SECD2523 – DATABASE

SEMESTER 1 2023/2024

PHASE 3 - DATABASE CONCEPTUAL DESIGN (ERD)

<Carbon Reduction and Sustainability Engagement System>

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Table of Contents

1.0 Introduction

This project explores the sustainability efforts that Malaysia has made, mainly concentrating on the Low Carbon Blueprint for Iskandar Malaysia 2025 and the Low Carbon Cities Framework (LCCF). By 2025, the target is to reduce carbon intensity by 58 percent from the baseline of 2005 levels. To raise awareness and promote the adoption of low carbon emission practices, the Malaysian government, more specifically in the Johor state has launched a number of initiatives. These include the Iskandar Malaysia Eco Life Challenge (IMELC) programme, the Johor Education Department's (JPNJ) e-Lestari system, and the Iskandar Puteri City Council's (MBIP) Iskandar Puteri Low Carbon (IPRK) initiative.

One of the main initiatives supporting the Low Carbon Society (LCS) in the Iskandar region is MBIP's IPRK initiative, which gathers information about community energy-saving activities. Among the projects included in this programme is the Iskandar Puteri Low Carbon Calendar Competition. However, there are issues with the existing data gathering approach, including a laborious entry process, a need for comprehensive participant information, and manual carbon reduction calculations.

The development of an automated data gathering and analysis system akin to the successful e-Lestari system executed by the Johor Education Department (JPNJ) is the most optimal solution that emerges to meet the current quandaries. This method is meant to cover a variety of community groupings, such as individuals who reside in multistory homes or landed property, institutions, MBIP divisions, and MBIP employees. This suggested data gathering and analysis system's main feature is a trustworthy computation process that determines carbon reductions for the usage of water, electricity, garbage, and repurposed frying oil. The ability to detect regions with significant carbon dioxide emissions—which includes a dashboard that allows users to self-monitor their carbon emissions—is another crucial component of the suggested system. Implementing the system in Bahasa Melayu, the national language, will ensure that all local users understand it.

The document highlights the potential for these solutions to enhance the Iskandar Puteri Low Carbon Calendar Competition in addition to providing a thorough outline of them. A self-monitoring dashboard for users is among the new dashboards that offer real-time insights into participants' carbon contributions. The Iskandar Puteri City Council (MBIP) is the client in this instance. They anticipate accurate cost estimates, technical viability, and clarity on suggested solutions. In addition, customers want a clearly defined schedule with quantifiable benchmarks and results, including improved data quality and higher engagement. This document functions as a thorough and complete plan to meet these goals and improve the Iskandar Puteri Low Carbon Calendar Competition's efficacy.

2.0 Overview of Project

This project focuses on the development of a new data collection and analysis system to monitor and assess current levels of carbon dioxide in Malaysia, particularly in the area of Johor, with the aim to achieve Low Carbon Society (LCS). This system aims to overcome various conundrums faced by the Iskandar Puteri City Council (MBIP) where their prior endeavors to achieve LCS has yet to be accomplished. The primary scope of this new system-in-planning covers data gathering, and reporting processes which ultimately comes down to a key goal of promoting more effective carbon reduction initiatives.

To illustrate the explanation, Data Flow Diagrams (DFD) are used to show how information flows between the "Carbon Reduction and Sustainability Engagement System" and outside entities like participants and MBIP. To describe the main data items, attributes, and relationships, a database conceptual model and data dictionary will be created based on the prerequisites that were previously stated. The new business rule, conceptual ERD, enhanced ERD, and data dictionary will be established in order to translate the requirements into comprehensive and accurate system design specifications. Then, the normalization process takes place until it reaches the Boyce Codd Normal Form (BCNF). From that, relational schemas are derived after normalization. Finally, SQL statements are created to convert the requirements into thorough and comprehensive system design specifications.
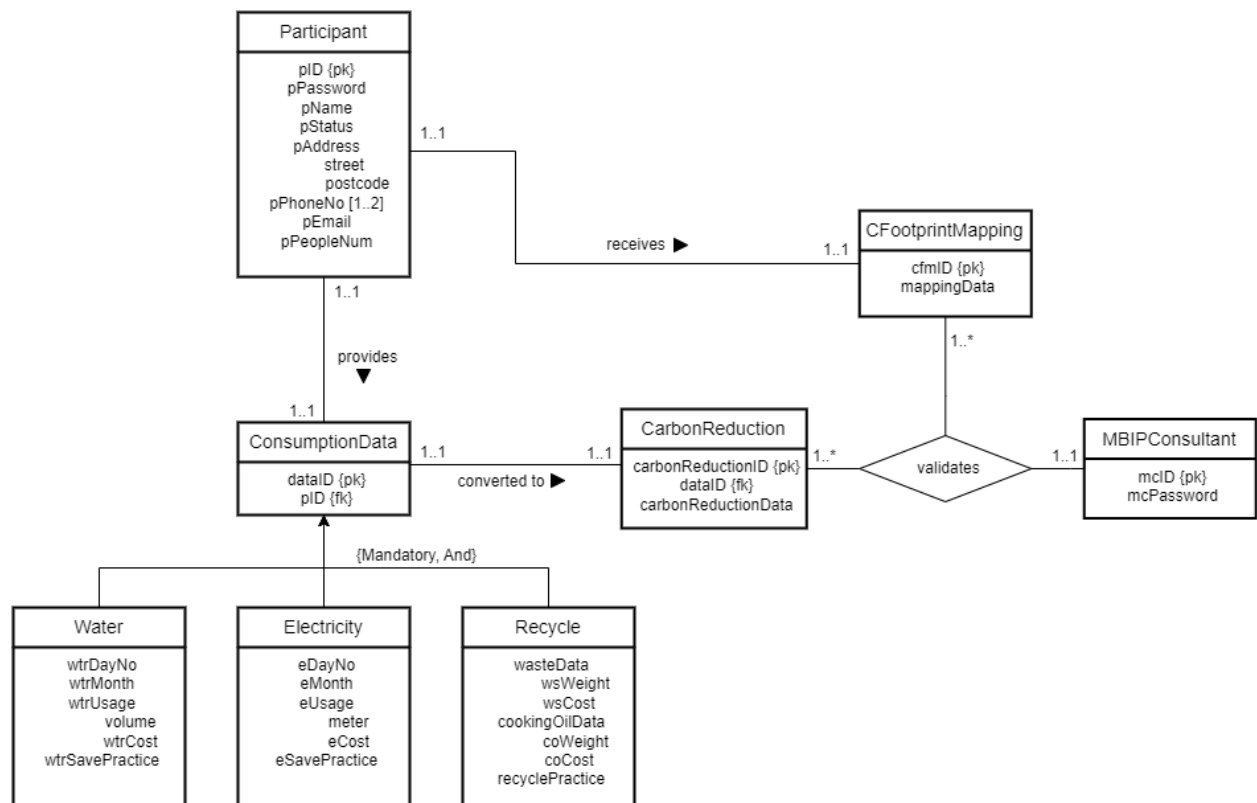
3.0 Database Conceptual Design

