FACULTY OF COMPUTING

SECD2523 DATABASE
SECTION 5 (SECJH)

PROJECT PHASE 2: DATABASE CONCEPTUAL DESIGN (ERD)

SYSTEM NAME:
LOW CARBON INITIATIVES COMMUNITY MONITORING SYSTEM

TEAM: CLOUD DB

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1.0 Introduction

Malaysia has developed a number of sustainability projects aiming at addressing three issues: environmental, social, and economic concerns. One significant attempt is the Low Carbon Cities Framework (LCCF), which aims to combat global warming and climate change. It is a vital step to monitor and minimize carbon dioxide emissions in real time. The Low Carbon Blueprint for Iskandar Malaysia 2025 covers five local authorities, including the entire Johor Bahru and Kulai Jaya districts, and proposes a set of 281 strategic policies with the goal of achieving a 58 percent reduction in carbon intensity by 2025.

The Iskandar Puteri City Council (Majlis Bandaraya Iskandar Putri - MBIP) is one among the organizations engaged in promoting the Low Carbon Society (LCS) through the Iskandar Puteri Low Carbon (IPRK) program. The purpose is to collect information on energy-saving measures in the community, schools, residential areas, higher education institutions, factories, and other locations.

MBIP organized a competition in 2019 to minimize electricity and energy consumption, but unfortunately, the competition experienced various hurdles. To solve the concerns, MBIP intends to create a data collecting and analysis system similar to the e-Lestari system. However, this time the platform will target a fresh demographic, including occupants of multi-story and landed houses, institutions, MBIP divisions, and MBIP staff. Maps of the carbon footprint within the MBIP region, carbon reductions for waste, water, electricity, and recycled cooking oil consumption, identification of high CO_2 community areas, and the development of a user-monitoring dashboard for carbon emissions are among the anticipated data and analysis requirements for MBIP. This new system's primary language will be Bahasa Malaysia.

We will conduct database conceptual design, proposed business rules, proposed data and transactions, create conceptual ERD , Enhanced ERD (EERD) and data dictionary.

2.0 DFD TO-BE
2.1 Context Diagram (To-Be)

The context diagram is the highest level of DFD where there is only one process and no data store. In this diagram, the participant/user is attached to the process low carbon initiative community monitoring system, which is connected to simplification of external entities admin.
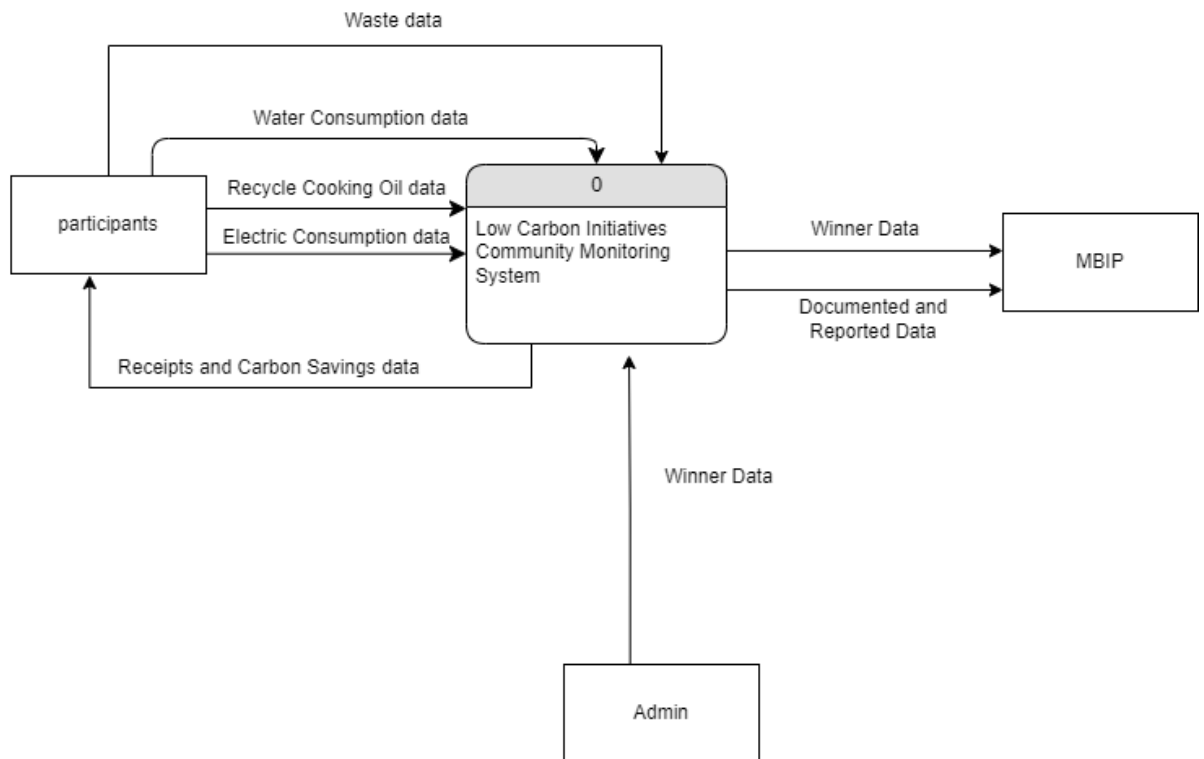
CONTEXT DIAGRAM

