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**FACULTY OF COMPUTING**

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**SECD2523 DATABASE**

**SECTION 06**

**PHASE 2: DATABASE CONCEPTUAL DESIGN (ERD)**

**CARBON EMISSION MONITORING SYSTEM**

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## **Table of Contents**

|                                    |   |
|------------------------------------|---|
| 1. Introduction                    | 3 |
| 2. Data Flow Diagram (DFD)         | 3 |
| 3. Data & Transaction requirement  | 3 |
| 3.1. Proposed Business Rule        | 3 |
| 3.2. Proposed data & transactional | 3 |
| 4. Database conceptual design      | 3 |
| 4.1. Conceptual ERD                | 3 |
| 4.2. Enhance ERD (ERD)             | 3 |
| 5. Data Dictionary                 | 3 |
| 6. Summary                         | 3 |

## **1. Introduction**

Carbon makes up a huge portion of the environment, and the movement and presence of carbon are necessary for natural systems to function. The movement of carbon between various reservoirs, including the atmosphere, seas, land, and living organisms, is a crucial environmental activity referred to as the "carbon cycle". Comprehending the function of carbon in the environment is essential for mitigating climate change and preserving the equilibrium of ecosystems.

In this paper, we are going to introduce the Carbon Emission Monitoring System that is used to monitor, measure, and regulate the amount of carbon dioxide (CO<sub>2</sub>) in ecosystems. By reducing and controlling carbon emissions, Majlis Perbandaran Iskandar Puteri (MBIP) can mitigate global warming and promote sustainability in Iskandar Puteri. Features of this system might include gathering information from each client about their consumption of water and electricity as well as calculating their carbon footprint using a certain mathematical formula. Additionally, this system offers its clients helpful tips with the goal of limiting carbon emissions on the local scale. Since it won't take much of the clients' time, there's a greater chance that they'll participate in the activity to significantly improve the atmosphere collectively.

This paper also presents Data Flow Diagrams (DFDs) that illustrate the data flow of the Carbon Emission Monitoring System from input to output via processes, data storage, and external entities. Apart from that, the business rule is a set of precise instructions that specify how information should be input, saved, handled, or altered inside a database system and it is a crucial initial element to design a conceptual entity relationship diagram (ERD) or enhance ERD. From this, we can also build a data dictionary that performs the role of a reference manual, offering thorough definitions and explanations of all data objects utilized in the database, such as tables, columns, data types, constraints, relationships, and other features.