3.1 Updated Business Rule

The business rule for the Carbon Reduction and Sustainability Engagement System :

1. One participant provides at least one carbon consumption reduction
2. At least one carbon consumption reduction are provided by one participant
3. Each participant receive one carbon footprint mapping
4. Each carbon footprint mapping are receive by one participant
5. Each participant provides one phone number
6. Every phone number are provided by two participant
7. Each carbon consumption reduction requires one validation
8. Each one validation can validate more then one carbon consumption reduction
9. Each validation can creates more than on carbon footprint mapping
10. Each carbon footprint mapping are been created by on validation
11. Every MBIP consultant process one validation
12. Each validation are been processed by on MBIP consultant.

3.2 Conceptual ERD

Participant
- pID {pk}
- pPassword
- pName
- pStatus
- pAddress
  - street
  - postcode
- pPhoneNo [1..2]
- pEmail
- pPeopleNum

CFootprintMapping
- cfmID {pk}
- mappingData

ConsumptionData
- dataID {pk}
- pID {fk}

CarbonReduction
- carbonReductionID {pk}
- dataID {fk}
- carbonReductionData

MBIPConsultant
- mcID {pk}
- mcPassword

1..1 receives ▶ 1..1

1..1 provides ▼ 1..1

1..1 converted to ▶ 1..1

1..* validates 1..1

1..*

{Mandatory, And}

Water
- wtrDayNo
- wtrMonth
- wtrUsage
- volume
- wtrCost
- wtrSavePractice

Electricity
- eDayNo
- eMonth
- eUsage
- meter
- eCost
- eSavePractice

Recycle
- wasteData
- wsWeight
- wsCost
- cookingOilData
- coWeight
- coCost
- recyclePractice