Diagram 2.1 Context Diagram (To-Be)

2.2 Parent Diagram DFD Level 0 (To-Be)

In a system's DFD hierarchy, the Parent Data Flow Diagram (DFD) is the highest-level diagram. Without going into specific subprocesses, it offers a comprehensive picture of the complete system, showing how data moves between external entities, processes, and data stores. Comprehending the scope, boundaries, and primary data interactions of the total system requires knowledge of the parent DFD.
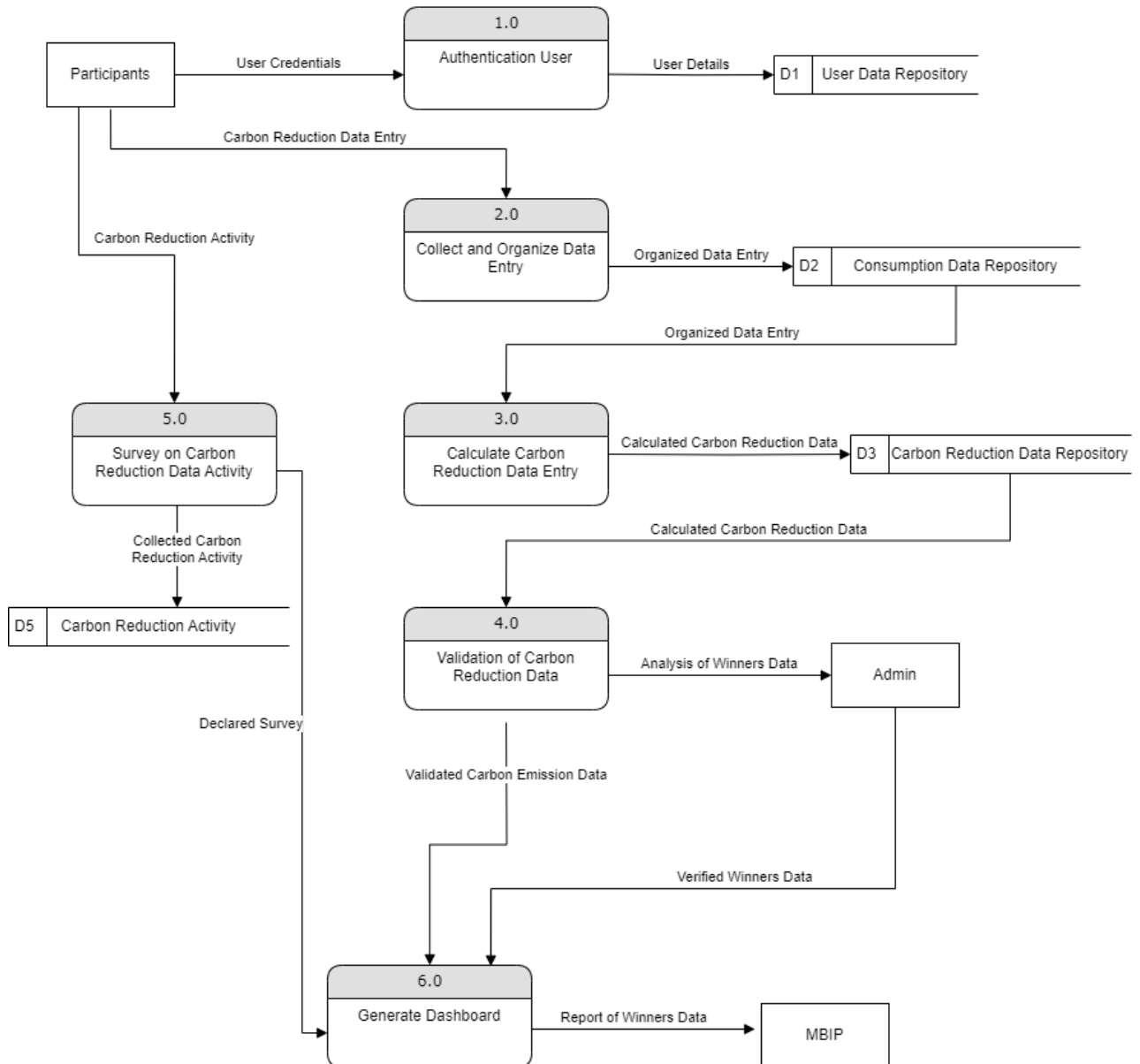
PARENT DFD LEVEL 0

