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FACULTY OF COMPUTING
UTM Johor Bahru

PROJECT PHASE 1

SECD2523 - DATABASE

SEMESTER I - SESSION 2023/2024

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SECTION : 06

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1.0 Introduction

In response to the pressing global challenges posed by climate change and environmental degradation, numerous nations across the world have increased their efforts towards sustainable development. Malaysia, which has actively engaged on a few sustainable initiatives such as Low Carbon Cities Framework (LCCF) which helps Malaysian cities in implementing strategies for low-carbon development.

Johor government has also formulated its own plan to foster low-carbon societies through a series of strategic initiatives and comprehensive plans. Its commitment to sustainability is proven through Iskandar Malaysia 2025 Low Carbon Blueprint. These frameworks act as a set of guidelines that communities, educational institutions, and local government bodies can use to coordinate their efforts in the direction of lowering carbon intensity and advancing sustainable practices. Iskandar Puteri City Council (MBIP) targets to reduce carbon intensity by 58% by the year 2025 as compared with the baseline of 2005.

MBIP, which is the key stakeholder of Iskandar Puteri Low Carbon (IPRK) seeks to collect energy-savings data within different communities such as residential areas, schools, factories and more. Iskandar Puteri Low Carbon Calendar Competition is one of the initiatives established with the aim of reducing electricity and energy consumption within Iskandar Puteri region. A new data collection and analysis platform is proposed to map the carbon footprint within the MBIP region, calculating carbon reductions for electricity, water, waste, and recycled cooking oil consumption, identifying communities with high CO2 emissions.

This document proposes a detailed plan for the implementation of the database system of this data collection and analysis platform. This document encompasses the proposed solutions including feasibility study, scope of project, project planning, system's requirement analysis (based from AS-IS analysis) and system's transaction requirement (data entry, data update/delete, data queries).

2.0 Background Study

There are few considerations needed to take into account for the proposed data collection and analysis platform. First of all, a database is needed for the proposed platform which a centralized database streamlines the collection of data from various regions such as educational institutions and industry areas. This consolidation promotes accuracy and allows for comprehensive analysis by providing a single repository for all relevant data.

Secondly, thorough analysis and insights should be made easier by the centralized database. This is due to the fact that it serves as a single point of reference for all pertinent data by allowing stakeholders to perform in-depth studies, draw insightful conclusions, and make well-informed decisions. Consolidating data from different regions into this repository ensures that comprehensive and correct conclusions may be formed, while also promoting accuracy and dependability in analysis.

Moreover, the database's capacity should be able to simplify data gathering from various domains such as industry sectors and educational institutions. For example, it highlights importance in fostering precision and permitting thorough examination. Despite only organizing the data, this consolidation makes it possible to evaluate carbon intensity in a unified and thorough manner across different industries.

3.0 Problem Statement

Majlis Bandaraya Iskandar Putri (MBIP) faces significant challenges in efficiently collecting, analyzing, and engaging the community in carbon data assessment. The challenges include:

I. **Manual computations for carbon reduction data.** Manual computations involve labor-intensive processes and are time-consuming that is not economically feasible for MBIP. This laborious method requires human intervention at every step resulting in longer data processing times. In addition, manual computations are also prone to human error which have higher probability of mistakes which causes inaccurate data.

II. **Laborious and difficult for users to enter data.** Users will discover it is challenging and time-consuming to input data because of the complex and detailed requirements that define the data entry process. Potential participants are discouraged by this complexity which frequently entails a high number of required fields or technical data formatting. Hence, this barrier discourages community members from actively participating in this carbon-reduction initiative.

III. **Lack of data analysis capabilities**. Lack of advanced instruments limits the level of assessment, making it more difficult to find patterns, trends, or correlations in the gathered carbon data from various places such as industry areas and residential areas. This hinders the extraction of meaningful insights from collected data and unable to provide stakeholders to make an well-informed decision based on the data collected.

IV. **Diverse user types with varying technological literacy**. This is because community members come from a variety of backgrounds and professions and have varied degrees of technological literacy. Some might have advanced technological skills but others might still struggle with basic technological skills. This implies an user-friendly interface is crucial to accommodate users that come from different backgrounds and professions.