4.0 Database Logical Design

4.1 Logical ERD
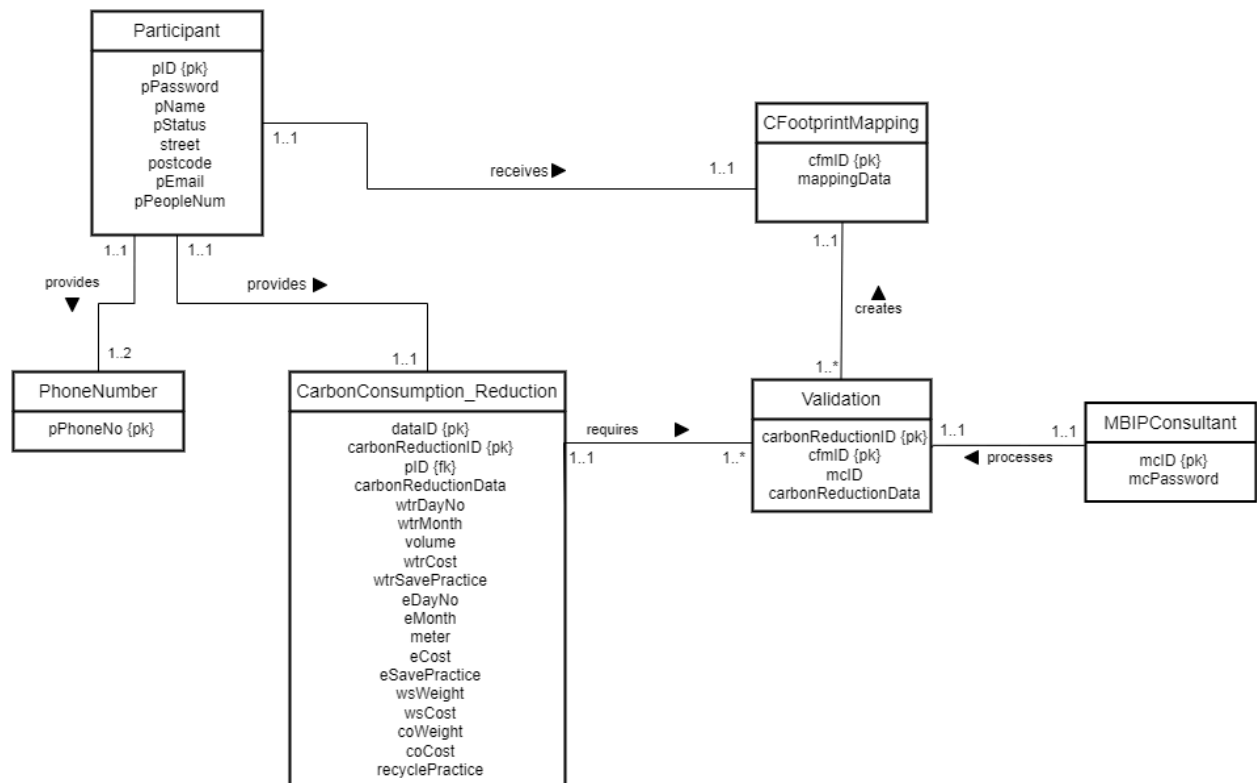
4.2 Updated Data Dictionary

Entity Relationship

Entity	Description	Aliases	Occurrence
Participant	Holds participant information	Consumer	Participants receive carbon reduction data.Participants provides consumption data
CarbonConsumption_Reduction	Hold consumption reduction data	Data Carbon Consumption Reduction	Every consumption data are converted to one carbon reduction data
Water	Hold participant water consumption	Water	Every water consumption data from each participants must store at consumption data
Electricity	Holds participant electricity consumption	Electricity	Every electricity consumption data from each participants must store at consumption data
Recycle	Holds participant recycle consumption	Recycled waste and cooking oil	Every recycled waste and cooking oil data from each participants must store at consumption data
PhoneNumber	Holds participant phone number	Phone number	Each participant has phone number
CFootprintMapping	CFootprintMapping validates by MBIPConsultant	Carbon Footprint Map	CFootprint Mapping are been validated by carbon reduction data and MBIP consultant

Validation	Holds carbon footprint mapping and carbon reduction data for validation	Validation	A report show the carbon footprint mapping and carbon reduction	
MBIPConsultant	Process on validate the information	MBIP Consultant	MBIP consultant validates Carbon reduction and CFootprint Mapping	

Entity Relationship

Entity	Multiplicity	Relationship	Entity 2	Multiplicity
Participant	1..1	provides	PhoneNumber	1..2
	1..1	provides	CarbonConsumption_Reduction	1..1
	1..1	receives	CFootprintMapping	1..1
CarbonConsumption_Reduction	1..1	requires	Validation	1..1
MBIPConsultant	1..1	processes	Validation	1..1
Validation	1..*	creates	CFootprintMapping	1..1

Entity Attributes

Entity	Attribute	Description	Data type & Length	Constraints
Participant	pID	Participant identification number attribute	VARCHAR2(20)	Primary Key, Not NULL, Unique
	pPassword	Participant's password during login	VARCHAR2(20)	Not NULL
	pName	Participant's	VARCHAR2(30)	Not NULL

		name		
	pStatus	Participant's status (employed, unemployed, student)	VARCHAR2(15)	Not NULL
	street	The street's name where participant lives	VARCHAR2(15)	Not NULL
	postcode	The postcode number of where participant lives	VARCHAR2(15)	Not NULL
	pEmail	Participant's email	VARCHAR2(15)	Not NULL, Unique
	pPeopleNum	Total number of people in the household	NUMBER(2)	Not NULL
PhoneNumber	pPhoneNo	Participant phone number	VARCHAR2(15)	Primary Key, Not NULL,
Carbon Consumption_Reduction	dataID	Carbon consumption data identification number	VARCHAR2(20)	Primary Key, Not NULL, Unique
	carbonReductionID	Carbon reduction data identification number	VARCHAR2(20)	Primary Key, Not NULL, Unique
	pID	Participant identification number attribute	VARCHAR2(20)	Foreign Key, Not NULL
	carbonReductionData	Carbon reduction data	VARCHAR2(25)	Not NULL
	wtrDayNo	Number of days the data covered for water usage	NUMBER(4)	Foreign Key, Not NULL,

	wtrMonth	Number of months the data covered for water usage	NUMBER(3)	Foreign Key, Not NULL,
	volume	Data regarding water usage (m³)	NUMBER(5, 2)	Foreign Key, Not NULL,
	wtrCost	Data regarding water bill (RM)	NUMBER(5, 2)	Foreign Key, Not NULL,
	wtrSavePractice	Participant's practice to save water usage	VARCHAR2(30)	Foreign Key, Not NULL,
	eDayNo	Number of days the data covered for electricity usage	NUMBER(4)	Foreign Key, Not NULL,
	eMonth	Number of months the data covered for electricity usage	NUMBER(3)	Foreign Key, Not NULL,
	meter	Data regarding electricity usage (kWh)	NUMBER(4)	Foreign Key, Not NULL,
	eCost	Data regarding electricity bill (RM)	NUMBER(5, 2)	Foreign Key, Not NULL,
	eSavePractice	Participant's practice to save electricity usage	VARCHAR2(30)	Foreign Key, Not NULL,
	wsWeight	Data regarding wastes weight (kg)	NUMBER(4)	Foreign Key, Not NULL,
	wsCost	Data regarding wastes cost (RM)	NUMBER(5, 2)	Foreign Key, Not NULL,
	coWeight	Data regarding cooking oil weight (kg)	NUMBER(4)	Foreign Key, Not NULL,