Diagram 2.2 Parent Diagram Level 0 (To-Be)

2.3 Child DFD Level 1 For Process 1: <Authentication User>

The parent process is 1.0 < Authentication User >. This process involves with user to login into the system by creating an account and login using their own credentials first once registered. After creating account, it will validate first before login into existing account.

CHILD DFD LEVEL 1

Diagram 2.3 Child DFD Level 1 for Process <Authentication User>

2.4 Child DFD Level 2 For Process 2: <Collect And Organize Data Entry>

The parent process is 2.0 < Collect and Organize Data Entry >. This process will ask user to enter Waste, Water Consumption, Electric Consumption, and Recycle Cooking Oil Data. Then, system will classify the data based on its category.

Diagram 2.4 Child DFD Level 2 for Process < Collect and Organize Data Entry >

2.5 Child DFD Level 3 For Process 3: <Calculate Carbon Reduction Data Entry>

The parent process is 3.0 < Calculate Carbon Reduction Data Entry >. In this process, it will calculate the carbon emission and carbon reduction after obtain the value of

carbon emission on each data entry. It will also give an indicator of the carbon emission after calculating it.

CHILD DFD LEVEL 3

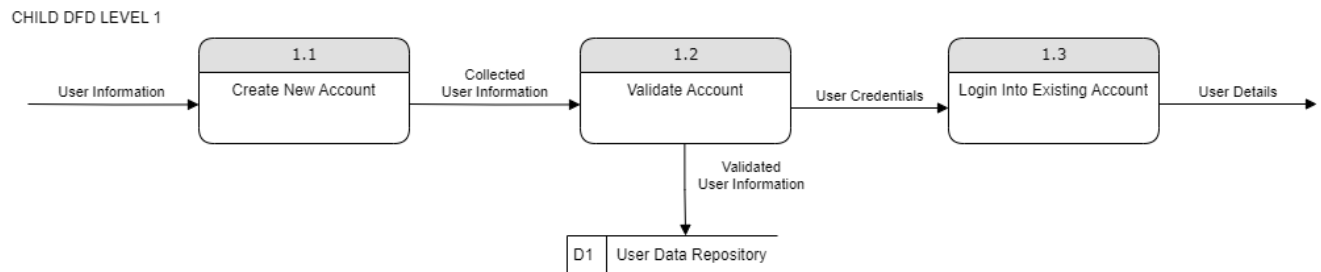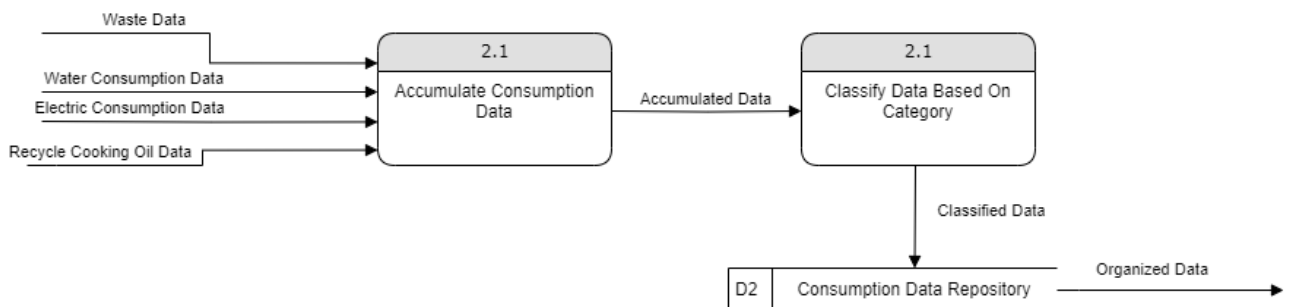Diagram 2.5 Child DFD Level 3 for Process < Calculate Carbon Reduction Data Entry >

2.6 Child DFD Level 4 For Process 4: <Validation Of Carbon Reduction Data>

The parent process is 4.0 < Validation of Carbon Reduction Data >. This process involves in validating the data that has been calculated. After validating the data, system will analyse the winner with highest carbon reduction data. The data then will be transfer to Admin.