## 2. Data Flow Diagram (DFD)

### 2.1. Context Diagram

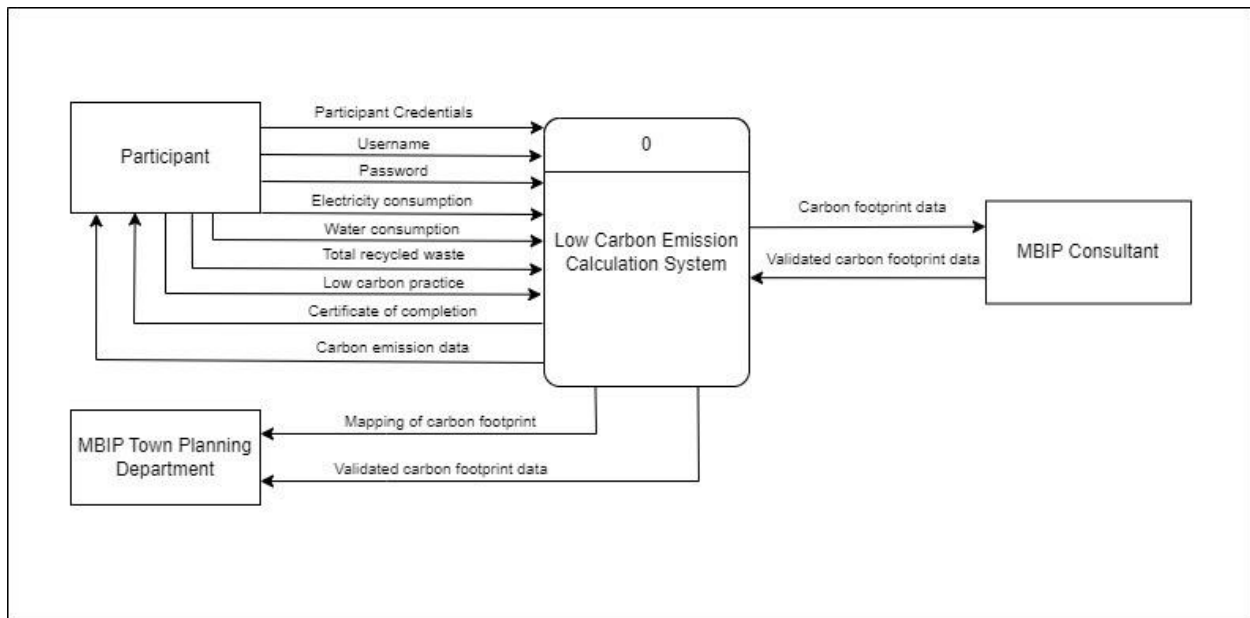


Figure 1: Context diagram

## 2.2. Diagram level - 0

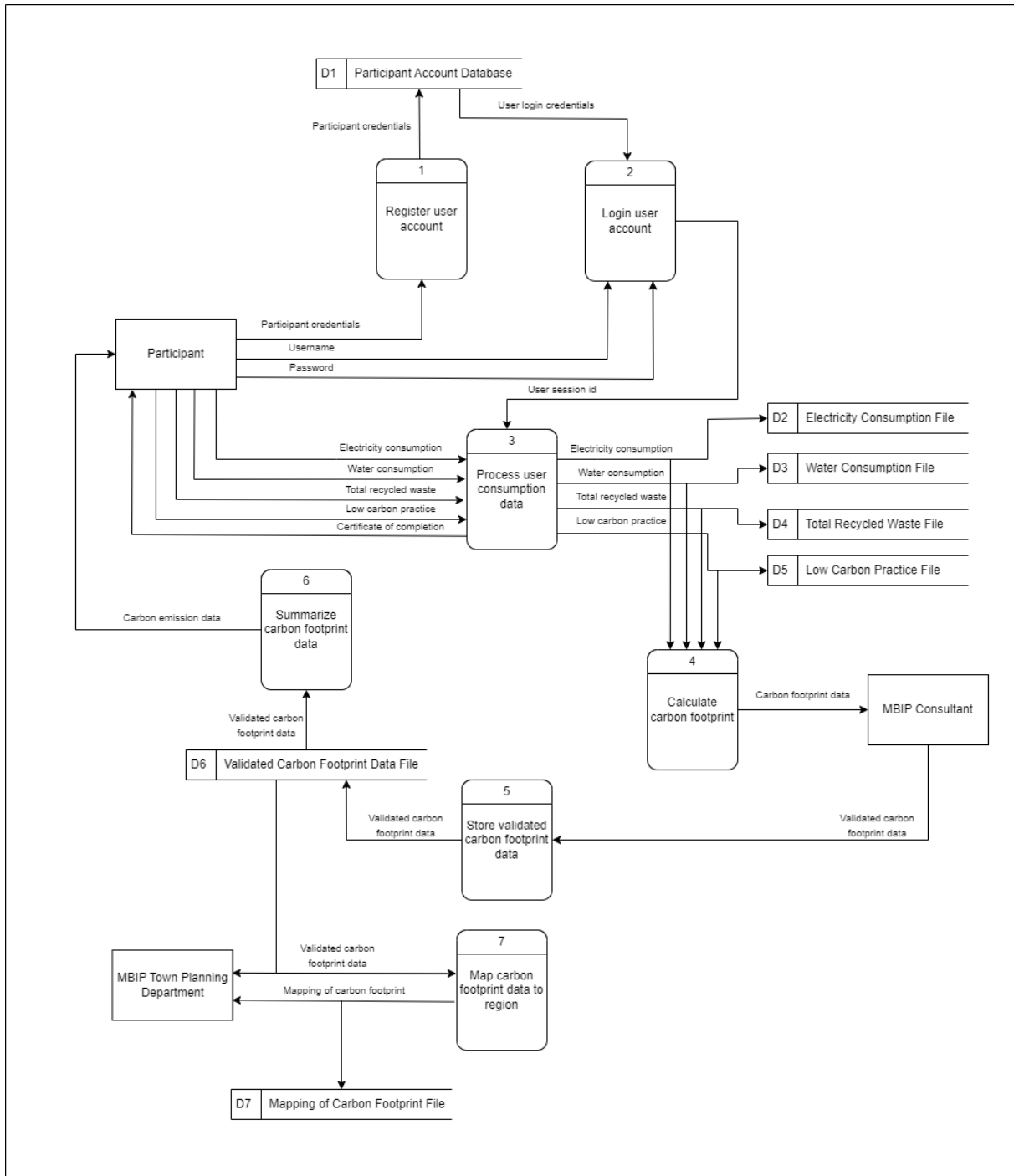


Figure 2: Diagram level - 0

### **3. Data & Transaction requirement (Hisyamuddin)**

#### **3.1. Proposed Business Rule**

A business rule is a statement that specifies the constraint on the elements and the relationships of the elements within a relation. Business rule provides a definitive way on how an organization perceives and uses its data. Therefore, the proposed business rules are as follows:

- Each participant can have one electricity consumption data while each of the electricity consumption data can only be related to one participant.
- Each participant can have one water consumption data while each of the water consumption data can only be related to one participant.
- Each participant can have one total recycled waste data while each of the total recycled waste data can only be related to one participant.
- Each participant can have one low-carbon practice data while each of the low-carbon practice data can only be related to one participant.

#### **3.2. Proposed data & transactional**

The transactional data between entities and processes is the most crucial step in any system. Without it, the interaction between processes and entities can not be realized as other functionality of a system relies heavily upon the data transactional process whether it is input or output data. Therefore, the proposed data and transactional are determined as follows:

##### **Proposed data**

- Participant's credentials
- Participant's electricity consumption
- Participant's water consumption
- Participant's total recycled waste
- Participant's low-carbon practice

- Participant's certificate of completion
- Percentage of carbon emission
- Total carbon footprint produced
- Percentage of carbon footprint
- Mapping of carbon footprint

### **Proposed transactional data**

- Participants register a new account in the Low Carbon Emission Calculation System by providing it with participant credentials.
- Participants submitted their consumption data to the Low Carbon Emission Calculation System by filling out the form provided by the system.
- The Low Carbon Emission Calculation System takes the participants' consumption data from the system database to calculate the carbon footprint data.
- The Low Carbon Emission Calculation System will provide the MBIP consultant with the carbon footprint data to be validated.
- The MBIP consultant will submit the validated carbon footprint data back to the system.
- The Low Carbon Emission Calculation System will store the validated carbon footprint data in the system database.
- The system will also use the validated carbon footprint data to generate a mapping of the carbon footprint within the MBIP region.
- The system will provide the participant with summarized carbon emission data by displaying it on their dashboard.