V. **Data fragmentation.** Carbon intensity data may come from various sources and in a variety of formats. Fragmentation causes challenges for MBIP to combine the data efficiently for the use of comprehensive analysis.

4.0 Proposed Solution

The proposed solution to solve the challenges faced by MBIP is to implement a new data collections and analysis platform with appropriate centralized database systems. The platform encompasses the following features:

I. **Automated Computation Module**. Create an automated computation module that is incorporated into the database management system (DBMS). This is able to assure the accuracy and efficiency of carbon reduction data through this module. This is able to prevent human error and do away from manual calculation which consumes time and money.

II. **Streamlined Data Entry Interface**. Redesign the data entry interface within the database system to simplify and optimize the data entry process which is currently complex. For instance, minimize required fields, add logical design components, and improve user experience to promote greater community involvement due to easiness to input the data. User input and usability testing will be incorporated into the interface design procedure.

III. **Integration of powerful analysis tools**. By integrating powerful analysis tools such as statistical software into the database system, stakeholders are able to extract meaningful insights from collected carbon data from various sources and make informative decisions.

IV. **User-Friendly Interface for Diverse Users**. Create an interface that is easy to use and simple for a range of user types and technological literacy levels. This is to ensure that everything is accessible by using simple navigation, clear instructions, and flexible design elements.

V. **Data Validation and Quality Assurance**. Data validation protocols are implemented within the database system to ensure the accuracy and reliability of collected carbon data.

It establishes a checking process for data consistency, completeness, and conformity to predefined standards.

4.1 Technical feasibility

Technical feasibility is a formal assessment to test whether it is technically possible to manufacture a product or service. For this proposed carbon monitoring system, it works well with a wide range of browser combinations such as google chrome, safari, firefox and more. It guarantees worldwide accessibility and operates smoothly to ensure best user experience and worldwide accessibility for users to input or monitor carbon intensity data. In addition, the seamless integration between the carbon monitoring system and database management system (DBMS) is emphasized by our evaluation. The system occupies the ability to manage a significant amount of users and carbon data collected and its complexity fits in nicely with our needs for data management. This is to ensure comprehensive analysis taken is accurate and reliable for stakeholders to make paramount decisions. Furthermore, strong security plans are taken in order to protect users' privacy data and local government confidential information. This is to prevent privacy and important data from being revealed or stolen by unauthorized parties.

4.2 Operational feasibility

User needs assessment and analysis is executed in order to assess whether the proposed system meets the operational requirements of the end users. This is done by evaluating whether the new system fits with their daily responsibilities and whether they are willing and able to adjust to it. Users express their willingness to use the proposed system which brings convenience for them. In addition, a resource availability check is conducted to assess whether the organization is able to handle or maintain the new proposed system. MBIP possesses the ability to operate the proposed carbon monitoring system.

5.0 Objectives

There are FOUR objectives for this proposed database project:

- To develop a centralized database system which capable of storing users and carbon intensity data

- To enhance data integration and standardization which ensure uniformity, reliability and accuracy of data collected.

- To ensure data security and compliance which implement robust data security measures to protect sensitive users data

- To enable comprehensive analysis and insights which integrate various analysis tools with the database system

6.0 Scope

- The scope of this project covers the development of a new system, located around the Iskandar Puteri area, Johor, to address the imperfections of the current business process of overcoming environmental challenges. The primary goal is to achieve a significant reduction in carbon intensity, aiming for a 58% reduction by 2025 compared to the 2005 baseline.

- Solutions were developed to overcome problems faced by both users and MBIP administrators. An adumbration of the proposed solution includes implementation of several user friendly features which indirectly emphasizes on data entry accuracy; implementation of a reliable and automated backend system where calculations are done automatically and data of results are stored in a well-developed database that can store diverse data types and user interactions using appropriate Database Management System (DBMS). With the above agenda as our project scope, the business flow now involves collecting, storing, and analyzing data related to carbon emissions, energy usage, water consumption, waste management, and other sustainability metrics from various sources, including schools, residential areas, institutions, factories, and government divisions.

