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SECD 2523 Database

Section 06

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Team 5: Bot

PHASE 2: DATABASE CONCEPTUAL DESIGN (ERD)

Low Carbon Initiatives Community Monitoring System[Bot]

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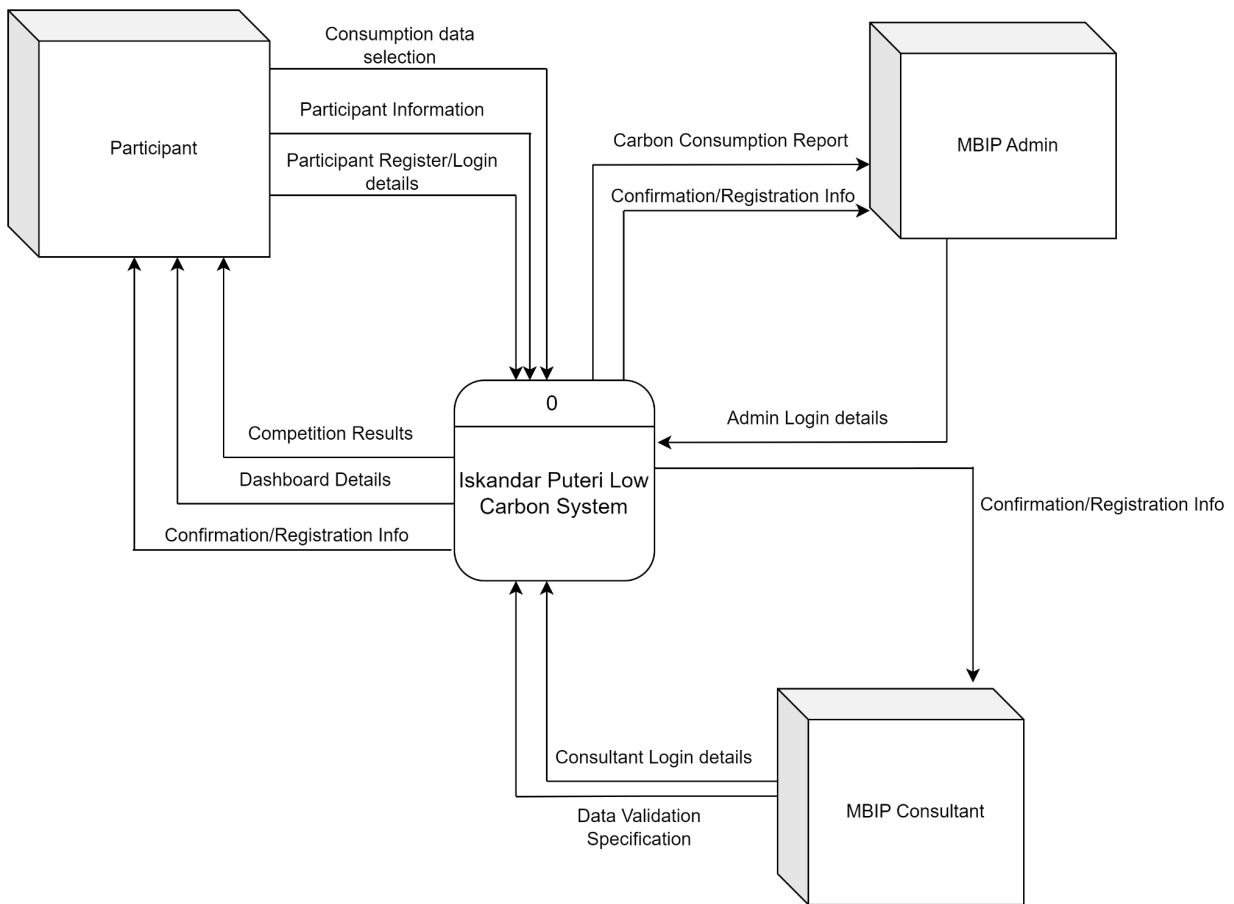
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1.0 Introduction

In order to create a low carbon environment, MBIP intends to develop a data collection and analysis system similar to the e-Lestari system. To help MBIP in developing a low carbon environment, a new database system is designed to fix and modify the problem and challenges faced by MBIP in collecting and analyzing carbon consumption data. Following the completion of the project planning phase, the project design phase now takes precedence, focusing on the development of a conceptual database design for the proposed system. The goal is to design a new database system with a self-monitoring dashboard to let participants monitor their carbon commission data. Apart from that, an automation calculation of carbon footprint using provided data is crucial to simplify MBIP's work in analyzing participants' carbon consumption data and reducing human error in calculating carbon footprint. To provide MBIP with an easily navigable and well-organized database system that supports their goals of attaining a low-carbon society as we move through this phase. The parts that follow will go into detail about the different elements and approaches used during the conceptual design phase, which establishes the framework for the logical design and SQL statement development stages that follow. The database conceptual design phase will include data flow diagram (DFD), proposed business rule, data and transaction requirements, conceptual ERD and enhanced ERD and data dictionary.