	coCost	Data regarding cooking oil cost	NUMBER(5, 2)	Foreign Key, Not NULL,
	recyclePractice	Participant's practice to recycle	VARCHAR2(30)	Foreign Key, Not NULL,
MBIPConsultant	mcID	MBIP Consultant identification number	VARCHAR2(20)	Primary Key, Not NULL, Unique
	mcPassword	MBIP consultant password for login	VARCHAR2(20)	Not NULL
CFootprintMapping	cfmID	Carbon footprint mapping identification number	VARCHAR2(20)	Primary Key, Not NULL, Unique
	mappingData	Carbon footprint mapping data	VARCHAR2(20)	Not NULL
Validation	carbonrReductionID	Carbon reduction data identification number	VARCHAR2(20)	Primary Key, Not NULL, Unique
	cfmID	Carbon footprint mapping identification number	VARCHAR2(20)	Primary Key, Not NULL, Unique
	mcID	MBIP Consultant identification	VARCHAR2(20)	Foreign Key, Not NULL,
	carbonReductionData	Carbon reduction data	VARCHAR2(25)	Not NULL

4.3 Normalization

First Normal Form (1NF)

Relational Schema
Participant(pID,pPassword,pName,pStatus,street,postcode,pEmail, pPeopleNum) Primary Key : pID
PhoneNumber(pID,pPhoneNo) Primary Key : pPhoneNo Foreign Key : pID reference Participant(pID)
CFootprintMapping(cfmID, mappingData) Primary key : cfmID
CarbonConsumption_Reduction(dataID, carbonReductionID, pID, carbonReductionData,wtrDayNo,wtrMonth, volume, wtrCost, wtrSavePractice,eDayNo,eMonth,meter,eCost,eSavePractice,wsWeight,wsCost,coWeight,coCost,recyclePractice) Primary Key : dataID, carbonReductionID Foreign Key : pID reference Participant(pID)
Validation(carbonReductionID,cfmID,mcID,carbonReductionData) Primary Key : carbonReductionID, cfmID Foreign Key 1 : mcID reference MBIPConsultant(mcID) Foreign Key 2 : carbonReductionID reference CarbonConsumption_Reduction(carbonReduction) Foreign Key3 : carbonReductionData reference CarbonConsumption_Reduction(carbonReductionData)
MBIP(mcID,mcPassword) Primary Key : mcID

Second Normal Form (2NF)

Relational Schema
ParticipantAccount(<u>pID</u>,pPassword, pEmail) Primary Key : pID
ParticipantInfo(<u>pID</u>, pName, pStatus, pPeopleNum) Primary Key: pID Foreign Key : pID reference ParticipantAccount(pID)
ParticipantAddress(<u>pID</u>,street,postcode) Primary Key : pID Foreign Key : pID reference ParticipantAccount(pID)
PhoneNumber(pID, <u>pPhoneNo</u>) Primary Key : pPhoneNo Foreign Key : pID reference ParticipantAccount(pID)
CFootprintMapping(<u>cfmID</u>, mappingData) Primary key : cfmID
CarbonReduction(<u>carbonReductionID</u>, carbonReductionData) Primary Key : carbonReductionID
CarbonConsumption_Reduction(<u>dataID</u>, <u>carbonReductionID</u>, pID) Primary Key : dataID, carbonReductionID Foreign Key 1 : pID reference ParticipantAccount(pID) Foreign Key 2 : carbonReductionID reference CarbonReduction(carbonReductionID)
Water(<u>dataID</u>, wtrDayNo,wtrMonth, volume, wtrCost, wtrSavePractice) Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)
Electricity(<u>dataID</u>,eDayNo,eMonth,meter,eCost,eSavePractice) Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)
Recycle(<u>dataID</u>,wsWeight,wsCost,coWeight,coCost,recyclePractice)

Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)
Validation(<u>carbonReductionID,cfmID</u>) Primary Key : carbonReductionID, cfmID Foreign Key : carbonReductionID reference CarbonConsumption_Reduction(carbonReductionID)
ValidationMC(<u>carbonReductionID,cfmID</u>,mcID) Primary Key : carbonReductionID Foreign Key : carbonReductionID reference CarbonConsumption_Reduction(carbonReductionID)
MBIPConsultant(<u>mcID</u>, mcPasssword) Primary Key : mcID

Third Normal Form (3NF)

Relational Schema
ParticipantAccount(<u>pID</u>,pPassword, pEmail) Primary Key : pID
ParticipantInfo(<u>pID</u>, pName, pStatus, pPeopleNum) Primary Key: pID Foreign Key : pID reference ParticipantAccount(pID)
ParticipantAddress(<u>pID</u>,street,postcode) Primary Key : pID Foreign Key : pID reference ParticipantAccount(pID)
PhoneNumber(pID, <u>pPhoneNo</u>) Primary Key : pPhoneNo Foreign Key : pID reference ParticipantAccount(pID)
CFootprintMapping(<u>cfmID</u>, mappingData) Primary key : cfmID

CarbonReduction(<u>carbonReductionID</u>, carbonReductionData)
Primary Key : carbonReductionID

CarbonConsumption_Reduction(<u>dataID</u>, <u>carbonReductionID</u>, pID)
Primary Key : dataID, carbonReductionID
Foreign Key 1 : pID reference ParticipantAccount(pID)
Foreign Key 2 : carbonReductionID reference
CarbonReduction(carbonReductionID)

Water(<u>dataID</u>, wtrDayNo,wtrMonth, volume, wtrCost, wtrSavePractice)
Primary Key : dataID
Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)