6.1 User Views

6.1.1 Participants

- To actively participate in and contribute to low-carbon activities, participants have access to an intuitive interface for reporting sustainability efforts, performance evaluation, and educational materials.

6.1.2 MBIP Administrators

- Administrators of MBIPs have a comprehensive view, complete with tools for policy creation, data management and analysis, compliance monitoring, and reporting. They are able to oversee and assist users, which guarantees the platform runs well. This arrangement supports well-informed decision-making, efficient policy execution, and community involvement, all of which are in line with the main objective of promoting a low-carbon, sustainable society in the Iskandar Malaysia region.

6.2 System Boundary

- Geographic Restrictions: Data gathering and analysis will be restricted to the Iskandar Malaysia region, namely the districts of Johor Bahru and Kulai Jaya.

- Limitation on Data Type: The database will concentrate on information about the environment and sustainability, particularly as it relates to waste, energy, water, and carbon emissions.
- User Access Control: Varying degrees of engagement and access according to user roles (e.g., residents, local government officials, and school administrators).

7.0 Project Planning

7.1 Human Resource

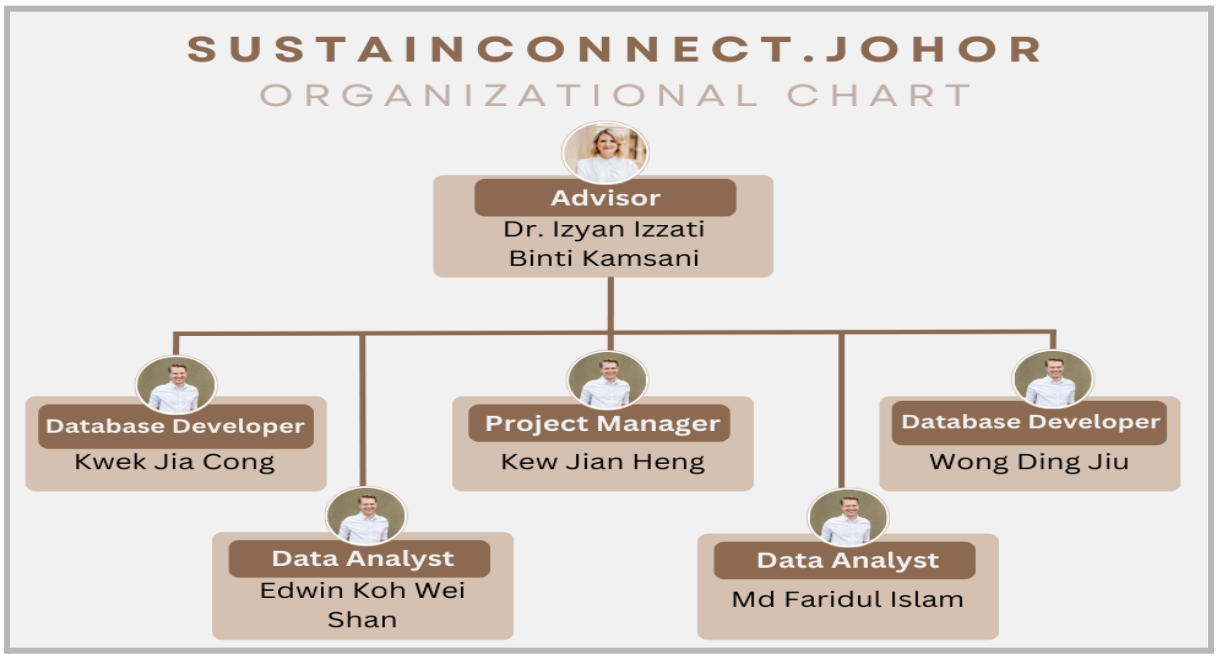

FIGURE 1 : HUMAN RESOURCE ALLOCATION

7.2 Work Breakdown Structure (WBS)

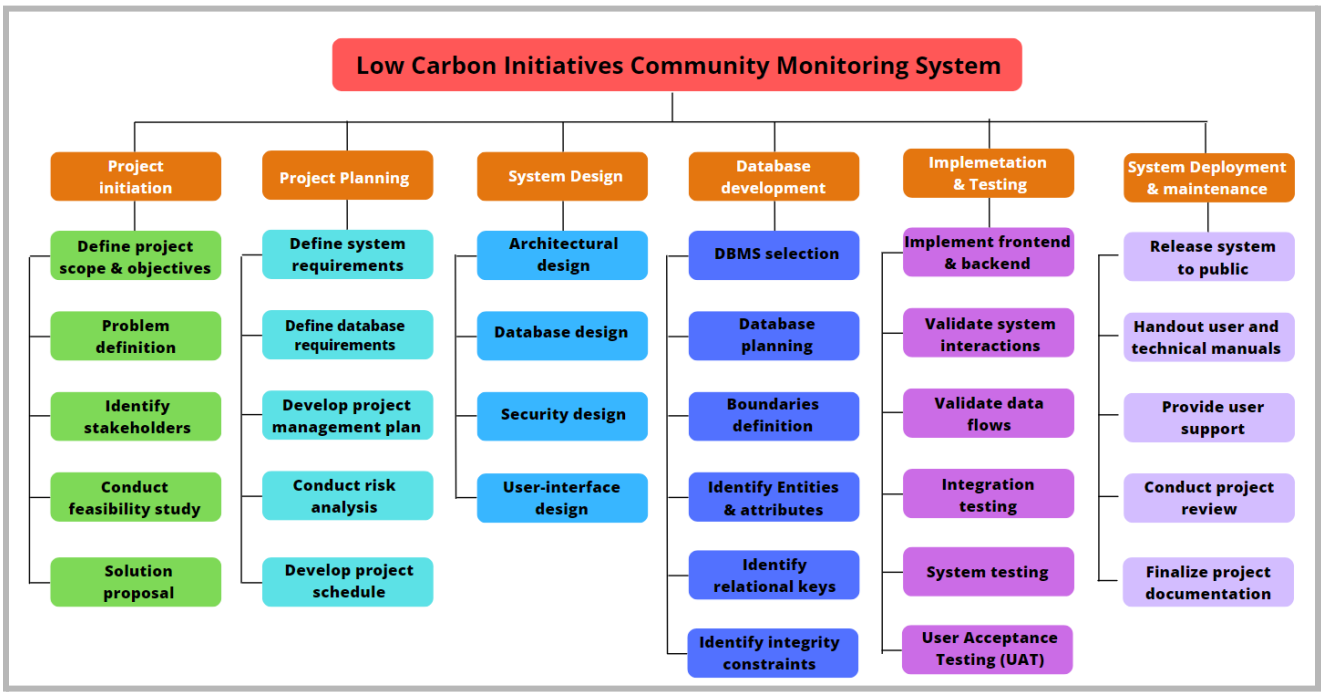

FIGURE 2 : WORK BREAKDOWN STRUCTURE (WBS)