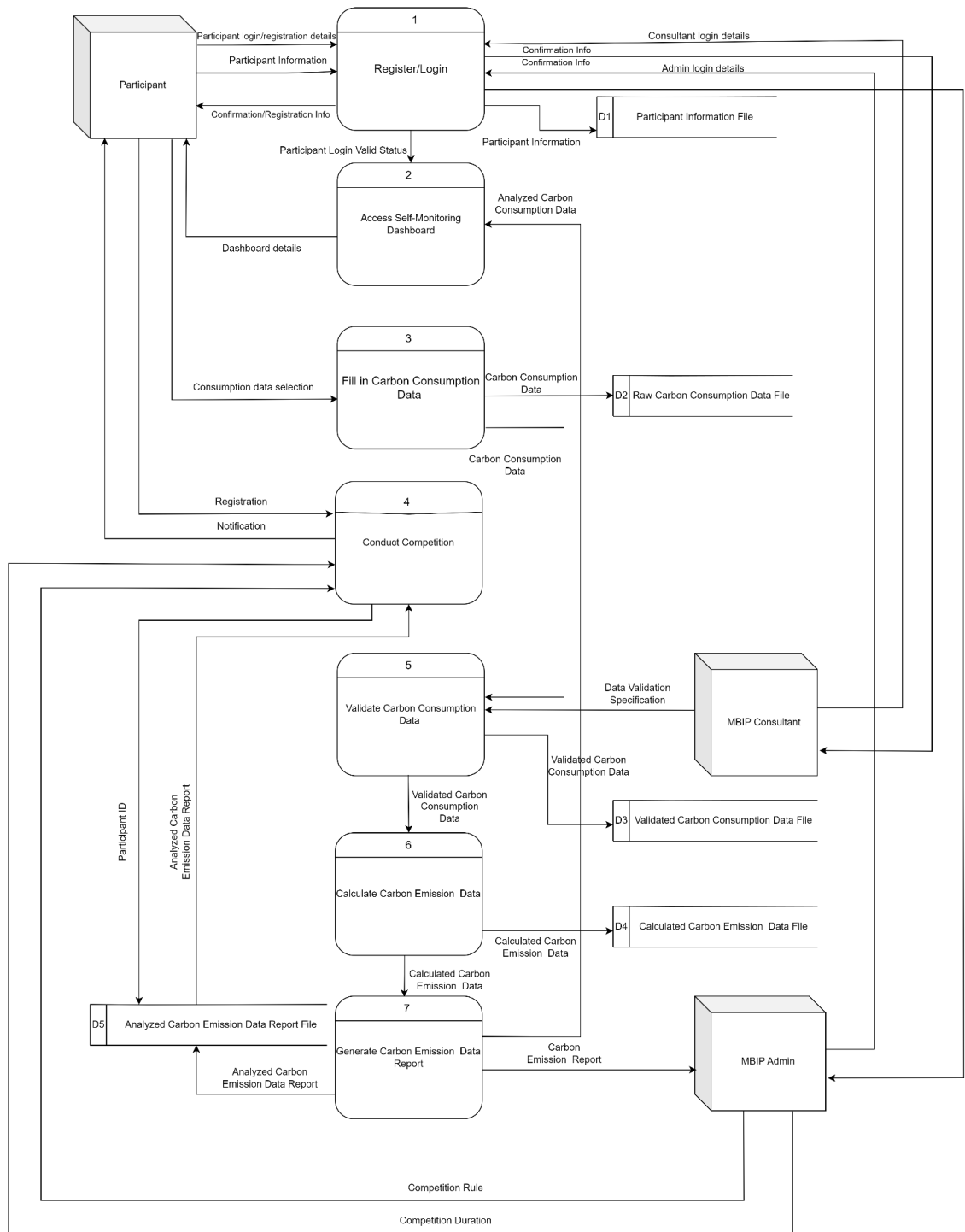
2.0 Data Flow Diagram (DFD)

2.1 Context Diagram



The Context diagram representing the Iskandar Puteri Low Carbon System, has 3 main entities, namely Participant, MBIP Admin and MBIP consultant.

2.2 Level 0 Diagram

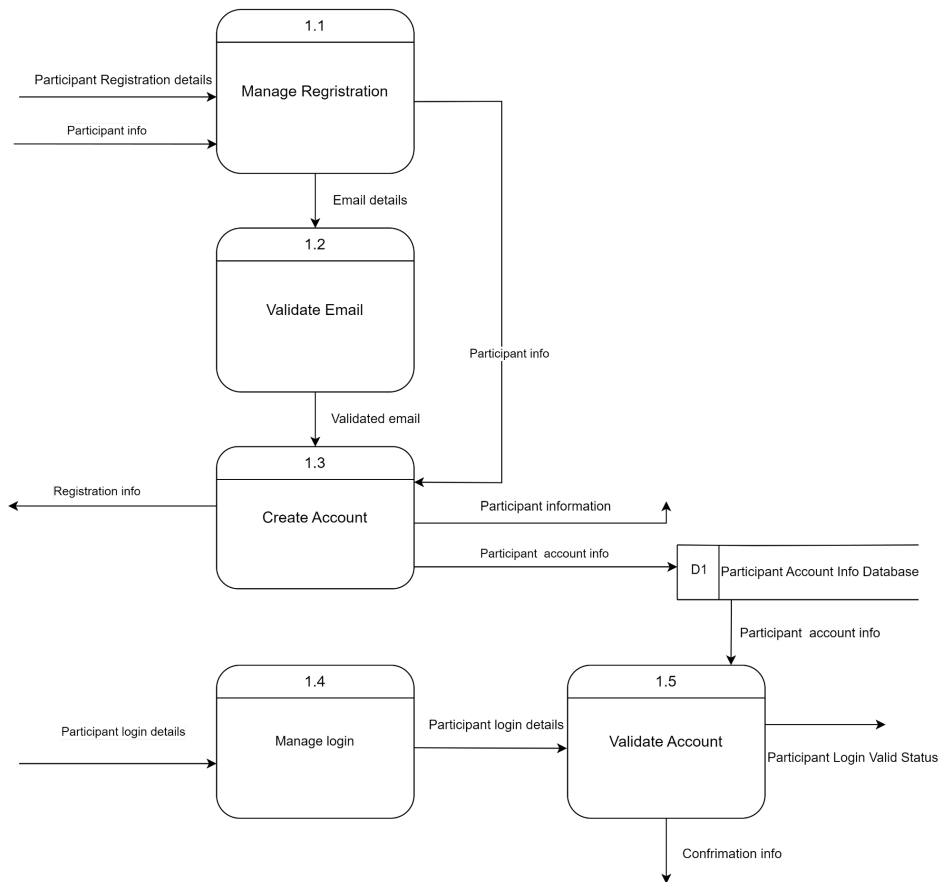


Parent diagram DFD level 0 has 6 main processes, to list them, they are:

1. Register/Login
2. Access Self-Monitoring Dashboard
3. Fill in carbon consumption data
4. Conduct Competition
5. Validate Carbon Consumption Data
6. Calculate Carbon Emission Data
7. Generate Carbon Emission Data Report