CHILD DFD LEVEL 4
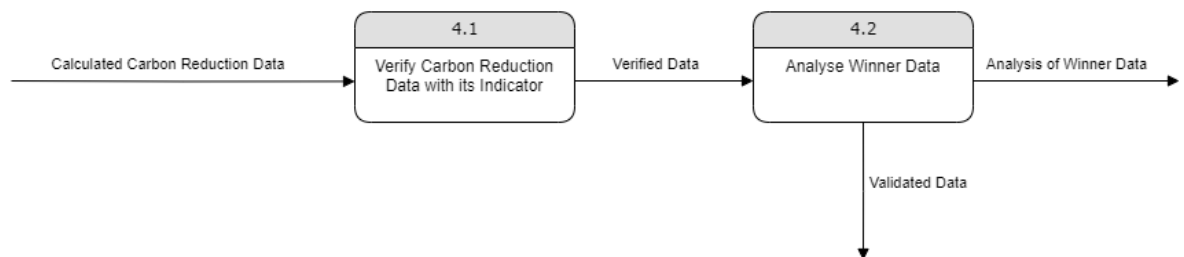
Diagram 2.6 Child DFD Level 4 for Process < Validation of Carbon Reduction Data >

2.7 Child DFD Level 5 For Process 5: <Survey On Carbon Reduction Data Activity>

The parent process is 5.0 < Survey on Carbon Reduction Data Activity >. This process will ask user to answer a survey on Carbon Reduction Activity that they have done. After survey completed, user need to declare this survey and submit it.

CHILD DFD LEVEL 5

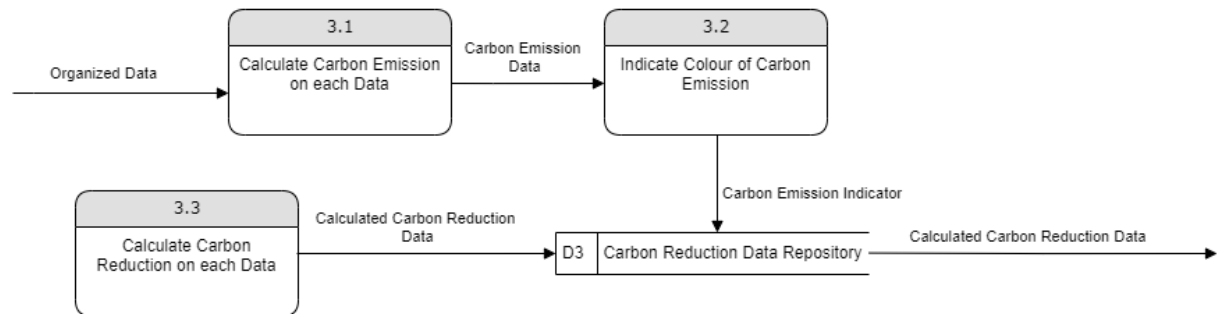Diagram 2.7 Child DFD Level 5 for Process < Survey on Carbon Reduction Data Activity >
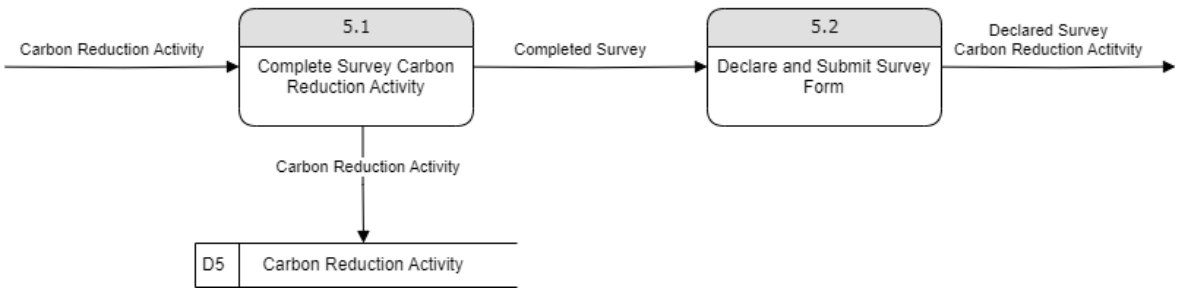
2.8 Child DFD Level 6 For Process 6: <Generate Dashboard>