7.3 Gantt Chart

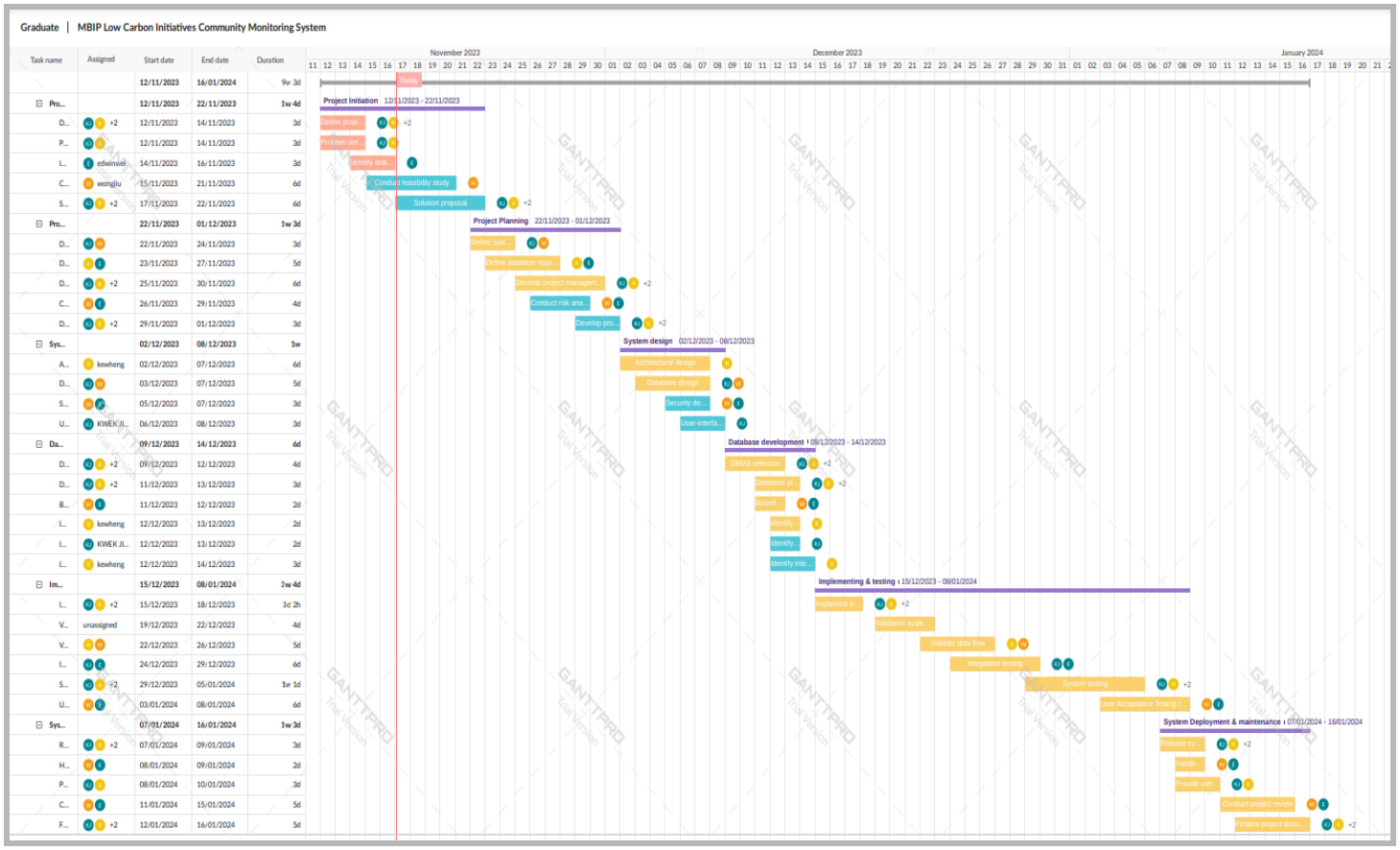

FIGURE 3 : GANTT CHART

8.0 Requirement Analysis

8.1 Current business process

Business scenario

1. The resident learns about the Iskandar Puteri Low Carbon Calendar Competition and decides to participate.
2. Participants enters google form given for the competition
3. Participants enter personal data and relevant information required for carbon reduction calculation such as electricity, water usage, and waste management in google form.
4. Google form is submitted and waiting to be evaluated by the organizer.
5. MBIP set up kiosks to assist those who fail to complete the google form.
6. The participant completes the data entry with assistance.
7. Calculations of carbon reduction is calculated manually by MBIP based on data entered in google form

8. MBIP finalizes and sends reports to respective participants.
9. Participants who successfully filled in the google form receive a report on carbon reduction calculation results.
10. Participants who successfully reduce carbon emissions are recognized and possibly rewarded.