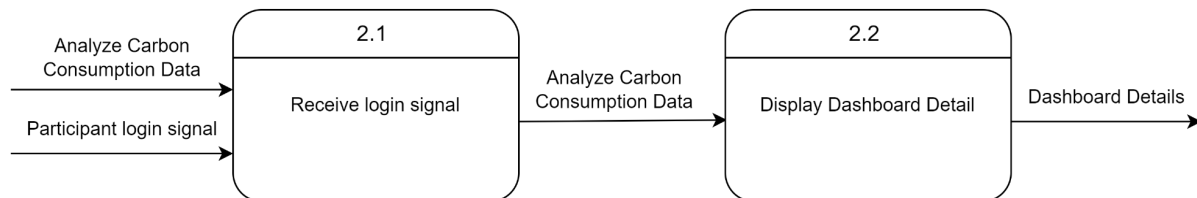
2.3 Child Diagram

2.3.1 CHILD DIAGRAM DFD LEVEL-1 FOR PROCESS 1 : <REGISTER/LOGIN>



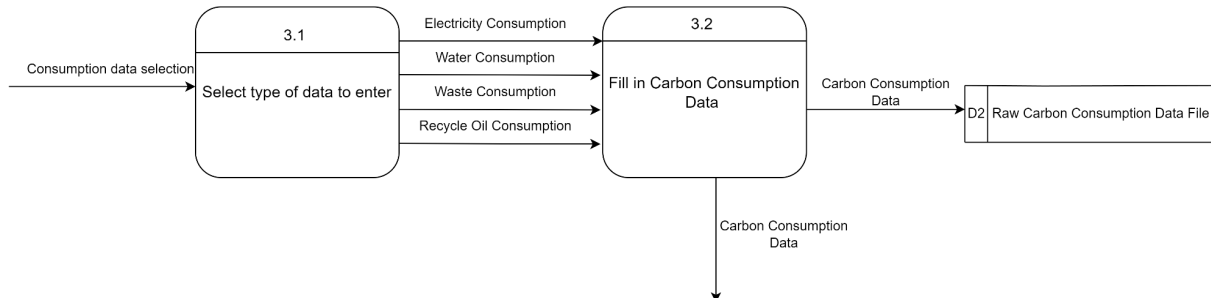
Level 0 Parent diagram of process 1 (Register/Login) exploded into a level 1 child diagram with 5 sub processes, 1.1, 1.2, 1.3, 1.4 and 1.5. One data store involved is D1(Participant Account Info Database).

2.3.2 CHILD DIAGRAM DFD LEVEL-1 FOR PROCESS 2 : <ACCESS SELF-MONITORING DASHBOARD>



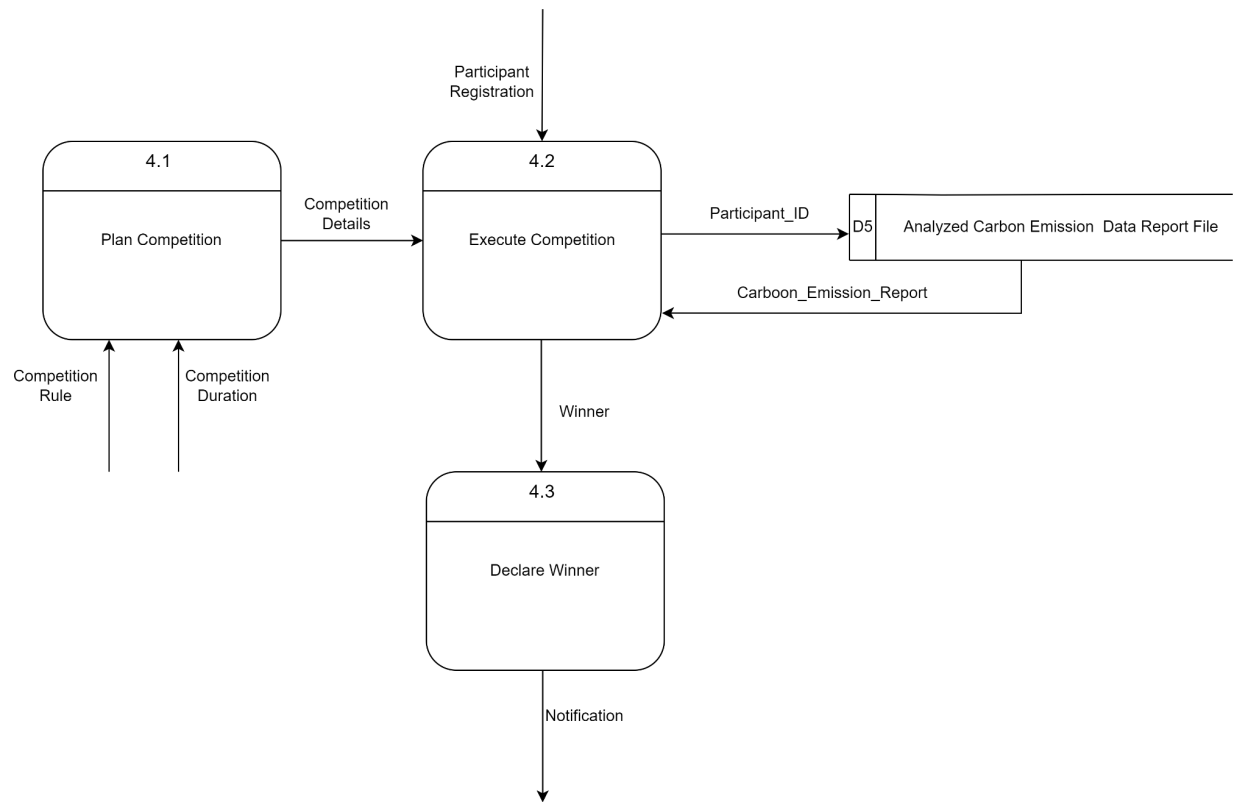
Level 0 Parent diagram of process 2 (Access Self-Monitoring Dashboard) exploded into a level 1 child diagram with 2 sub processes, 2.1 and 2.2.