Electricity(<u>dataID</u>,eDayNo,eMonth,meter,eCost,eSavePractice)
Primary Key : dataID
Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)

Recycle(<u>dataID</u>,wsWeight,wsCost,coWeight,coCost,recyclePractice)
Primary Key : dataID
Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)

Validation(<u>carbonReductionID</u>,<u>cfmID</u>)
Primary Key : carbonReductionID, cfmID
Foreign Key : carbonReductionID reference
CarbonConsumption_Reduction(carbonReductionID)

ValidationMC(<u>carbonReductionID</u>,<u>cfmID</u>,mcID)
Primary Key : carbonReductionID
Foreign Key : carbonReductionID reference
CarbonConsumption_Reduction(carbonReductionID)

MBIPConsultant(<u>mcID</u>, mcPasssword)
Primary Key : mcID

Boyce-Codd Normal Form (BCNF)

Relational Schema
ParticipantAccount(<u>pID</u>,pPassword, pEmail) Primary Key : pID
ParticipantInfo(<u>pID</u>, pName, pStatus, pPeopleNum) Primary Key: pID Foreign Key : pID reference ParticipantAccount(pID)
ParticipantAddress(<u>pID</u>,street,postcode) Primary Key : pID Foreign Key : pID reference ParticipantAccount(pID)
PhoneNumber(pID, <u>pPhoneNo</u>) Primary Key : pPhoneNo Foreign Key : pID reference ParticipantAccount(pID)
CFootprintMapping(<u>cfmID</u>, mappingData) Primary key : cfmID
CarbonReduction(<u>carbonReductionID</u>, carbonReductionData) Primary Key : carbonReductionID
CarbonConsumption_Reduction(<u>dataID</u>, <u>carbonReductionID</u>, pID) Primary Key : dataID, carbonReductionID Foreign Key 1 : pID reference ParticipantAccount(pID) Foreign Key 2 : carbonReductionID reference CarbonReduction(carbonReductionID)
Water(<u>dataID</u>, wtrDayNo,wtrMonth, volume, wtrCost, wtrSavePractice) Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)
Electricity(<u>dataID</u>,eDayNo,eMonth,meter,eCost,eSavePractice) Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)
Recycle(<u>dataID</u>,wsWeight,wsCost,coWeight,coCost,recyclePractice)

Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)
Validation(<u>carbonReductionID,cfmID</u>) Primary Key : carbonReductionID, cfmID Foreign Key : carbonReductionID reference CarbonConsumption_Reduction(carbonReductionID)
ValidationMC(<u>carbonReductionID,cfmID</u>,mcID) Primary Key : carbonReductionID Foreign Key : carbonReductionID reference CarbonConsumption_Reduction(carbonReductionID)
MBIPConsultant(<u>mcID</u>, mcPasssword) Primary Key : mcID

5.0 Relational Database Schemas (after normalization)

Relational Schema
ParticipantAccount(<u>pID</u>,pPassword, pEmail) Primary Key : pID
ParticipantInfo(<u>pID</u>, pName, pStatus, pPeopleNum) Primary Key: pID Foreign Key : pID reference Participant(pID)
ParticipantAddress(<u>pID</u>,street,postcode) Primary Key : pID Foreign Key : pID reference Participant(pID)
PhoneNumber(pID, <u>pPhoneNo</u>) Primary Key : pPhoneNo Foreign Key : pID reference Participant(pID)
CFootprintMapping(<u>cfmID</u>, mappingData) Primary key : cfmID
CarbonReduction(<u>carbonReductionID</u>, carbonReductionData) Primary Key : carbonReductionID
CarbonConsumption_Reduction(<u>dataID</u>, <u>carbonReductionID</u>, pID) Primary Key : dataID, carbonReductionID Foreign Key 1 : pID reference ParticipantAccount(pID) Foreign Key 2 : carbonReductionID reference CarbonReduction(carbonReductionID)
Water(<u>dataID</u>, wtrDayNo,wtrMonth, volume, wtrCost, wtrSavePractice) Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)
Electricity(<u>dataID</u>,eDayNo,eMonth,meter,eCost,eSavePractice) Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)

Recycle(<u>dataID</u>,wsWeight,wsCost,coWeight,coCost,recyclePractice) Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)	

Validation(<u>carbonReductionID,cfmID</u>)
Primary Key : carbonReductionID, cfmID
Foreign Key : carbonReductionID reference
CarbonConsumption_Reduction(carbonReductionID)
Foreign Key : cfmID reference CFootprintMapping (cfmID)

ValidationMC(<u>carbonReductionID,cfmID,</u>mcID)
Primary Key : carbonReductionID
Foreign Key : carbonReductionID reference
CarbonConsumption_Reduction(carbonReductionID)
Foreign Key : cfmID reference CFootprintMapping (cfmID)
Foreign Key : mcID reference MBIPConsultant(mcID)

MBIPConsultant(<u>mcID</u>, mcPasssword)
Primary Key : mcID

ParticipantInfo

pID	pName	pStatus	pEmail	pPeopleNum
A001	Ally	EMPLOYED	alliy248@gmail.com	6
A002	Khai	EMPLOYED	mokmok@gmail.com	3
A003	Atirah	UNEMPLOYED	email312@gmail.com	2

ParticipantAccount

pID	pPassword
A001	Alias_32JJK248
A002	MessixRonaldo7@0
A003	pass2to3t0@

ParticipantAddress

pID	street	postcode
A001	Jalan Jeje	81200
A002	Jalan Borara	95600
A003	Jalan Hafiz	62000