The parent process is 6.0 < Generate Dashboard >. This process will combine all data from survey, carbon emission and winners data in a dashboard. After all data divided into each section, system will generate a report to be sent to MBIP.
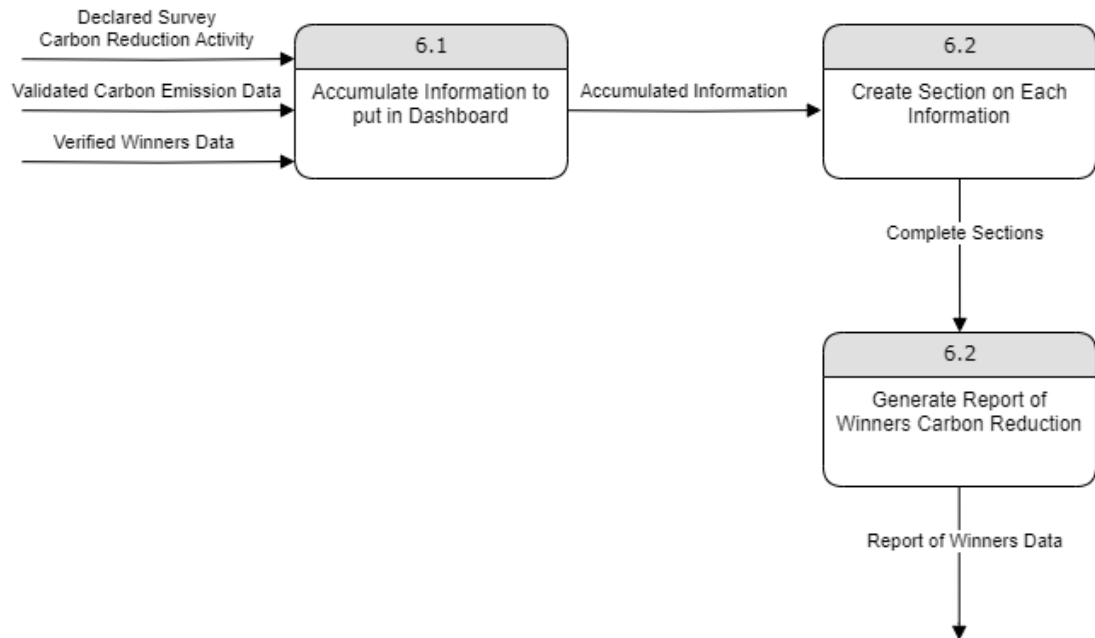

Diagram 2.8 Child DFD Level 6 for Process < Generate Dashboard >

3.0 Data & Transactional Requirements

3.1 Proposed Business Rule

1. The system operates 24 hours a day, 7 days a week.

2. During scheduled maintenance for environmental conservation, certain features of the system, such as data entry and updates, may be temporarily halted every day from 12 am until 1 am.

3. Carbon footprint updates will be reflected in the system within 5 minutes of users recording their eco-friendly actions.

4. Users must register on the low-carbon initiative platform using their real names and relevant identification details.

5. Verification of eco-friendly practices, such as reducing carbon emissions, is required before accessing detailed reports on community sustainability efforts.

6. Users must input specific dates or date ranges to obtain precise reports on carbon reduction activities or community environmental impact.

7. Stock updates related to sustainable products can be performed by users using an excel file, specifying the purchase date and relevant documentation.

8. Users are encouraged to enable notification sounds to receive alerts on low-carbon product availability.

9. Two copies of the eco-friendly action reports are required: one for attaching to the community achievements, and the other for personal reference.

10. Users are responsible for ensuring that their sustainable actions have been successfully recorded and added to the community database.

11. Regular tracking of community environmental initiatives is essential until the information is shared with the wider community.

3.2 Proposed Data and Transactional Requirements

3.2.1 Data Entry

- Enter the details of eco-friendly actions and initiatives.

- Specify the time frame for low-carbon impact reports.

- Record information related to sustainable product purchases.

- Input data regarding changes in community environmental efforts.

3.2.2 Data Update/Delete

- Update or delete specific details of recorded eco-friendly actions.

- Modify or remove specified time frames for carbon impact reports.

- Update or delete information related to sustainable product inventory.

3.2.3 Data Queries

- List details of active community members leading low-carbon initiatives.

- Retrieve details of sustainable products available in the community.

- Identify the history of eco-friendly actions and initiatives.

- List the chronological order of community environmental efforts.

- Display tracking details associated with specific eco-friendly actions and initiatives.

- Identify the status of recorded environmental initiatives.

- Determine the payment status for sustainable product purchases.

- Trace the path of sustainable actions within the community.