2.3.3 CHILD DIAGRAM DFD LEVEL-1 FOR PROCESS 3 : <FILL IN CARBON CONSUMPTION DATA>



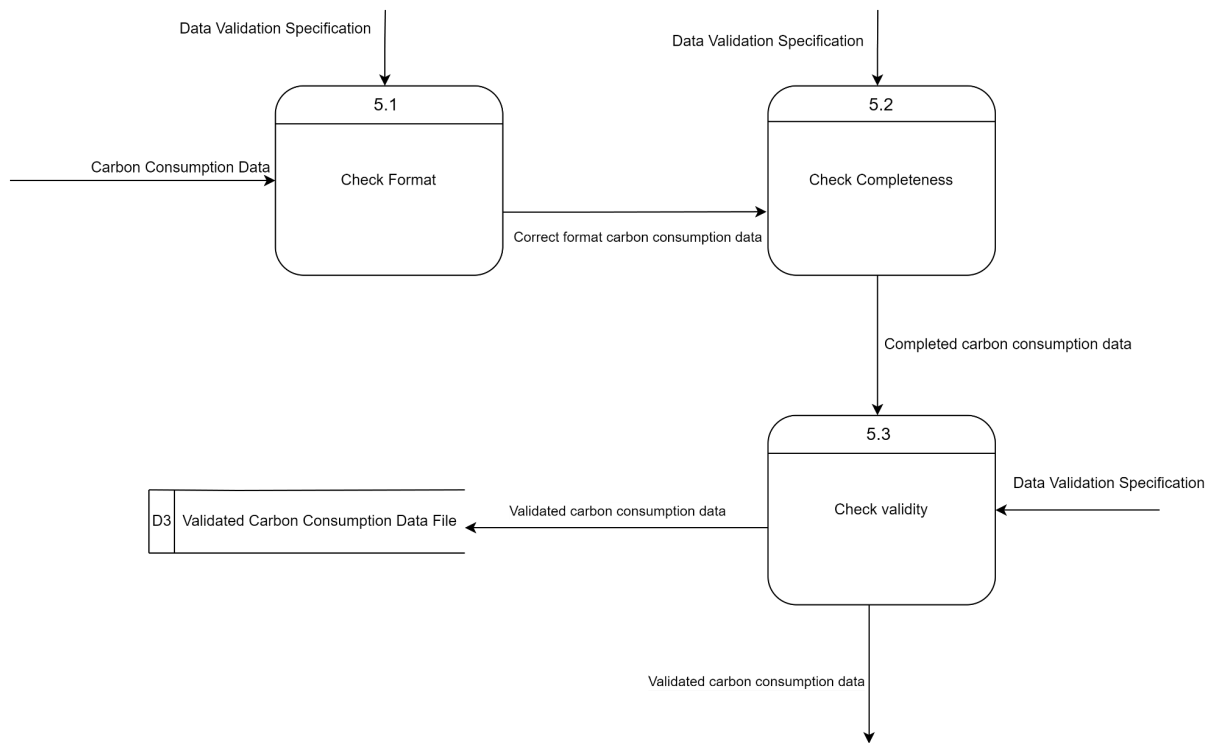
Level 0 Parent diagram of process 3 (Fill in Carbon Consumption Data) exploded into a level 1 child diagram with 2 sub processes, 3.1 and 3.2. One data store involved is D2(Raw Carbon Consumption Data File).

2.3.4 CHILD DIAGRAM DFD LEVEL-1 FOR PROCESS 4 : <CONDUCT COMPETITION>



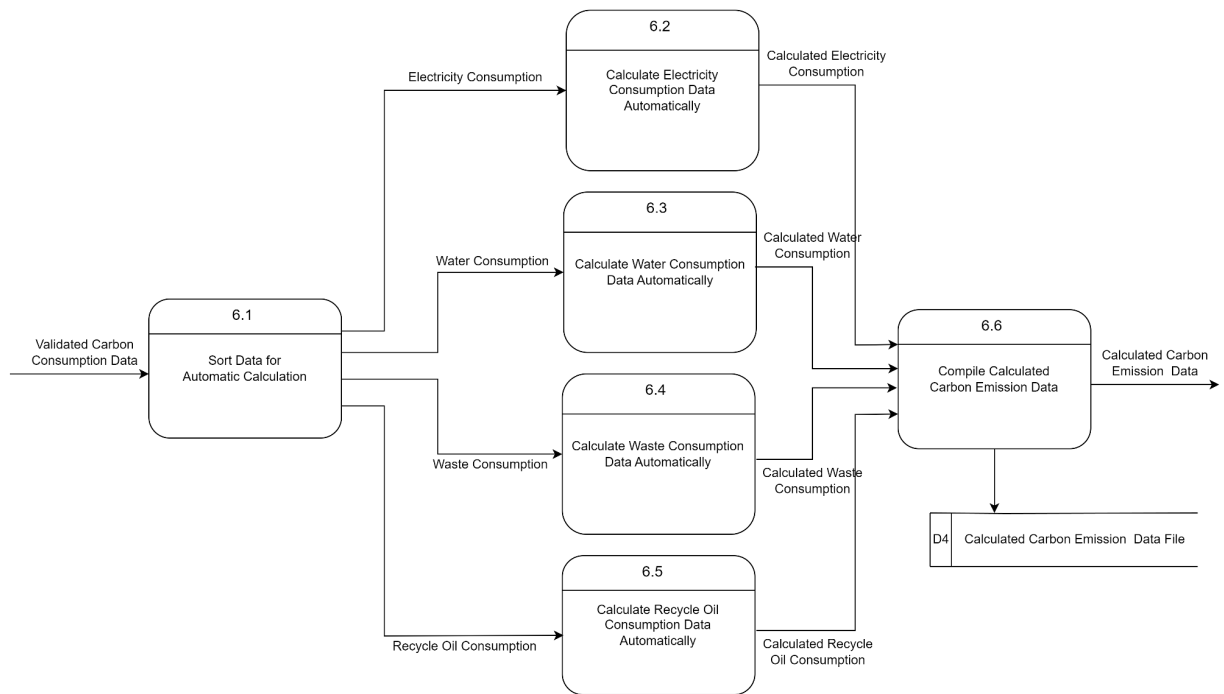
Level 0 Parent diagram of process 4 (Conduct Competition) exploded into a level 1 child diagram with 3 sub processes, 4.1, 4.2 and 4.3. One data store involved is D5(Analyzed Carbon Emission Data Report File).

