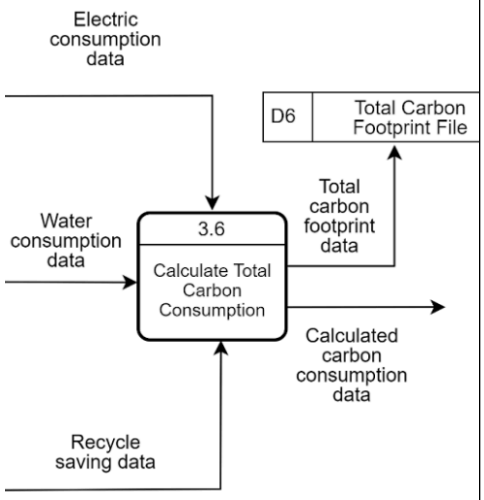
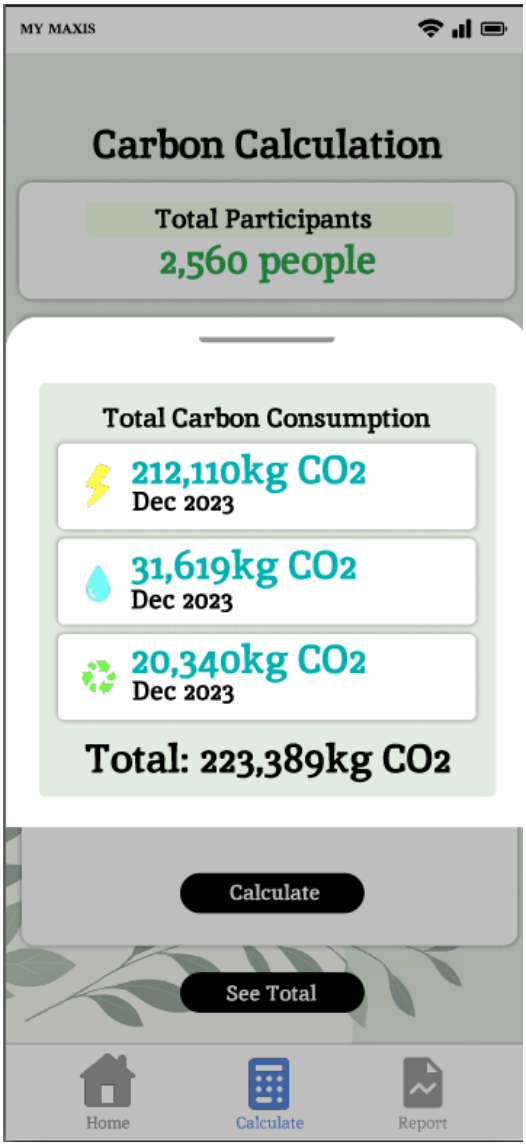

MY MAXIS
Carbon Calculation
Total Participants
2,560 people
Select your category
0.284kg co2 per m3
Water consumption(m3)
111,338
Number of data
2,560
Areas Involved:
Horizon Hills, Sungai Melayu, Puteri Harbour, Medini
Calculate
See Total
Home
Calculate
Report


MY MAXIS
Carbon Calculation
Total Participants
2,560 people
Select your category
0.954kg co2 per kwh
Electricity consumption(kwh)
222,338
Number of data
2,560
Areas Involved:
Horizon Hills, Sungai Melayu, Puteri Harbour, Medini
Calculate
See Total
Home
Calculate
Report

		This message will pop out after calculating the electricity consumption and it shows the total electricity consumption which is automatically calculated.

		This message will pop out after calculating the water consumption and it shows the total water consumption which is automatically calculated.