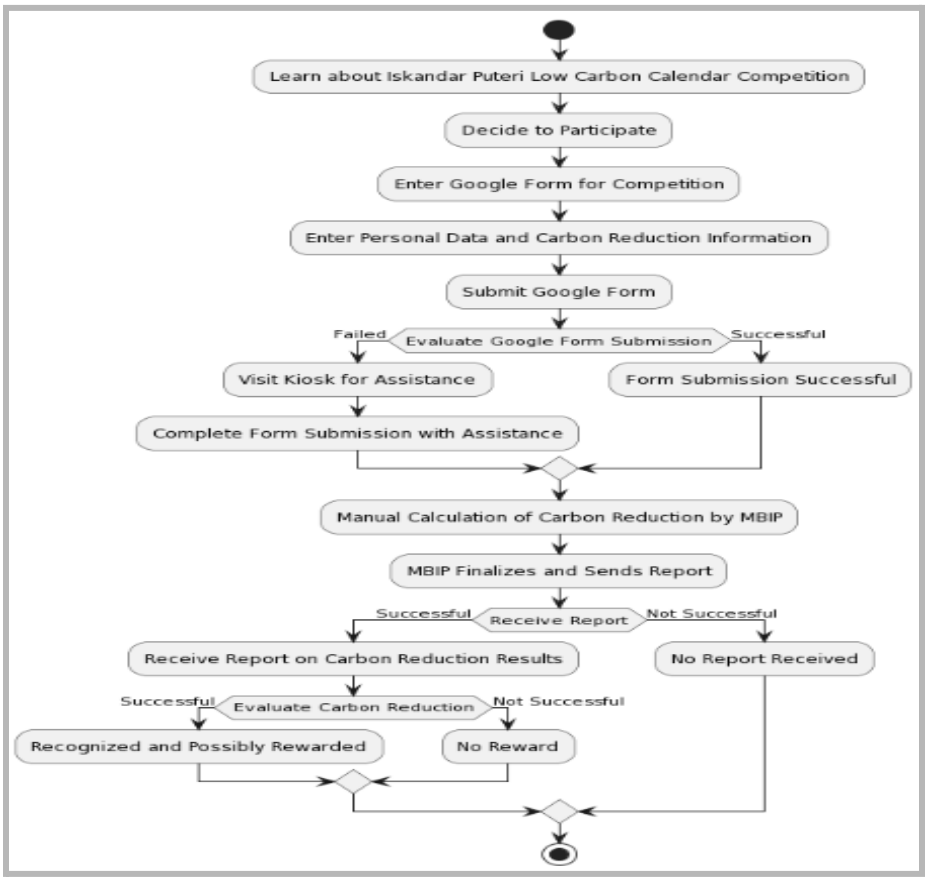

FIGURE 4 : CURRENT WORKFLOW

Entity and Attribute

Entity Name	Attribute
Participant	ParticipantID, FullName, Email, PhoneNumber, Address
Google Form Entry	Email,FullName, IC_NO, PhoneNumber, Status, Address, Institution, ResidentialCategory, HouseholdNo, ProportionalFactor, WaterUsage, ElectricUsage, RecycleItemMass, RecycleEarn, OilMass, OilEarn
Carbon Reduction Calculation	Calculation ID, Entry ID, Carbon Reduction Value, Calculation Date

Report	Report ID, Participant ID, Calculation ID, Report Details, Issue DateS
Assistance Kiosk	Kiosk ID, Location, Number of Assisted Entries

Relationships

1. Participant to Google Form Entry
    - One-to-One : Each participant can fill one Google Form.
    - One-to-One : Each Google Form can be filled by one participant.

2. Google Form Entry to Carbon Reduction Calculation
    - One-to-One : Each form entry has one carbon reduction calculation.

3. Carbon Reduction Calculation to Report
    - One-to-One : Each calculation results in one report.

4. Participant to Report
    - One-to-One : Each participant receives one report.

5. Assistance Kiosk to Participant
    - One-to-Many : One assistance kiosk can assist many participants.

Business Rule

1. A participant can fill only one Google Form.

2. Each Google Form can be filled by only one participant.

3. Each Google form entry has one carbon reduction calculation.

4. Each report produces one Reduction calculation result.

5. Each participant receives one report.

6. One kiosk can assist many participants.

9.0 Transaction requirement

9.1 Data Entry

a. **Participant Registration:**
In order to obtain a participant ID, new participants should be able to register on the system by providing their information (first and last names, email addresses, phone numbers, and addresses).

b. **Google Form Entry:**
Data on electricity, water use, and waste management can be entered by participants using a Google form that is made available for the Iskandar Puteri Low Carbon Calendar competition.

c. **Assistance Kiosk Entry:**
MBIP setup kiosks will be able to provide assistance to participants who are unable to fill out the Google form. The Kiosk interface allows participants to assist data entry and can be linked to their ParticipantID.