2.3.5 CHILD DIAGRAM DFD LEVEL-1 FOR PROCESS 5 : <VALIDATE CARBON CONSUMPTION DATA>



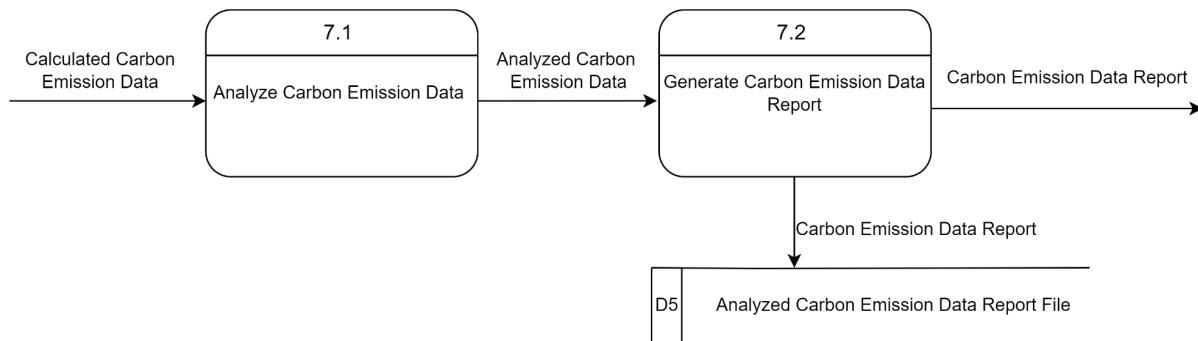
Level 0 Parent diagram of process 3 (Validate Carbon Consumption Data) exploded into a level 1 child diagram with 3 sub processes, 5.1, 5.2 and 5.3. One data store involved is D3 (Validated Carbon Consumption Data File).

2.3.6 CHILD DIAGRAM DFD LEVEL-1 FOR PROCESS 6 : <CALCULATE CARBON EMISSION DATA>



Level 0 Parent diagram of process 6 (Calculate Carbon Emission Data) exploded into a level 1 child diagram with 3 sub processes, 6.1, 6.2, 6.3, 6.4 6.5, 6.6. One data store involved is D4(Calculated Carbon Emission Data File).

2.3.7 CHILD DIAGRAM DFD LEVEL-1 FOR PROCESS 7 : <GENERATE CARBON EMISSION DATA REPORT>



Level 0 Parent diagram of process 7 (Generate Carbon Emission Data Report) exploded into a level 1 child diagram with 2 sub processes, 7.1, 7.2. One data store involved is D5(Analyzed Carbon Emission Data Report File).

3.0 Data & Transaction Requirement

3.1 Proposed business rule

Business Process

1. The system is accessible 24/7.
2. The system provides Malay and English language, the primary language of the system is Malay.
3. New users (participants) need to register a new account.
4. Users (participants/MBIP admins/MBIP consultant) need to log in to their account to access the system.
5. Users can only access data relevant to their role.
6. MBIP admin can organize and manage low carbon competitions.
7. Personal information provided by participants is secured and strictly confidential. MBIP has no right to share participants' personal information.
8. Participants need to enter the carbon consumption data.
9. MBIP consultant needs to set a rule to the system and let the system validate the data provided.
10. MBIP consultant needs to set the calculation method to the system so that the system can calculate the carbon footprint based on the data provided by participants.
11. The result is further processed to print it in the dashboard. Besides that, it is also being combined into a report by system.
12. The MBIP admins are accessible to the report and competition's winner will be announced based on the report.

Business Rule

1. A participant can participate in one or many competitions and a competition can be participated by more than one participant.
2. A participant can view one self-monitoring dashboard and each self-monitoring dashboard can only be viewed by a participant.
3. A participant can fill in one consumption data form and a consumption data form can be filled by one participant.
4. A MBIP admin can manage more than one competition and a competition can be managed by more than one MBIP admin.

5. A MBIP admin can access more than one emission report and an emission report can be accessed by more than one MBIP admin.
6. A MBIP consultant can proceed more than one data validation and each data validation can be proceeded by one MBIP consultant.
7. A MBIP consultant can manage more than one emission calculator and a emission calculator can be managed by one MBIP consultant.
8. A MBIP consultant can manage more than one report generator and a report generator can be managed by one MBIP consultant.
9. A self monitoring dashboard can associate with many emission results and each emission result can only be associated by a self monitoring dashboard.
10. A data consumption form can only contain one data and each consumption data can only store in one data consumption form.
11. A data validation can validate many data consumption forms and each data consumption form can only be validated by one data validation.
12. A data validation can only notify one participant and each participant can only be notified by one data validation.
13. An emission calculator can only associate with one consumption data form and each consumption data form can only be associated with one emission calculator.
14. An emission calculator can produce many emission results and each emission result can only be produced by one emission calculator.
15. A report generator can associate with many emission results and each emission result can only be associated with one report generator.
16. A report generator can generate many emissions reports and each emission report can only be generated by one report generator.
17. A competition can associate with many emission reports and each emission report can only be associated with one competition.

3.2 Proposed data & transaction

3.2.1 Data Requirement

User

Participant, MBIP consultant and MBIP admin are considered as users for the system. Users must have an account to access the system. Login details such as name and password of the account are stored as data. The data type for all the attributes is varchar2 with suitable size.

Participant

The data stored includes personal information of participant: name, identity card, phone number, address, number of people lived in the house, type of building, occupation status, name of participation area, (it can be name of residential area/Institution/School/Office), working institute category (e.g, Private/Public/Others). Participants also need to provide carbon consumption data such as water consumption, electricity consumption, recyclable items collection. The data type for all the attributes is varchar2 with suitable size.

Electricity Consumption

Participants need to fill data into the system for collecting and analyzing their water consumption. The data stored includes month, number of days, prorated factor, current electricity used and cost associated with the electricity usage, electricity saving habits that participants have and the method which is applied by the participants. Each Electricity Consumption should be analyzed by many reports. The data type for all the attributes is number with suitable size except habit and method which uses varchar2.

Water Consumption

Participants need to fill data into the system for collecting and analyzing their water consumption. The data stored includes month, number of days, prorated factor, current water usage and cost associated with the water usage, water saving method and explanation about their water saving method. Each Water Consumption should be analyzed by many reports. The data type for all the

attributes is a number with suitable size except method and explanation which uses varchar2.

Waste Consumption

Participants need to fill data into the system for collecting and analyzing their waste consumption. The waste consumption includes type of waste (eg.,plastic,paper,organic,food), weight or volume of waste, waste disposal method and explanation about the method applied by participants. Each waste consumption should be analyzed by many reports. The data type for all the attributes is varchar2 except weight or volume of waste uses number.

Recycle Oil Consumption

Participants need to fill data into the system for collecting and analyzing their recycle oil consumption. The recycle oil consumption includes weight or volume of recycle oil, price earned or points earned for recycle oil, recycling habits that participants have and the method which is applied by the participants. The data type for all the attributes is varchar2 except weight or volume of recycle oil and price or points earned for recycle oil use number.