3.3 Current Data Requirements

User:

Stored data includes the user ID, user's phone number, email address, and password. The user ID serves as a unique identifier. For this initiative, we assume the user to be an active community member, and the system allows them to lead multiple low-carbon initiatives simultaneously.

4.0 Data conceptual design

An essential phase in the database development process, data conceptual design seeks to capture the essence of an organization's information needs. Basic to it all is the conceptual Entity-Relationship Diagram (ERD), a representation that shows the high-level connections and entities in a system without going into specifics of how it is implemented. The conceptual ERD would list essential entities like Users, Carbon Reduction, and Carbon Emission and show their properties and interactions within the framework of the sustainability platform previously mentioned. Subclasses are introduced in the Enhanced ERD, which improves the structure to allow for complex interactions. To enhance the overall data architecture, subclasses such as Admins and Participants appear in the Enhanced ERD for the User entity. These subclasses have separate responsibilities and attributes. This design approach ensures a comprehensive understanding of the data structure, laying the foundation for an efficient and flexible database system that aligns seamlessly with the complexities of the real-world sustainability initiatives.
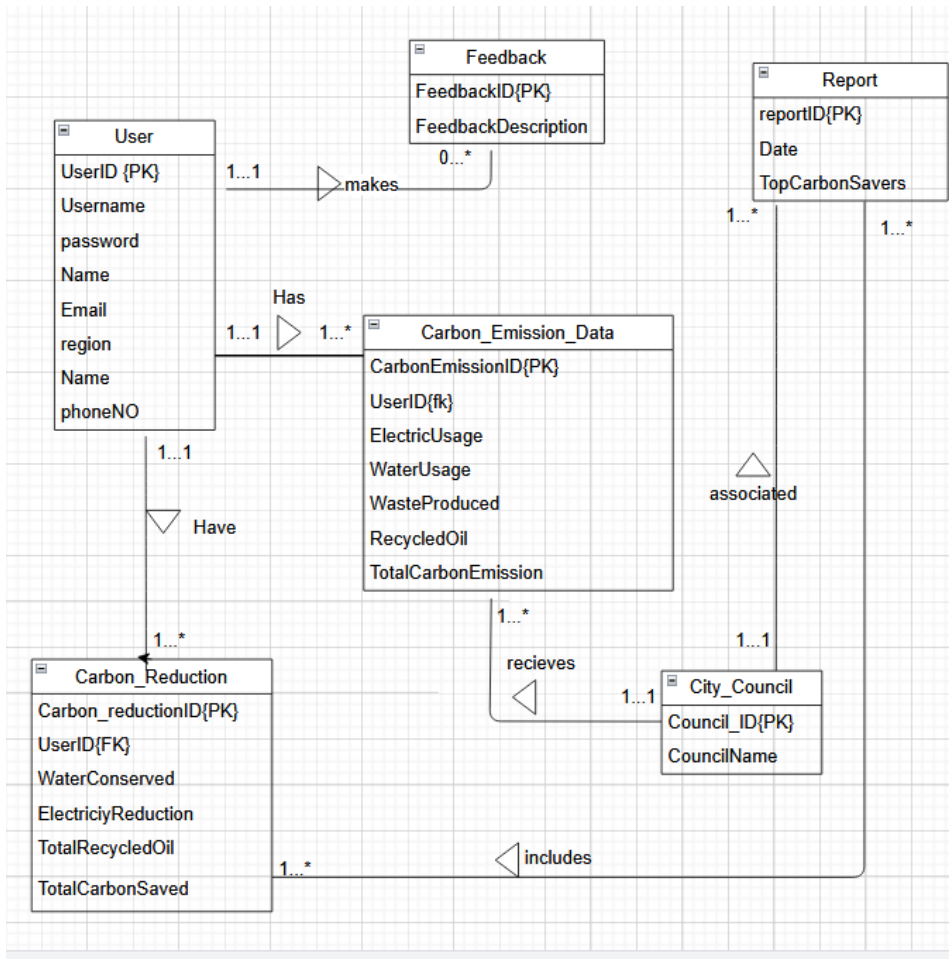
4.1 Conceptual ERD