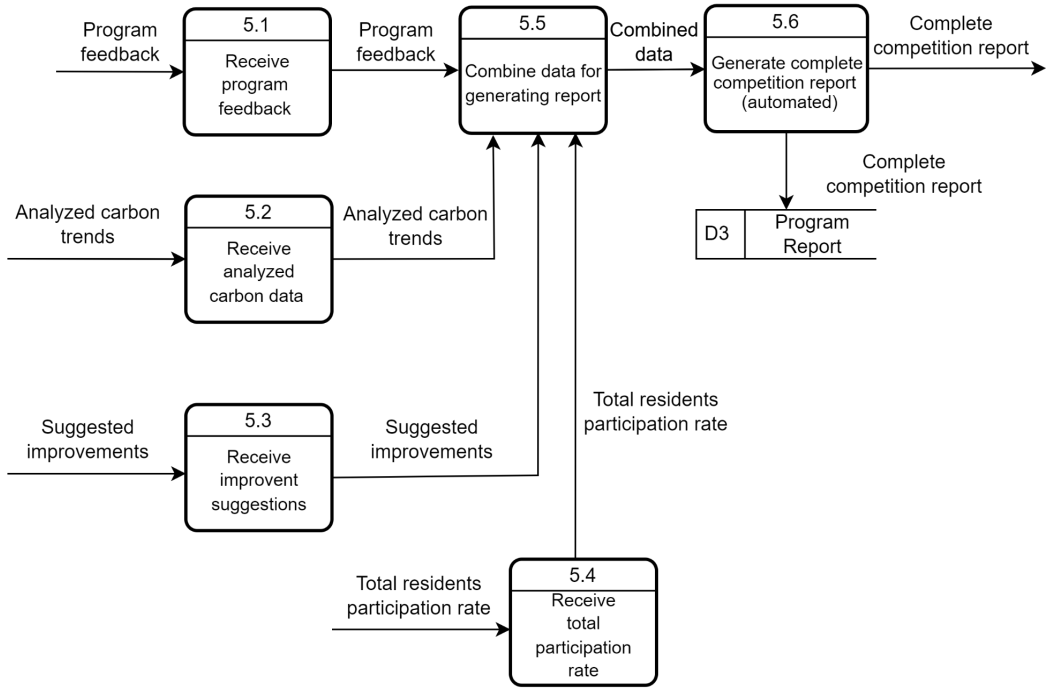
		This message will pop out after calculating the recycle savings and it shows the total recycle savings consumption which is automatically calculated.

		This message will pop out after pressing the 'See Total' button and it shows the total carbon consumption.

2.1.3 Member 3: Huang Bosheng

Module Assigned : Generate Competition Report

Child Physical Diagram :



2.1.3.1 PROCESS SPECIFICATION FOR PROCESS 5: Generate Competition Report

Number	5
Name	Generate Competition Report
Description	Combining all the data to display the data in a report form
Input Data Flow	1. Program Feedback 2. Analyzed carbon trends 3. Suggested improvements 4. Total residents participation rate
Output Data Flow	1. Complete competition report
Type of Process	[✔] Online [ ] Batch [ ] Manual

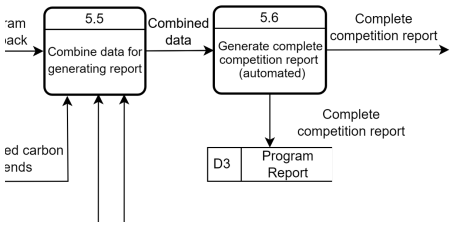
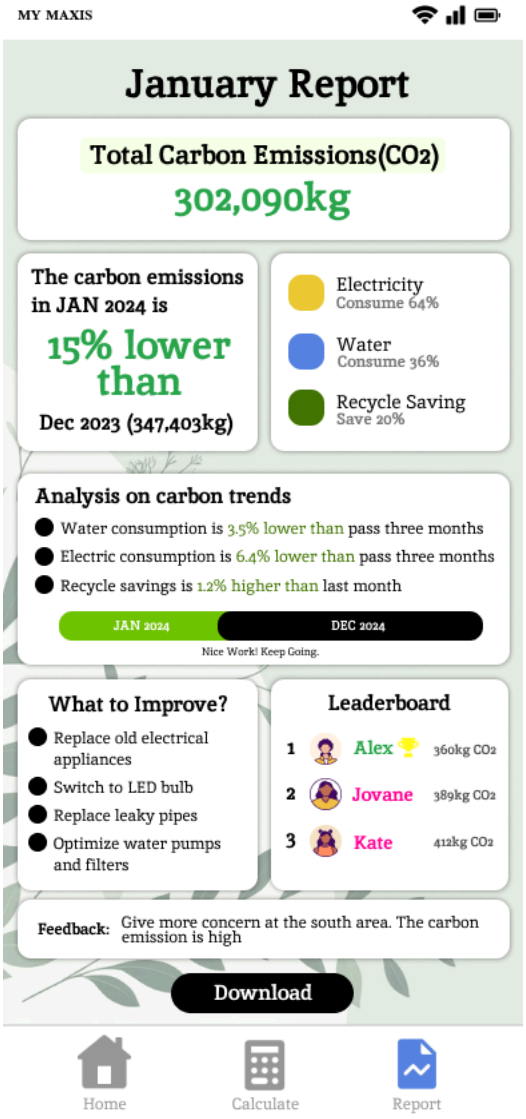
Process Logic	IF All necessary data are received THEN Combine data for generating report THEN Generate competition report THEN Store the data at program report data store ELSE Wait until all the data are prepared
Refer to Name	[✔] Structured English [ ] Decision Table [ ] Decision Tree
Unresolved Issue	1. Is there any method that handles errors if a report cannot be generated successfully? 2. Is there any validated process after the combination of the data to ensure a compatible format?