Self-monitoring Dashboard

The data stored includes real-time and historical carbon emission data provided by the participants and updated by self-monitoring dashboard to let participants monitor their carbon consumption data and carbon footprint calculated by itself. The data type for most of the attributes is varchar2 with suitable size except some with CLOB and BLOB.

Competition

The data stored includes competition ID, participant ID, report ID, duration (start date and end date) and winner (to decide the winner of the competition). The data type for all the attributes is varchar2 except the date uses datatype date.

Report

Report contains result ID, results of low carbon calculation which is calculated by self-monitoring dashboard and validated by MBIP consultant based on the category of participation area. Different reports will be generated depending on

the categories of participation. Each report should be associated with many participants. Each report should analyze many data in Water Consumption, Electricity Consumption, Recyclable Item Collection and Low Carbon Habit. Carbon footprint will be calculated using provided data by participants and included in the report. The data type for all the attributes is varchar2 with suitable size except some large size attributes which use CLOB.

3.2.2 Transaction Requirement

Data Entry

- Enter the details for login details
- Enter the details for participants
- Enter the details for electricity consumption every month
- Enter the details for water consumption every month
- Enter the details for waste consumption
- Enter the details for recycle oil consumption
- Enter the details for report

Data Update/Deletion

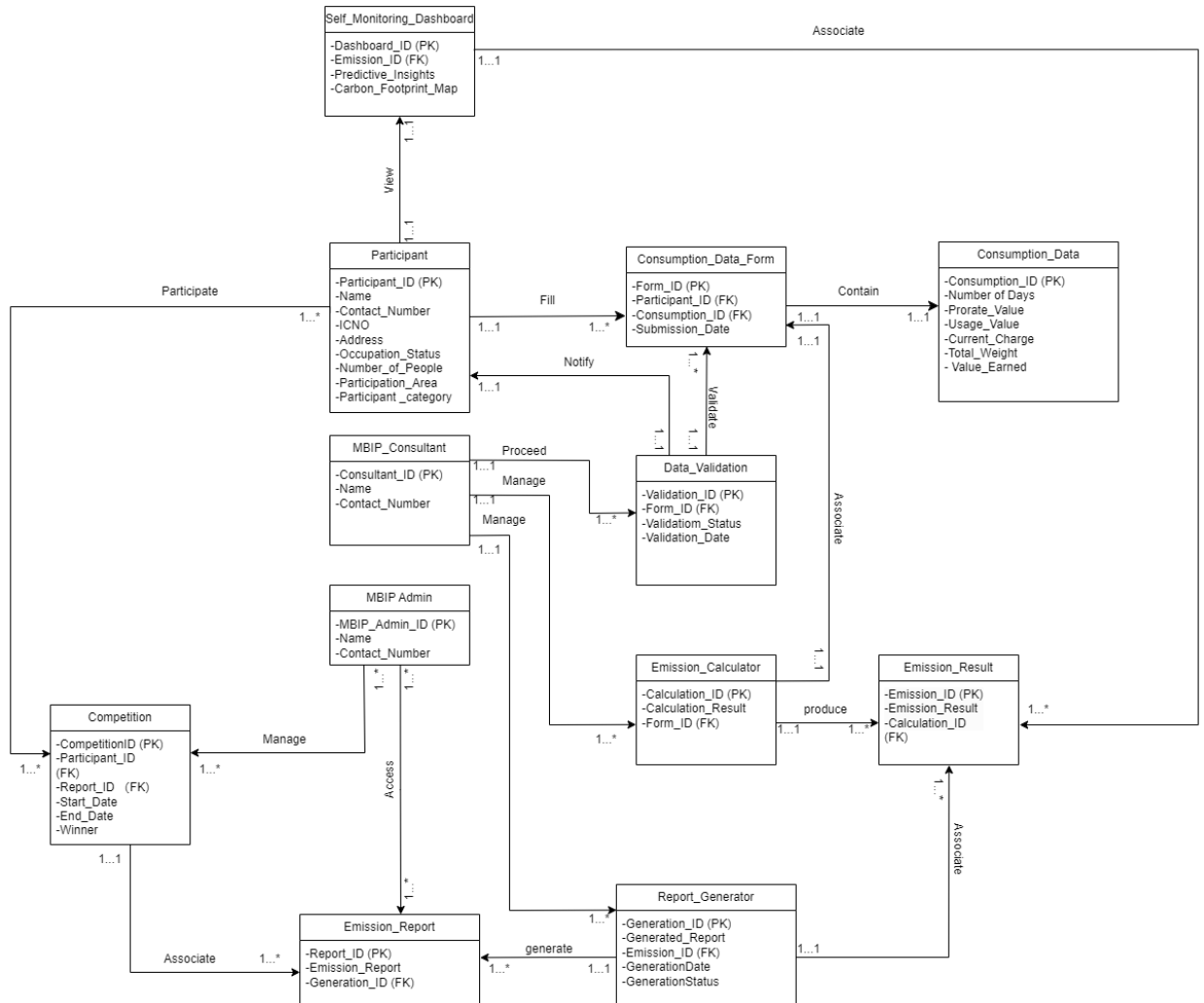
- Update/deletion the details of login details
- Update/deletion the details of participants
- Update/deletion the details of electricity consumption every month
- Update/deletion the details of water consumptions every month
- Update/deletion for waste consumption
- Update/deletion for recycle oil consumption
- Update/deletion the details of report