Diagram 4.1 Conceptual ERD

4.2 Enhanced ERD
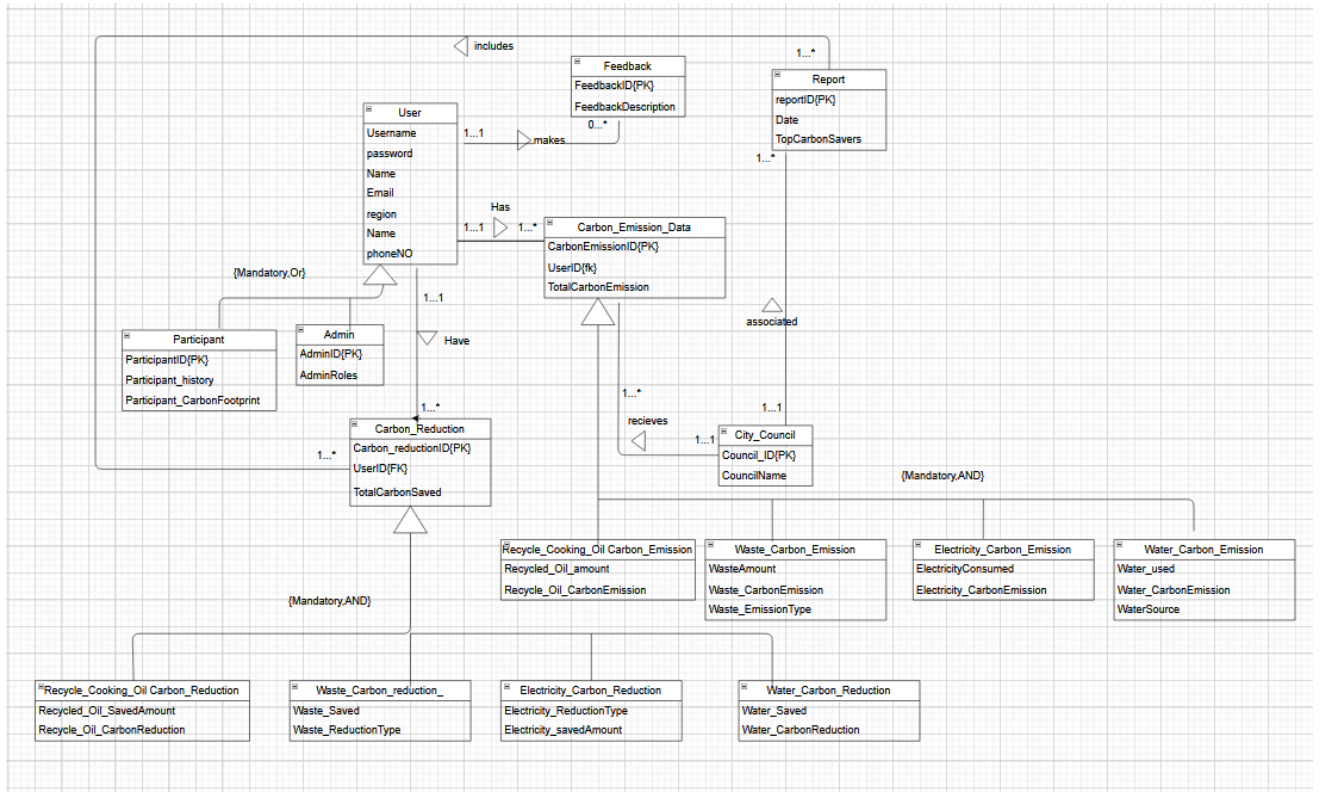
Diagram 4.2 Enhanced ERD

5.0 Data Dictionary

Entity	Attributes	Description	Datatype and Length	Null	Unique
User	UserID{pk}	The ID of the user, this is generated for them	number(3)	No	Yes
	username	The username of the user. This is used for login purposes.	varchar2(20)	No	Yes
	password	The password of the user. This is used for login purposes.	varchar2(20)	No	No
	name	The name of the user	varchar2(30)	No	No
	email	The email of the user	varchar2(30)	Yes	Yes
	region	Stores the user's region	varchar2(10)	Yes	No
	phoneNo	The phone number of the user	varchar2(11)	Yes	Yes
Admin	AdminID{pk}	Uniquely identify admins	number(3)	No	Yes
	AdminRoles	Describe the role of said admin	varchar2(10)	No	No
Participants	ParticipantID{pk}	Uniquely identify participants	number(3)	No	Yes
	Participant_history	Tell how many submission the participants have.	number(2)	No	No

	ParticipantCarbonFootprint	Points to the ID of the participant's carbon reduction. ParticipantCarbonFootprint references CarbonEmission{CarbonEmissionID}. This is a multi-valued attribute	number(3)	No	Yes
Council	CouncilID{pk}	The ID of the council	number(3)	No	Yes
	CouncilName	The name of council.	varchar2(20)	No	Yes
Feedback	FeedbackID{pk}	The feedback ID. Use to uniquely identify feedback.	number(3)	No	Yes
	feedbackDesc	The feedback given by users	varchar2(50)	Yes	No
Report	ReportID{pk}	The report ID. It uniquely identifies the report generated	number(3)	No	Yes
	Date	Date the report is generated	date	No	No
	TopCarbonSavers	The id of the user with most carbon reduction. TopCarbonSavers references User(UserID)	number(3)	Yes	No
Carbon Emission	CarbonEmissionID{pk}	Uniquely identifies the carbon emission data.	number(3)	No	Yes