## 4. Database conceptual design

### 4.1. Conceptual ERD

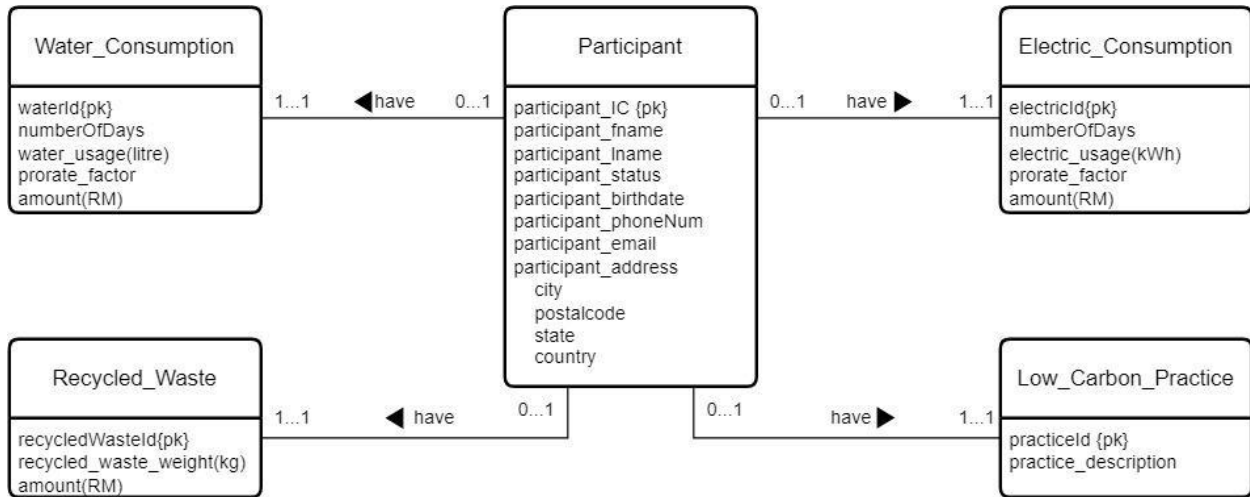


Figure 1: Entity Relationship Diagram for Low Carbon Emission Calculation System



## 4.2. Enhance ERD (EERD)

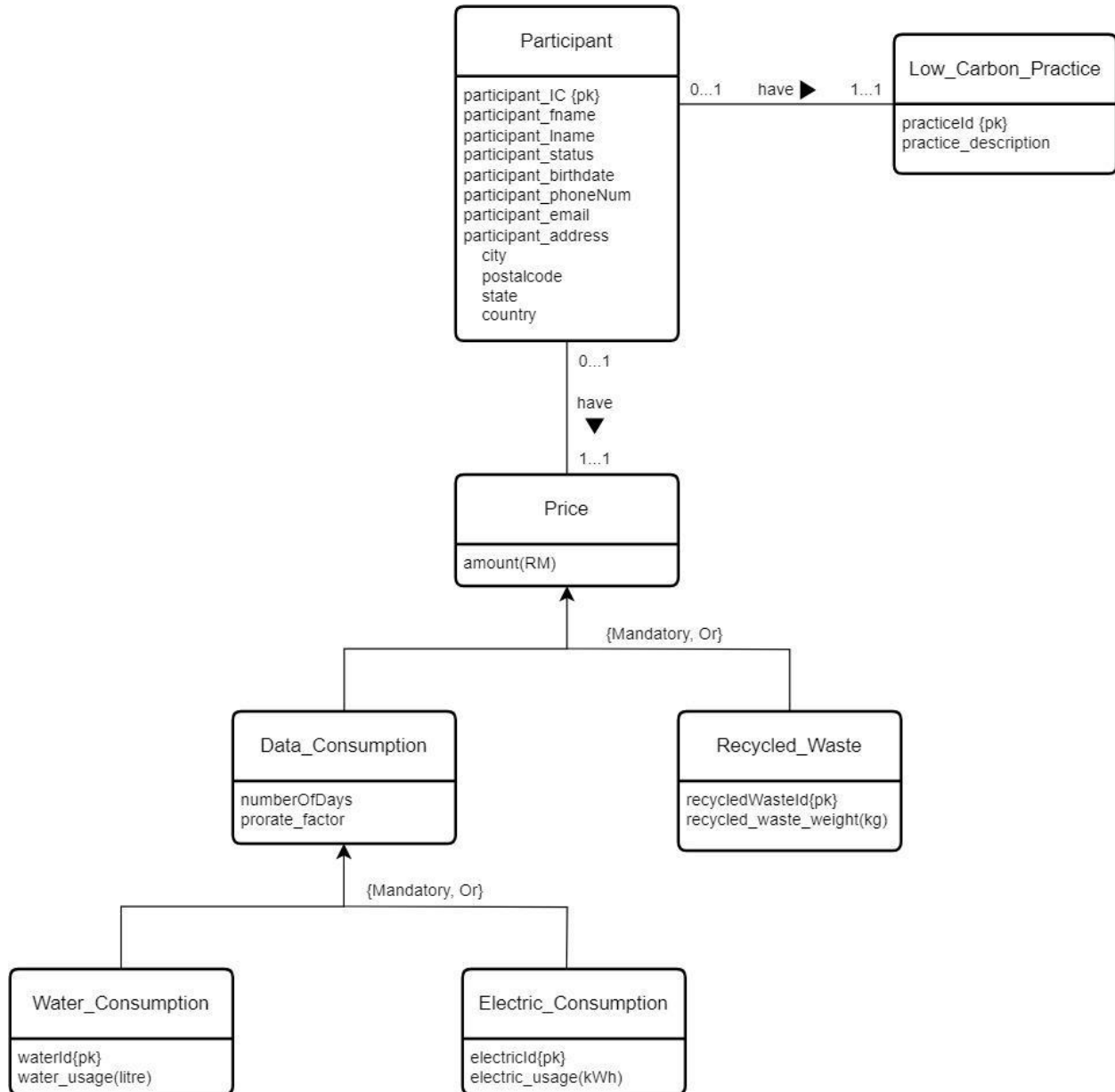


Figure 1: Entity Relationship Diagram for Low Carbon Emission Calculation System

## 5. Data Dictionary

A Data Dictionary is a collection of entities, definitions and attributes used or captured in a relation or database. Therefore, the Low Carbon Emission Calculation System Data Dictionary is defined as follows:

| Entity name          | Attributes  | Description   | Data Type & Length  | Nulls   | Multi-Valued   |
|----------------------|---|---|---|---|--|
| Participant          | participant_IC<br>participant_fname<br>participant_lname<br>participant_status<br>participant_birthdate<br>participant_phoneNum<br>participant_email<br>participant_address<br>city<br>postalCode<br>state<br>country | Participant's IC number<br>Participant's first name<br>Participant's last name<br>Participant's status<br>Participant's birthdate<br>Participant's phone number<br>Participant's email<br>Participant's current home address          | 12 variable characters<br>20 variable characters<br>20 variable characters<br>10 variable characters<br>Date<br>11 variable characters<br>40 variable characters<br>20 variable characters<br>5 variable characters<br>20 variable characters<br>20 variable characters | No<br>No<br>No<br>No<br>Yes<br>No<br>No<br>No<br>No<br>No<br>No | No<br>No<br>No<br>No<br>No<br>No<br>No<br>No<br>No<br>No<br>No |
| Water_Consumption    | waterId<br>numberOfDays<br>water_usage<br>prorate_factor<br>amount  | Uniquely identifies the water consumption tuple<br>Number of water consumption days<br>The amount of water usage in liters<br>The rate for the water charged in liters<br>Total amount of water usage in Ringgit Malaysia             | 10 variable characters<br>2 digits number<br>5 digits number<br>5 digits number<br>8 digits number  | No<br>No<br>No<br>No<br>No                                      | No<br>No<br>No<br>No<br>No                                     |
| Electric_Consumption | electricId<br>numberOfDays<br>electric_usage<br>prorate_factor<br>amount  | Uniquely identifies the electric consumption tuple<br>Number of electric consumption days<br>The amount of electric usage in kWh<br>The rate for the electricity charged in kWh<br>Total amount of electric usage in Ringgit Malaysia | 10 variable characters<br>2 digits number<br>5 digits number<br>5 digits number<br>8 digits number  | No<br>No<br>No<br>No<br>No                                      | No<br>No<br>No<br>No<br>No                                     |

|                     |                      |  |                        |    |    |
|---------------------|----------------------|--|------------------------|----|----|
| Recycled_Waste      | recycledWasteId      | Uniquely identifies the recycled waste tuple           | 10 variable characters | No | No |
|                     | recycle_waste_weight | The amount of recycled waste weight in kilogram        | 5 digits number        | No | No |
|                     | amount               | The total amount of recycled waste in Ringgit Malaysia | 8 digits number        | No | No |
| Low_Carbon_Practice | practiceId           | Uniquely identifies the low-carbon practice tuple      | 10 variable characters | No | No |
|                     | practice_description | Description of participant's low-carbon practice       | 50 variable characters | No | No |

*Table 1: Data Dictionary for Low Carbon Emission Calculation System*

## **6. Summary**

For our summary, the importance of carbon in the environment is discussed in this study with a focus on how knowing the carbon cycle is essential to preventing climate change and preserving ecological balance. In order to track, measure and control carbon dioxide (CO<sub>2</sub>) levels in MBIP developed the Low Carbon Emission Monitoring System.

Next is a one to one link between participants and their usage for water, electricity, total recycled waste and low carbon initiatives is guaranteed by the proposed business rules. The data and transactional needs are described in the project, along with participant credentials, consumption information, carbon footprint estimates and the validation procedure.

Moreover, the Data Flow Diagrams (DFDs) are used to show how data moves through the Low Carbon Emission Monitoring System's processes, data storage and external entities from input to output. The database design is represented visually by the Entity Relationship Diagram (ERD) and Enhanced Erd (EERD).

Furthermore, with its extensive reference handbook, the Data Dictionary lists important entities, attributes, descriptions, data types and lengths for the Low Carbon Emission Calculation System. Participant, water consumption, electric consumption, recycled waste and low carbon practice are among the entities covered.

Lastly, to ensure the efficient operation of the Low Carbon Emission Monitoring System for MBIP, in this phase introduces a comprehensive system to monitor and regulate carbon emissions. It includes business rules, data flow diagrams, conceptual and enhanced ERDs and a comprehensive data dictionary.