Data Queries

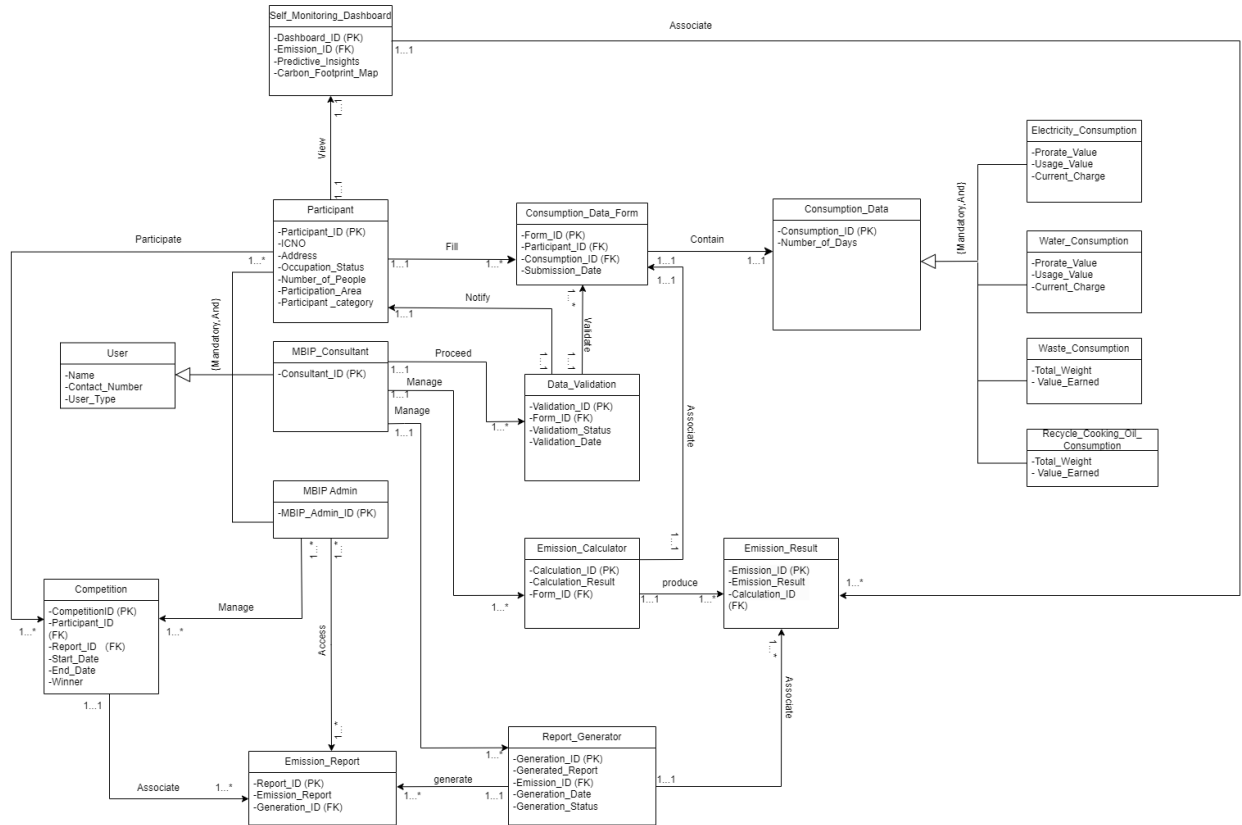
- Retrieve details of login details
- Retrieve details of participants
- Retrieve details of electricity consumption of participants
- Retrieve details of water consumption of participants
- Retrieve details for waste consumption
- Retrieve details for recycle oil consumption
- Retrieve details of report

4.0 Database conceptual design

4.1 Conceptual ERD



4.2 Enhanced ERD (EERD)



5.0 Data dictionary

5.1 Description of entities

| Entity | Description | Occurrence |
|-----------------------|--|--|
| User | Specialize to 3 different users: Participant, MBIP Admin, MBIP Consultant. Store the information of those 3 different users | Participant - participate in the competition and fill in their carbon consumption data. MBIP Admin - manage the low carbon competition, has accessibility to carbon emission report. MBIP Consultant - provide calculation method, data validation specification, carbon data, way to generate report. |
| Consumption data form | Store the data of consumption data form filled in by the participants. | When the participant fills in the form, the consumption data form will be stored in this entity. |
| Consumption data | Store the data of carbon consumption | The consumption data is taken out from the consumption data form and be used for further emission calculation. |
| Data Validation | Store the specification of carbon consumption data | The data validation is being set by the MBIP consultant and it will validate the carbon consumption data entered by participants. |
| Emission Calculator | Store the calculation function of carbon emission | The emission calculation will calculate the validated data to get the carbon emission result. |
| Emission Result | Store the result of carbon emission | Calculation is done, the result is generated. It will be sent to |

| | | |
|---------------------------|--|--|
| | | the report generator and dashboard. |
| Report Generator | Store the information of the generation of emission report | Report generator will collect all the results and generate a carbon emission report. |
| Emission Report | Store the emission report | Emission report is generated and sent to MBIP Admin. |
| Competition | Store the low carbon competition information | Competition is organized by MBIP. The result of the competition will be sent to the participants. |
| Self Monitoring Dashboard | Store participant's carbon emission details | The dashboard will collect and display the participants' carbon emission results to be viewed by them. |

5.2 Description of Relationship

| Entity | Multiplicity | Relationship | Multiplicity | Entity |
|-----------------|--------------|--------------|--------------|---------------------------|
| Participant | 1..* | Participate | 1..* | Competition |
| | 1..1 | View | 1..1 | Self Monitoring Dashboard |
| | 1..1 | Fill | 1..1 | Consumption Data Form |
| MBIP Admin | 1..* | Manage | 1..* | Competition |
| | 1..* | Access | 1..* | Emission Report |
| MBIP Consultant | 1..1 | Proceed | 1..* | Data Validation |
| | 1..1 | Manage | 1..* | Emission Calculator |

| | | | | |
|---------------------------|------|-----------|------|-----------------------|
| | 1..1 | Manage | 1..* | Report Generator |
| Self Monitoring Dashboard | 1..1 | Associate | 1..* | Emission Result |
| Consumption Data Form | 1..1 | Contain | 1..1 | Consumption Data |
| Data Validation | 1..1 | Validate | 1..* | Consumption Data Form |
| | 1..1 | Notify | 1..1 | Participant |
| Emission Calculator | 1..1 | Associate | 1..1 | Consumption Data Form |
| | 1..1 | Produce | 1..* | Emission Result |
| Report Generator | 1..1 | Associate | 1..* | Emission Result |
| | 1..1 | Generate | 1..* | Emission Report |
| Competition | 1..1 | Associate | 1..* | Emission Report |