	UserID{fk}	Bound the data to the user. UserID references User(UserID)	number(3)	No	Yes
	TotalCarbonEmissions	The sum of all the carbon emmited			
Water_carbon_emission	Water_used	The data of how many water was used. Unit in kgm^3	number(7,2)	Yes	No
	Water_carbonEmission	The data of how many carbon was released through water usage. Unit in kiloton	number(7,2)	Yes	No
	WaterSource	The location of water source	varchar2(20)	Yes	No
Electricity_carbon_emission	ElectricyConsumed	The data of how many electricity was used. Unit in kWh	number(7,2)	Yes	No
	Electricity_CarbonEmission	The data of how many carbon was released through electric usage. Unit in kiloton	number(7,2)	Yes	No
Recyle_cooking_oil_carbon_emission	Recycle_Oil_amount	The data of how many oil was used. Unit in kg,	number(7,2)	Yes	No
	Recycle_oil_CarbonEmission	The data of how many carbon was released through oil	number(7,2)	Yes	No

		usage. Unit in kiloton			
Waste_carbon_emission	WasteAmount	The data of how many waste was created. Unit in kg	number(7,2)	Yes	No
	Waste_CarbonEmission	The data of how many carbon was released through waste. Unit in kiloton	number(7,2)	Yes	No
	Waste_EmissionType	Type of waste	varchar2(10)	Yes	No
Carbon Reduction	Carbon_reductionID{pk}	Uniquely identifies the carbon reduction data	number(3)	No	Yes
	UserID{fk}	Bound the data to the user. UserID references User(UserID)	number(3)	No	Yes
	TotalCarbonSaved	The total of all the carbon saved in kiloton	number(7,2)	No	Yes
Water_carbon_emission	Water_saveed	The data of how many water was saved. Unit in kgm^3	number(7,2)	Yes	No
	Water_carbonReduction	The data of how many carbon was saved through water usage. Unit in kiloton	number(7,2)	Yes	No
	ElectricyReductionType	The type of the reduction	varchar2(10)	Yes	No

Electricity _carbon_e mission					
	Electricity_save dAmount	The data of how many electricity was saved. Unit in kWh	number(7,2)	Yes	No
Recyle_co oking_oil_ carbon_e mission	Recycle_Oil_Sa vedamount	The data of how many oil was saved via recycling. Unit in kg,	number(7,2)	Yes	No
	Recycle_oil_Ca rbonReduction	The data of how many carbon was saved through oil recycling. Unit in kiloton	number(7,2)	Yes	No
Waste_car bon_emiss ion	WasteSaved	The data of how many waste was saved via recycling. Unit in kg	number(7,2)	Yes	No
	Waste_CarbonE mission	The data of how many carbon was saved through waste recycling. Unit in kiloton	number(7,2)	Yes	No

6.0 Summary

Iskandar Puteri City Council (MBIP) in Malaysia is undertaking sustainability projects, notably the Low Carbon Cities Framework (LCCF), to combat global warming and climate change. The Low Carbon Blueprint for Iskandar Malaysia 2025 targets a 58% reduction in carbon intensity by 2025, covering five local authorities.

MBIP, through the Iskandar Puteri Low Carbon (IPRK) program, is focusing on data collection and analysis for energy-saving measures. A 2019 competition faced challenges, prompting MBIP to develop a new system. This system will encompass multi-story and landed houses, institutions, MBIP divisions, and staff.

The proposed system aims to provide insights into carbon emissions, waste, water, electricity, and recycled cooking oil consumption. It includes mapping carbon footprints in the MBIP region and identifying high CO_2 community areas. Additionally, a user-monitoring dashboard will be developed for real-time tracking of carbon emissions.

The database conceptual design involves entities like occupants, institutions, MBIP divisions, and staff. Attributes capture specific information on energy consumption, and relationships depict interactions and dependencies. Proposed business rules outline competition participation and data collection, while transactions cover regular data inputs, competition results, and carbon footprint mapping updates.

In summary, the Iskandar Puteri Low Carbon Program's database and Enhanced Entity-Relationship Diagram (EERD) aim to create a robust system for monitoring and reducing carbon emissions across various entities in the MBIP region, fostering sustainable practices and achieving environmental goals.