9.1.1 Participant Information Entry:

- Entities:
  Entity Name: Participant
- Attributes:
  - ParticipantID (Primary Key) [NUMBER]
  - FullName [VARCHAR2]
  - Email [VARCHAR2]
  - PhoneNumber [VARCHAR2]
  - Address [VARCHAR2]

9.1.2 Google Form Data Entry:

- Entities:
  Entity Name: Google Form Entry
- Attributes:
  - Email [VARCHAR2]
  - FullName [VARCHAR2]
  - IC_NO [VARCHAR2]
  - PhoneNumber [VARCHAR2]
  - Status [VARCHAR2]
  - Address [VARCHAR2]
  - Institution [VARCHAR2]

- ResidentialCategory [VARCHAR2]
- HouseholdNo [NUMBER]
- ProportionalFactor [NUMBER]
- WaterUsage [NUMBER]
- ElectricUsage [NUMBER]
- RecycleItemMass [NUMBER]
- RecycleEarn [NUMBER]
- OilMass [NUMBER]
- OilEarn [NUMBER]

9.1.3 Carbon Reduction Calculation Entry:

- Entities:
  Entity Name: Carbon Reduction Calculation
- Attributes:
  - CalculatioID [NUMBER]
  - EntryID (Foreign Key) [NUMBER]
  - CarbonReductionValue [NUMBER]
  - CalculationDate [DATE]

9.1.4 Report

- Entities:
  Entity Name: ReportID
- Attributes:
  - ParticipantID (Foreign Key) [NUMBER]
  - CalculationID (Foreign Key) [NUMBER]
  - ReportDetails [VARCHAR2]
  - IssueDate [DATE]

9.1.5 Assistance Kiosk Interaction

- Entities:
  Entity Name: Assistance Kiosk
- Attributes:
  - KioskID [NUMBER]
  - Location [VARCHAR2]
  - NumberOfAssistedEntries [NUMBER]

9.2 Data Update/Delete:

a. **Update/Delete Participant Information:**
If necessary, participants should be able modify their FirstName, LastName, Email, PhoneNumber, and Address.

b. **Update/Delete Google Form Entries:**
Allow participants to modify information entered in the Google form such as correcting mistakes in electricity usage, water consumption and so on.

c. **Update/Delete Kiosk Information:**
If necessary, administrators should be able modify their Kiosk details such as location.

9.2.1 Update/Delete Participant Information:

- Entities:
  Entity Name: Participant
- Attributes:
  - ParticipantID (Primary Key) [NUMBER]
  - First Name [VARCHAR2]
  - Last Name [VARCHAR2]
  - Email [VARCHAR2]
  - PhoneNumber [VARCHAR2]
  - Address [VARCHAR2]

9.2.2 Update/Delete Google Form Entry:

- Entities:
  Entity Name: Google Form Entry
- Attributes:
  - Email [VARCHAR2]
  - FullName [VARCHAR2]
  - IC_NO [VARCHAR2]
  - PhoneNumber [VARCHAR2]
  - Status [VARCHAR2]
  - Address [VARCHAR2]
  - Institution [VARCHAR2]
  - ResidentialCategory [VARCHAR2]
  - HouseholdNo [NUMBER]
  - ProportionalFactor [NUMBER]
  - WaterUsage [NUMBER]
  - ElectricUsage [NUMBER]
  - RecycleItemMass [NUMBER]

- RecycleEarn [NUMBER]
- OilMass [NUMBER]
- OilEarn [NUMBER]

9.3 Data Queries:

a. **Participants Data Queries:**
Allows administrators to retrieve participant information based on predefined criteria such as ResidentialCategory, Institution, or ParticipantID.

b. **Carbon Reduction Calculation Queries:**
Allow administrators to retrieve calculations based on EntryID or ReportID.

c. **The Full Report Queries:**
Allow administrators to retrieve calculations based on Participant ID or ReportID.

d. **Assistance Kiosk Usage Queries:**
Retrieve data on the number of secondary entries per kiosk or location with the highest usage.