5.3 Description of Attributes

| Entity | Attribute | Description | Data Type | Constraint |
|--------|----------------|---|---------------|------------|
| User | Name | User name | VARCHAR2 (20) | NOT NULL |
| | Contact_Number | User's contact number | NUMBER(12) | NOT NULL |
| | User_Type | Type of user (Participant, MBIP Admin, MBIP | VARCHAR2 (20) | NOT NULL |

| | | | | |
|------------------------------|----------------------|---|----------------|--|
| | | Consultant) | | |
| Participant | Participant_ID | Participant's identification number | VARCHAR2 (15) | PRIMARY KEY |
| | ICNO | Participant's identity card number | VARCHAR2 (20) | NOT NULL |
| | Address | Participate area's address | VARCHAR2 (100) | NOT NULL |
| | Occupation_Status | Participant's occupation status | VARCHAR2 (30) | NOT NULL |
| | Number_of_People | Number of people in participate area | NUMBER(6) | NOT NULL |
| | Participation_Area | Name of participate area | VARCHAR2 (30) | NOT NULL |
| | Participant_Category | Category of participate area | VARCHAR2 (30) | NOT NULL |
| MBIP Consultant | Consultant_ID | Consultant's identification number | VARCHAR2 (30) | PRIMARY KEY |
| MBIP Admin | MBIP_Admin_ID | Admin's identification number | VARCHAR2 (30) | PRIMARY KEY |
| Consumption Data Form | Form_ID | Consumption Data Form's identification number | VARCHAR2 (30) | PRIMARY KEY |
| | Participant_ID | Participant's identification number | VARCHAR2 (15) | FOREIGN KEY REFERENCE PARTICIPANT |
| | Consumption_ID | Consumption record's identification number | VARCHAR2 (30) | FOREIGN KEY REFERENCE CONSUMPTION DATA |
| | Submission_Date | Date of submit consumption data | DATE | DEFAULT SYSDATE |

| | | | | |
|----------------------------|--------------------|---|---------------|---|
| | | form | | |
| Consumption Data | Consumption_ID | Consumption identification number | VARCHAR2 (30) | PRIMARY KEY |
| | Number_of_Days | Number of days in a month | NUMBER(4) | NOT NULL |
| Data Validation | Validation_ID | Data validation's identification number | VARCHAR2 (15) | PRIMARY KEY |
| | Form_ID (FK) | Consumption Data Form's identification number | VARCHAR2 (30) | FOREIGN KEY REFERENCE CONSUMPTION DATA FORM |
| | Validation_Status | Data validation's Status | VARCHAR2 (30) | NOT NULL |
| | Validation_Date | Data validation's Date | DATE | DEFAULT SYSDATE |
| Emission Calculator | Calculation_ID | Emission Calculation's identification number | VARCHAR2 (15) | PRIMARY KEY |
| | Calculation_Result | Result after calculation | CLOB | NOT NULL |
| | Form_ID | Consumption Data Form's identification number | VARCHAR2 (30) | FOREIGN KEY REFERENCE CONSUMPTION DATA FORM |
| Emission Result | Emission_ID | Carbon emission result's identification number | VARCHAR2 (30) | PRIMARY KEY |
| | Emission_Result | Carbon emission result details | CLOB | NOT NULL |
| | Calculation_ID | Carbon Emission Calculation's identification number | VARCHAR2 (15) | FOREIGN KEY REFERENCE EMISSION |

| | | | | |
|----------------------------------|----------------------|---|---------------|--|
| | | | | CALCULATOR |
| Self Monitoring Dashboard | Dashboard_ID | Dashboard's identification number | VARCHAR2 (15) | PRIMARY KEY |
| | Emission_ID | Carbon Emission Calculation's identification number | VARCHAR2 (30) | FOREIGN KEY REFERENCE EMISSION RESULT |
| | Predictive_Insights | Prediction of Carbon emission | CLOB | NOT NULL |
| | Carbon_Footprint_Map | Carbon footprint map | BLOB | NOT NULL |
| Report Generator | Generation_ID | Report Generation's identification number | VARCHAR2 (15) | PRIMARY KEY |
| | Generated_Report | Generated report's details | CLOB | NOT NULL |
| | Emission_ID | Carbon emission's identification number | VARCHAR2 (30) | FOREIGN KEY REFERENCE EMISSION RESULT |
| | Generation_Date | Date to generate report | DATE | DEFAULT SYSDATE |
| | Generation_Status | Report generation status | VARCHAR2 (30) | NOT NULL |
| Emission Report | Report_ID | Report's identification number | VARCHAR2 (15) | PRIMARY KEY |
| | Emission_Report | Emission report details | CLOB | NOT NULL |
| | Generation_ID | Report Generation's identification number | VARCHAR2 (15) | FOREIGN KEY REFERENCE REPORT GENERATOR |

| | | | | |
|--------------------|----------------|-------------------------------------|---------------|---|
| Competition | Competition_ID | Competition's identification number | VARCHAR2 (15) | PRIMARY KEY |
| | Participant_ID | Participant's identification number | VARCHAR2 (15) | FOREIGN KEY REFERENCE CONSUMPTION DATA FORM |
| | Report_ID | Report's identification number | VARCHAR2 (15) | FOREIGN KEY REFERENCE EMISSION REPORT |
| | Start_Date | Date to start the competition | DATE | NOT NULL |
| | End_Date | Due date of the competition | DATE | NOT NULL |
| | Winner | Winner's name | VARCHAR2 (15) | NOT NULL |

6.0 Summary

To satisfy the requirements of MBIP in developing a new data collection and analysis system of carbon emission, a self-monitoring dashboard is developed to automate the process of analyzing and calculating carbon commission data. Self-monitoring dashboard can automatically calculate the carbon footprint using data provided by participants. Real-time data is also updated by self-monitoring dashboard for participants to monitor their carbon commission data. An automated system is provided to reduce human error and increase efficiency of calculating results. In the project design phase, conceptual design for the database is developed. To provide a high-level understanding of how data will be arranged and related within the system, the foundational structure and relationships of the database are outlined and defined during this phase. Data flow diagram (DFD) is designed to visualize the data flow, provide clear understanding of the proposed system including identification of the process, data store and entities within the system. Data flow diagram includes context diagram, level 0 diagram and level 1 diagram. Besides, business rules and data and transaction requirements of the proposed system are established to build a governance framework and specify the requirements of data and transaction. After that, conceptual ERD and enhanced ERD are designed to identify the relationship between the entities. Data dictionary which contains entities, attributes, relationship, data type and others is created. To conclude the work in this phase, a conceptual design for the proposed database has been established, paving the way for the subsequent phase where the logical design and SQL statements for the database system will be developed.