PhoneNumber

pID	pPhoneNo
A001	016-597 2862
A002	014-848 7293
A003	013-280 6822

CFootprintMapping

cfmID	mappingData
CFMA01	564.23
CFMA02	465.23
CFMA03	789.65

CarbonReduction

carbonReductionID	mappingID
CRID001	506.56
CRID002	1589.35
CRID003	354.29

CarbonConsumption_Reduction

dataID	carbonReductionID	pID
DID001	CRID001	A001
DID002	CRID002	A002
DID003	CRID003	A003

Water

dataID	wtrDay	wtrMonth	volume	wtrCost	wtrSavePractice
DID001	15	3	456.94	46.97	Water reservoir
DID002	31	5	357.52	89	Less time showering
DID003	28	12	512.34	62.01	Wash cloth full loaded

Electricity

dataID	eDay	eMonth	meter	eCost	eSavePractice
DID001	15	3	780.46	110.32	Switch off lights
DID002	31	5	556.23	78.45	Use warmlight light
DID003	28	12	895.24	150.69	Turn off water pump

Recycle

dataID	wsWeight	wsCost	coWeight	coCost	recyclePractice
DID001	10	7.87	5	50	Keep used oil
DID002	5	1.20	3	15	Keep tin can
DID003	5	2.46	6	5	Recycle

Validation

carbonReductionID	cfmID
CRID001	CFMA01
CRID002	CFMA02
CRID003	CFMA03

ValidationMC

carbonReductionID	cfmID	mcID
CRID001	CFMA01	MC001
CRID002	CFMA02	MC002
CRID003	CFMA03	MC003

MBIPConsultant

mcID	mcPassword
MC001	ja@12
MC002	zaz@12
MC003	don@12

6.0 SQL Statements (DDL & DML)

CREATE TABLE PARTICIPANTACCOUNT

```
CREATE TABLE PARTICIPANTACCOUNT

(

pID VARCHAR2(20) NOT NULL,

pPassword VARCHAR(20) NOT NULL,

pEmail VARCHAR2(20) NOT NULL,

CONSTRAINT pID_pk PRIMARY KEY (pID)

);
```

CREATE TABLE PARTICIPANTINFO

```
CREATE TABLE PARTICIPANTINFO (

    pID VARCHAR2(20),

    pName VARCHAR2(30) NOT NULL,

    pStatus VARCHAR2(15) NOT NULL,

    pPeopleNum NUMBER(2) NOT NULL,

    CONSTRAINT pi_pID_pk PRIMARY KEY (pID),

    CONSTRAINT  pi_pID_fk  FOREIGN  KEY  (pID)  REFERENCES
PARTICIPANTACCOUNT (pID)

);
```

CREATE TABLE PARTICIPANTADDRESS

```
Unset
CREATE TABLE PARTICIPANTADDRESS (

  pID VARCHAR2(20),

  street VARCHAR2(15) NOT NULL,

  postcode VARCHAR2(15) NOT NULL,

  CONSTRAINT pa_pID_pk PRIMARY KEY (pID),

 CONSTRAINT pa_pID_fk FOREIGN KEY (pID) REFERENCES PARTICIPANTACCOUNT
(pID)

);
```

CREATE TABLE PHONENUMBER

```
Unset
CREATE TABLE PHONENUMBER (

  pPhoneNo VARCHAR(15),

  CONSTRAINT pPhoneNo_pk PRIMARY KEY (pPhoneNo)

);
```

CREATE TABLE CFOOTPRINTMAPPING

```
Unset
CREATE TABLE CFOOTPRINTMAPPING
(
cfmID VARCHAR2(20) NOT NULL,
mappingData VARCHAR2(20) NOT NULL,
CONSTRAINTS cfm_cfmID_pk PRIMARY KEY(cfmID)
);
```

CREATE TABLE CARBONREDUCTION

```
Unset
CREATE TABLE CARBONREDUCTION (
carbonReductionID VARCHAR2(20),
carbonReductionData VARCHAR2(25) NOT NULL,
CONSTRAINT cr_crID_pk PRIMARY KEY (carbonReductionID)
);
```

CREATE TABLE CARBONCONSUMPTION_REDUCTION

```
Unset
CREATE TABLE CARBONCONSUMPTION_REDUCTION (
    dataID VARCHAR2(20) UNIQUE,
    carbonReductionID VARCHAR2(20),
    pID VARCHAR2(20) NOT NULL,
    CONSTRAINT cr_pk PRIMARY KEY (dataID, carbonReductionID),
    CONSTRAINT cr_pID_fk FOREIGN KEY (pID) REFERENCES PARTICIPANTACCOUNT (pID),
    CONSTRAINT   cr_crID_fk   FOREIGN   KEY   (carbonReductionID)   REFERENCES
CARBONREDUCTION (carbonReductionID)
);
```

CREATE TABLE WATER

```
Unset
CREATE TABLE WATER
(
dataID VARCHAR2(20),
wtrDayNo NUMBER(4,0) NOT NULL,
wtrMonth NUMBER(3,0) NOT NULL,
volume NUMBER(5,2) NOT NULL,
wtrcost NUMBER(5,2) NOT NULL,
wtrSavePractice VARCHAR2(30) NOT NULL,
CONSTRAINT wtr_dataID_pk PRIMARY KEY(dataID),
CONSTRAINT     wtr_dataID_fk     FOREIGN     KEY     (dataID)     REFERENCES
CARBONCONSUMPTION_REDUCTION (dataID)
);
```