9.3.1 Retrieve Carbon Reduction Calculation:

- Entities:
  Entity Name: Carbon Reduction Calculation
- Attributes:
  - CalculatioID [NUMBER]
  - EntryID (Foreign Key) [NUMBER]
  - CarbonReductionValue [NUMBER]
  - CalculationDate [DATE]

9.3.2 Retrieve The Full Report:

- Entities:
  Entity Name: Report
- Attributes:
  - ParticipantID (Foreign Key) [NUMBER]
  - CalculationID (Foreign Key) [NUMBER]
  - ReportDetails [VARCHAR2]
  - IssueDate [DATE]

9.3.3 Query Assistance Kiosk Data:

- Entities:

  Entity Name: Assistance Kiosk

- Attributes:
  - KioskID [NUMBER]
  - Location [VARCHAR2]
  - NumberOfAssistedEntries [NUMBER]

10.0 Benefit and Summary of Proposed System

Some of the benefits of our proposed system are Reducing data entry errors, ensuring efficiency through the Database, Automated Computation for Carbon Emissions, making strategic decisions through analytics and also improving user support and their training. Below we briefly explain every point.

For reducing the data entry error we proposed some features like auto-fill, drop down menu and instantaneous data validation that significantly reduce the data entry error. It might ensure that the information collected is accurate and reliable, and it also provides us a solid foundation for meaningful analysis.

By utilizing the existing database for user information will minimize the need for participants to manually key in extensive details.This not only helps the data entry process but also help to encourage greater participation by reducing the perceived burden on users.

To increase the use of data analysis software and the provide of automated computations instant feedback to participants on their carbon emissions is not only make easy the process for users but also enables the Iskandar Puteri City Council (MBIP) to efficiently analyze data, identify trends, and target interventions where they are most needed.

Another benefit worth mentioning is that Self-Monitoring Dashboards allow the participants to track their carbon emission in real time. This feature will promote the sense of user accountability and also empowers them to make instance adjustments to their activities to promote their more environmentally conscious lifestyle.

Strategic Decision-Making Through Analytics is another beneficial solution that improves the data analytics capabilities and empower MBIP for making informed decisions based on participant data. This will help to identify the areas that have high carbon emissions and understand effective strategies for emission reduction, and raising awareness within the community. These are the most effective benefits of our proposing system.

The Low Carbon Initiatives Community Initiatives System will be a more effective and user-focused suggested system, which makes use of user-friendly features, pre-existing datasets, and sophisticated analytics. The system seeks to improve participant engagement and overall competition effectiveness by reducing data entry errors, streamlining the entry process, and offering real-time feedback. Additionally, by placing a strong emphasis on data analytics, MBIP is better able to make strategic decisions and focus on specific interventions, which helps to align the competition with more general sustainability objectives. In summary, the suggested framework not only tackles the present obstacles encountered by MBIP, but also presents the

competition as a dynamic and significant instrument in the endeavor to achieve low-carbon societies in Iskandar Puteri.

11.0 Summary

The environment is our asset. As human beings, It's our responsibility to always keep it good. Iskandar Puteri City Council (MBIP) is one such organization that takes the initiative to reduce the carbon intensity. To ensure the process, focus on collecting and analyzing the data, mapping carbon footprint, finding reduction in electricity, water, waste, and recycling cooking oil consumption. In addition to covering project scope, planning, and system requirements analysis—which includes transaction requirements for data entry, update/delete, and queries—it provides a detailed implementation strategy for a database system. In general, the suggested method seeks to assist MBIP in reaching its sustainability objectives through community involvement and well-informed decision-making.