Structured English :

```
IF All necessary data are received
    THEN Combine data for generating report
    THEN Generate competition report
    THEN Store the data at program report data store
ELSE
    Wait until all the data are prepared
```

Figure 2.1.3.1 Structured English for Process 5 (Generate competition report)

For Process 5 (Generate Competition Report), we choose structured English as the technique of the process specification. This is because we add a IF condition to check whether all the necessary data are received or not. If the condition is met, then a competition report will be generated and the report will be stored at the program report data store.

Portion of Child Diagram	UI Representation	Description
		For this report, we can see the quantity of Total Carbon Emissions, as well as the comparison to the previous month's reduction in carbon emissions, and the percentage of carbon consumed by electricity and water, plus how much has been saved through recycling. We can also view the Analysis on Carbon trends compared to last month's data, and some areas that need improvement. Additionally, there is our Leaderboard to motivate users' interest in reducing carbon emissions. If users need, they can download the report.

2.1.4 Member 4 : Muhammad Mujahidul Adli

Module Assigned : Analyze Carbon Consumption Data

Child Physical Diagram :

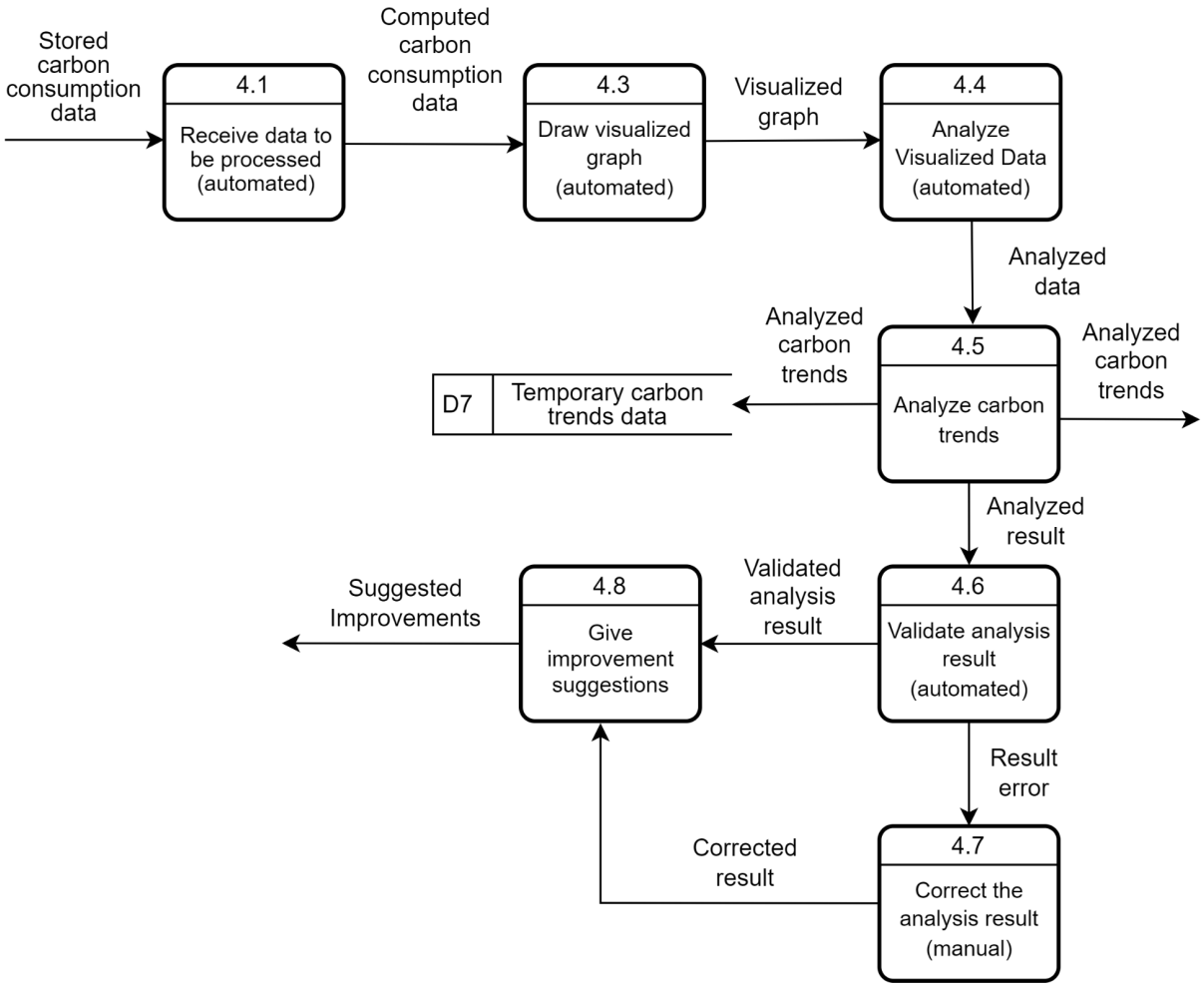


Figure 2.1.4 Child Diagram for Process 4 (Analyze Carbon Consumption Data)