CREATE TABLE ELECTRICITY

```
Unset
CREATE TABLE ELECTRICITY
(
dataID VARCHAR2(20),
eDayNo NUMBER(4,0) NOT NULL,
eMonth NUMBER(3,0) NOT NULL,
meter NUMBER(4) NOT NULL,
cost NUMBER(5,2) NOT NULL,
eSavePractice VARCHAR2(30) NOT NULL,
CONSTRAINT e_dataID_pk PRIMARY KEY(dataID),
CONSTRAINT   e_dataID_fk   FOREIGN   KEY   (dataID)   REFERENCES
CARBONCONSUMPTION_REDUCTION (dataID)
);
```

CREATE TABLE RECYCLE

```
Unset
CREATE TABLE RECYCLE
(
dataID VARCHAR2(20),
wsWeight NUMBER(4,0) NOT NULL,
wsCost NUMBER(3,0) NOT NULL,
coWeight NUMBER(4) NOT NULL,
coCost NUMBER(5,2) NOT NULL,
recyclePractice VARCHAR2(30) NOT NULL,
CONSTRAINT ws_dataID_pk PRIMARY KEY(dataID),
CONSTRAINT   ws_dataID_fk   FOREIGN   KEY   (dataID)   REFERENCES
CARBONCONSUMPTION_REDUCTION (dataID)
);
```

CREATE TABLE VALIDATION

```
Unset
CREATE TABLE VALIDATION
(
carbonReductionID VARCHAR2(20) UNIQUE NOT NULL,
cfmID VARCHAR2(20) UNIQUE NOT NULL,
CONSTRAINTS val_crID_pk PRIMARY KEY (carbonReductionID,cfmID),
CONSTRAINTS   val_crID_fk   FOREIGN   KEY   (carbonReductionID)
REFERENCES CARBONCONSUMPTION_REDUCTION(carbonReductionID),
CONSTRAINTS   val_cfmID_fk   FOREIGN   KEY   (cfmID)   REFERENCES
CFOOTPRINTMAPPING (cfmID)
);
```

CREATE TABLE VALIDATIONMC

```
Unset

CREATE TABLE VALIDATIONMC
(
carbonReductionID VARCHAR2(20) UNIQUE NOT NULL,
cfmID VARCHAR2(20) UNIQUE NOT NULL,
mcID VARCHAR2(20) NOT NULL,
CONSTRAINTS valmc_crID_pk PRIMARY KEY (carbonReductionID,cfmID),
CONSTRAINTS   valmc_crID_fk   FOREIGN   KEY   (carbonReductionID)
REFERENCES CARBONCONSUMPTION_REDUCTION(carbonReductionID),
CONSTRAINTS   valmc_cfmID_fk   FOREIGN   KEY   (cfmID)   REFERENCES
CFOOTPRINTMAPPING (cfmID),
CONSTRAINTS   valmc_mcID_fk   FOREIGN   KEY   (mcID)   REFERENCES
MBIPCONSULTANT (mcID)
);
```

CREATE TABLE MBIPCONSULTANT

```
Unset
CREATE TABLE MBIPCONSULTANT (
  mcID VARCHAR2(20),
  mcPassword VARCHAR2(20) NOT NULL,
  CONSTRAINT mc_mcID_pk PRIMARY KEY (mcID)
);
```

INSERT INTO PARTICIPANTACCOUNT

```
Unset
INSERT INTO PARTICIPANTACCOUNT(pID,pPassword,pEmail)
        VALUES ('A001','Alias_32JJK248','alliy248@gmail.com');

INSERT INTO PARTICIPANTACCOUNT(pID,pPassword,pEmail)
  VALUES('A002','MessixRonaldo7@0','mokmok@gmail.com');

INSERT INTO PARTICIPANTACCOUNT(pID,pPassword,pEmail)
  VALUES('A003','pass2to3t0@','email312@gmail.com');
```

INSERT INTO PARTICIPANTINFO

```
Unset
INSERT INTO PARTICIPANTINFO(pID,pName,pStatus,pPeopleNum)
        VALUES('A001','Ally','EMPLOYED','6');

INSERT INTO PARTICIPANTINFO(pID,pName,pStatus,pPeopleNume)
        VALUES('A002','Khai','EMPLOYED','3');

INSERT INTO PARTICIPANTINFO(pID,pName,pStatus,pPeopleNume)
        VALUES('A003','Atirah','UNEMPLOYED','2');
```

INSERT INTO PARTICIPANTADDRESS

```
Unset
INSERT INTO PARTICIPANTADDRESS(pID,street,postcode)
        VALUES('A001','Jalan Jeje','81200');

INSERT INTO PARTICIPANTADDRESS(pID,street,postcode)
        VALUES('A002','Jalan Borara','95600');

INSERT INTO PARTICIPANTADDRESS(pID,street,postcode)
        VALUES('A003','Jalan Hafiz','62000');
```

INSERT INTO PHONENUMBER

```
Unset
INSERT INTO PHONENUMBER(pPhoneNo)
  VALUES('016-597 2862');

INSERT INTO PHONENUMBER(pPhoneNo)
  VALUES('014-848 7293');

INSERT INTO PHONENUMBER(pPhoneNo)
        VALUES('013-280 6822');
```

INSERT INTO CFOOTPRINTMAPPING

```
Unset
INSERT INTO CFOOTPRINTMAPPING(cfmid,mappingData)
        VALUES('CFMA01','564.23');

INSERT INTO CFOOTPRINTMAPPING(cfmid,mappingData)
        VALUES('CFMA02','465.23');

INSERT INTO CFOOTPRINTMAPPING(cfmid,mappingData)
        VALUES('CFMA03','789.65');
```