Description That Highlight The Issue :

This process will draw a visualized graph to identify and analyze the carbon trends. From the graph, they can know which areas need more concern, and make suggestions on improving or reducing the carbon consumption in those particular areas.

2.1.4.1 PROCESS SPECIFICATION FOR PROCESS 4 : Analyze Carbon Consumption Data

Number	4
Name	Analyze Carbon Consumption Data
Description	A process that is used to analyze the carbon trends from graph and give improvement suggestions based on the result
Input Data Flow	1. Stored carbon consumption dat
Output Data Flow	1. Analyzed carbon trends 2. Suggested improvements
Type of Process	[ ] Online [✔] Batch [ ] Manual

Process Logic	DO WHILE Data to be processed is received
	Draw visualized graph
	IF visualized data is not analyzed
	THEN Analyze Visualized Data
	THEN Analyze Carbon Trens
	ELSE Validate analysis result
	ENDIF
	WHILE analysis result is wrong
	THEN Correct the analysis result
	END WHILE
	Generate improvement suggestions
	ENDDO

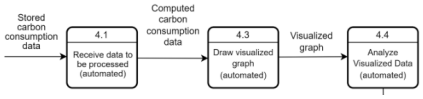
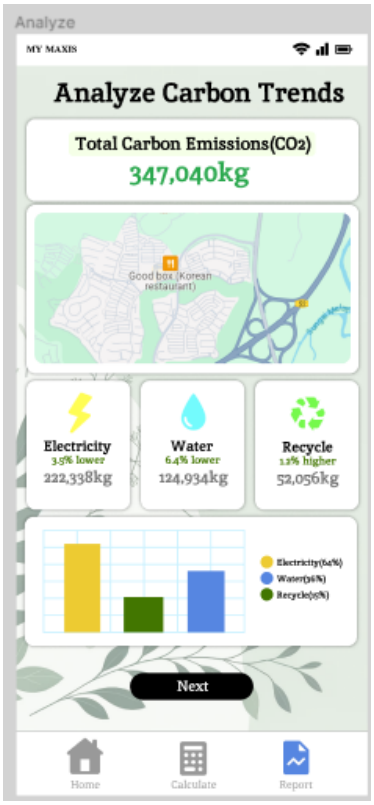
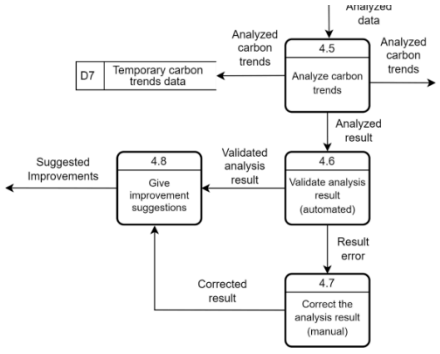
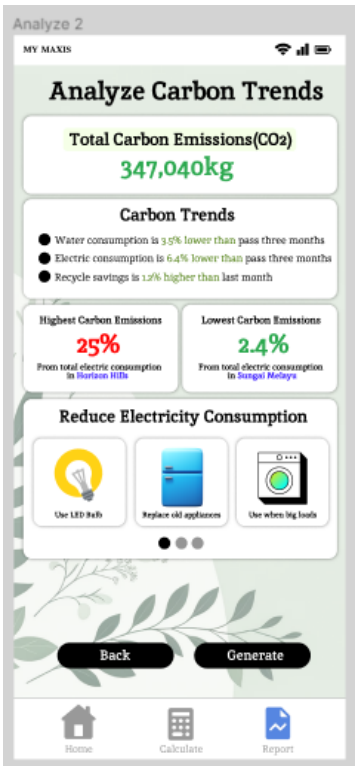
Refer to Name	[✔] Structured English [ ] Decision Table [ ] Decision Tree
Unresolved Issue	1. Is it necessary to define methods for handling data that cannot be validated or corrected? 2. Should a procedure be established to ensure that data remains accurate as new information becomes available?