INSERT INTO CARBONREDUCTION

```
Unset
INSERT INTO CARBONREDUCTION(carbonReductionID,carbonReductionData)
  VALUES('CRID001','506.56');

INSERT INTO CARBONREDUCTION(carbonReductionID,carbonReductionData)
  VALUES('CRID002','1589.35');

INSERT INTO CARBONREDUCTION(carbonReductionID,carbonReductionData)
  VALUES('CRID003','354.29');
```

INSERT INTO CARBONCONSUMPTION

```
Unset
INSERT INTO CARBONCONSUMPTION_REDUCTION(dataID,carbonReductioinID,pID)
  VALUES('DID001','CRID001','A001');

INSERT INTO CARBONCONSUMPTION_REDUCTION(dataID,carbonReductioinID,pID)
  VALUES('DID002','CRID002','A002');


INSERT INTO CARBONCONSUMPTION_REDUCTION(dataID,carbonReductioinID,pID)
  VALUES('DID003','CRID003','A003');
```

INSERT INTO WATER

```
Unset
INSERT INTO WATER(dataID,wtrDayNo,wtrMonth,volume,wtrcost,wtrSavePractice)
  VALUES('DID001',15,3,456.94,46.97,'Water reservoir');

INSERT INTO WATER(dataID,wtrDayNo,wtrMonth,volume,wtrcost,wtrSavePractice)
  VALUES('DID002',31,5,357.52,30.89,'Less time showering');

INSERT INTO WATER(dataID,wtrDayNo,wtrMonth,volume,wtrcost,wtrSavePractice)
  VALUES('DID003',28,12,512.34,62.01,'Wash cloth full loaded');
```

INSERT INTO ELECTRICITY

```
Unset
INSERT INTO ELECTRICITY(dataID,eDayNo,eMonth,meter,cost,eSavePractice)
  VALUES('DID001',15,3,780.46,110.32,'Switch off lights');

INSERT INTO ELECTRICITY(dataID,eDayNo,eMonth,meter,cost,eSavePractice)
  VALUES('DID002',31,5,556.23,78.45,'Use warmlight light');

INSERT INTO ELECTRICITY(dataID,eDayNo,eMonth,meter,cost,eSavePractice)
  VALUES('DID003',28,12,895.24,150.69,'Turn off water pump');
```

INSERT INTO RECYCLE

```
Unset
INSERT INTO RECYCLE(dataID,wsWeight,wsCost,coWeight,coCost,recyclePractice)
  VALUES ('DID001',10,7.87,5,50,'Keep used oil');

INSERT INTO RECYCLE(dataID,wsDayNo,wsMonth,coWeight,coCost,recyclePractice)
  VALUES ('DID002',5,1.20,3,15,'Keep tin can');

INSERT INTO RECYCLE(dataID,wsDayNo,wsMonth,coWeight,coCost,recyclePractice)
  VALUES ('DID003',5,2.46,6,5,'Recycle');
```

INSERT INTO VALIDATION

```
Unset
INSERT INTO VALIDATION(carbonReductionID,cfmID)
  VALUES('CRID001','CFM001A01');

INSERT INTO VALIDATION(carbonReductionID,cfmID)
  VALUES('CRID002','CRID02CB9');

INSERT INTO VALIDATION(carbonReductionID,cfmID)
  VALUES('CRID003','CFM001A55');
```

INSERT INTO MBIPCONSULTANT

```
Unset
INSERT INTO MCCONSULTANT(mcID,mcPassword)
  VALUES('MC001','Ja@12');

INSERT INTO MCCONSULTANT(mcID,mcPassword)
  VALUES('MC002','zaz@12');

INSERT INTO MCCONSULTANT(mcID,mcPassword)
  VALUES('MC003','don@12');
```

INSERT INTO VALIDATIONMC

```
Unset
INSERT INTO VALIDATIONMC(carbonreductionID,cfmID,mcID)
  VALUES('CRID001','CFM001A01','MC001');

INSERT INTO VALIDATIONMC(carbonreductionID,cfmID,mcID)
  VALUES('CRID002','CRID02CB9','MC002');

INSERT INTO VALIDATIONMC(carbonreductionID,cfmID,mcID)
  VALUES('CRID003','CFM001A55','MC003');
```

7.0 SUMMARY

For this particular phase, the MBIP's Carbon Reduction and Sustainability Engagement System is created based on the logical ERD. The logical ERD is derived from the conceptual ERD (EERD) from the previous phase.

From the logical ERD, the entities go through the normalization process from the 1st Normal Form (1NF) up until Boyce-Codd Normal Form (BCNF). The normalization process serves the purpose of supporting the database design while also identifying any data redundancy and update anomalies. This also will make the system able to handle the data more efficiently, all while the data integrity is not compromised.

Apart from that, the data dictionary is updated according to the normalized relations. This is a crucial step in the phase as it records the information of all the entities, attributes and relationships. Then, SQL code statements for the system are defined using Oracle Developer, and thorough documentation is done to further clarify the purpose of the code. A prototype is also created to clearly demonstrate the flow of the system and how the database works.

To conclude, at the end of the phase and the project, we hope the system will achieve the objectives of the system based on the requirements of MBIP. We also hope that the system will prove to be not only functional, but also user-friendly, so that users and stakeholders alike are satisfied with the product.

8.0 REFERENCE

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