Structured English :

```
DO WHILE Data to be processed is received
  Draw visualized graph
  IF visualized data is not analyzed
    THEN Analyze Visualized Data
    THEN Analyze Carbon Trens
  ELSE Validate analysis result
  ENDIF
  WHILE analysis result is wrong
    THEN Correct the analysis result
  END WHILE
  Generate improvement suggestions
ENDDO
```

Figure 2.1.4.1 Structured English for Process 4 (Analyze Carbon Consumption Data)

For process 4, we use Structured English to show the sub processes involved. First, we will continue the process 4 if the data to be processed are received successfully. Then, there is IF condition to check whether the visualized data has been analyzed or not. Then, there is a WHILE loop to keep checking the analysis result to ensure there are no errors at all.

Portion of Child Diagram	UI Representation	Description
		For screen 1, it will help to draw out the graph based on the carbon consumption category to enable the MBIP department to view the details and do analysis.
		For screen 2, it will help the MBIP department to do the carbon trends analysis such as do the comparison with the data past few months, identify the highest and lowest carbon emissions area, and give the tips to reduce the carbon consumption.

3.0 Conclusion

3.1 Team Achievement

Phase 1 :

Our team has identified the project background such as the current issues that lead to the current project. This is to ensure that we understand the requirements of the stakeholders which are MBIP consultant and MBIP planning department. Then, we had done the economical feasibility study which is the Cost-Benefit Analysis to estimate the profitability index to calculate the gain or loss for the project. Then, we do the project planning using work breakdown structure and gantt chart to make sure every team member can complete their work on time.

Phase 2 :

Our team had reached the information gathering process. We use interviews and STROBE to help us to gather all the necessary information. After gathering the information, we had listed out the current business process for the current system. We also construct context diagram, parent diagram and child diagrams for the AS-IS system. We also identify the non-functional requirement for the system as well.

Phase 3 :

In this phase, we will mainly focus on the proposed TO-BE system. At first, we had constructed the physical TO-BE DFD with the partition to give a clear representation for our system. Then, we also draw the structured charts to visualize the data flows between the modules. Then, we had constructed the physical child diagrams for each process by adding the temporary data store, specifying the sub processes involved and identifying the automated and manual process. We also make the process specification using structured english so we can understand the child process well.

Phase 4 :

In this phase, we generate the GUI for each of the modules assigned. Our GUI will be based on the child diagram constructed earlier. The GUI will show how the improved system will work and how it can solve the issues in the current system.

3.2 Future Suggestions

Database and System Analysis Design projects should be combined together to develop a complete system for the project. The project should reduce the redundancy in every phase such as the problem definition and proposed solutions and only compile every element in the final project. Moreover, we think that it is necessary to add one more section for usability testing. Hence, we can gain feedback from the users to enhance the system and eliminate the existing bugs. At the beginning of the project, it is better to provide the students with which entities should be included in the system so they can have a clear direction when completing the project, especially in constructing the physical DFD part.