UTM

UNIVERSITI TEKNOLOGI MALAYSIA

PROJECT: PHASE 1

SECD2523 - DATABASE
SEMESTER I, SESSION 2023/2024

LECTURER: DR. IZYAN IZZATI BINTI KAMSANI

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1.0 Introduction

Malaysia has made great progress towards sustainability, concentrating on resolving issues related to the environment, society, and economy. The Low Carbon Cities Framework (LCCF), which helps Malaysian cities create low-carbon development strategies, is one noteworthy project. To support a low-carbon society, the Johor government created the Low Carbon Blueprint for Iskandar Malaysia 2025 in accordance with these initiatives. This plan calls for a number of tactics and laws to be implemented in order to significantly lower carbon intensity by 2025.

2.0 Background Study

The sustainability initiatives in Malaysia encompass a range of programs and agencies working towards common goals but tailored to specific user groups. For instance, the Iskandar Malaysia Ecolife Challenge (IMELC) program aims to enhance awareness of the Low Carbon Society (LCS) among students, teachers, and families in Iskandar Malaysia, with the overarching objective of achieving the carbon reduction target by 2025. The Johor Education Department's (JPNJ) e-Lestari system, introduced in 2022, focuses on integrating sustainability elements into the education curriculum and extracurricular activities, aiming to enhance sustainability education, evaluate programs, raise awareness, and conduct energy audits. MBIP also plays a key role in promoting the Low Carbon Society through its Iskandar Puteri Low Carbon (IPRK) initiative, which focuses on data collection and energy-saving efforts within the community.

However, the Iskandar Puteri Low Carbon Calendar Competition, a part of the IPRK initiative, faced several challenges, including a cumbersome data entry process, extensive participant information requirements, manual carbon reduction calculations, a lack of data analysis capabilities, varied user profiles, and participants' unfamiliarity with the Google Form.

3.0 Problem Statement

The Iskandar Puteri Low Carbon Calendar Competition's ineffective and difficult-to-use data gathering and analysis procedures are the main source of concern. Difficulties include the need for analytical tools, complex participation requirements, and manual data entry. Furthermore, it is imperative to optimise and improve community-wide sustainability initiatives, monitor carbon emissions, and encourage low-carbon behaviours.

4.0 Proposed Solutions

In response to the identified issues, MBIP plans to develop a data collection and analysis platform similar to the successful e-Lestari system. This new platform will be directed at different groups within the community, such as landed and multi-story home owners, institutions, MBIP divisions, and staff members. In addition to calculating carbon reductions for waste, water, power, and recycled cooking oil consumption, the system will be able to map the carbon footprint within the MBIP region, identify communities with high CO2 emissions, and create a self-monitoring dashboard for carbon emissions among users. Main operating language of the system will be Bahasa Melayu.

Feasibility Study :

- **Technical Feasibility:** Evaluate the technical capabilities and infrastructure required for developing and maintaining the proposed platform.

- **Financial Feasibility:** Determine the budget required for system development, deployment, and ongoing maintenance.

- **Operational Feasibility:** Assess how well the proposed system will integrate with existing processes and whether MBIP has the necessary resources and expertise to manage it effectively.

- **User Acceptance:** Analyze the willingness of various user categories (residents, institutions, MBIP divisions, staff) to adopt and engage with the new platform.

5.0 Objectives

The main objective of this proposed solution is to create a data collection and analysis platform similar to the e-Lestari system in order to enhance the efficiency of data management and overcome all the challenges that are currently faced by the organization. This new platform's purpose is to:

- **Simplify Data Entry:** Create a more efficient and user-friendly data entry procedure in order to have systematic data and information management. This process encompasses a lot of aspects such as electricity, water, waste, and recycled cooking oil consumption. The purpose is to streamline data entry and make it more accessible for the users.

- **Automated Carbon Calculations:** Enhance the performance of the calculations while also reducing any potential errors and inaccuracies. This will indirectly lead to quicker and more reliable outcomes, which is essential for effective analysis and reporting.

- **Data Analysis and Insights:** provide MBIP with a higher potential and skills to analyze collected data with the help of data analysis tools. Given that the expected data and analysis requirements should also include mapping the carbon footprint within the MBIP region, identifying communities with high CO2 emissions, and gaining insights into energy consumption data. These insights are crucial for decision-making processes and to make improvements.

- **Community Involvements and Encouragement:** Allows MBIP to ensure that the diverse user groups, including various residential areas, institutions, MBIP divisions, and staff, can get involved in low carbon initiatives through the helpful insights gained from the more efficient and simplified data entry processes.

- **Language Localization:** Ensure accessibility and enhance comprehension for the local citizens or communities with the use of Bahasa Melayu as the primary language during the development of this platform. This language choice will coordinate with the organization's objective of creating a user-friendly platform for the participants

6.0 Scope

Major User View

The scope of this new system known as the Iskandar Puteri City Council (Majlis Bandaraya Iskandar Putri - MBIP) Low Carbon Initiatives Community Monitoring System, involves a thorough, inclusive design that covers all crucial aspects of the proposed system. This system also includes the implementation of a database application capable of fulfilling the requirements and needs of different various user views. This might include improved interfaces, efficient data mapping tools, and accurate carbon reduction calculations. The major user views for this proposed database application are:

Residential users

- Collect data which associated with the electricity, water, waste, and recycled cooking oil consumption from both multi-story and landed house.
- Ensure that the interface for residents to is user-friendly and easy to use, facilitating the input and tracking of their carbon footprint.

Institutions:

- Gather and analyze data on feasibility from different MBIP region institutions.
- Provide the institutions with tools which can evaluate and monitor their energy and resource consumption, assisting them in meeting the low-carbon goals.

MBIP divisions

- Create a tailored interface for MBIP in order for them to monitor and report on their particular contribution to low-carbon initiatives.
- Contributes to streamlined and smooth data entry and reporting for MBIP's internal division.

MBIP staff

- Provide a user interface which is specifically tailored for MBIP staff to work with the monitoring system
- Allows staff to gather the data, track their personal and corporate carbon footprint, while always remain updated on the organization's overall performance.

Administrative users

- Provide authorized staff with administration tools so that they can handle and monitor the entire database application.
- Involves user access control, system configuration, and data validation features

Boundaries

The boundaries of the database application are established by its emphasis on low-carbon initiatives within the MBIP region. The application is limited to the major user views region which is residential areas, institutions, MBIP divisions, and MBIP staff. Furthermore, the system will not covers any unrelated sustainability areas outside of the authority of MBIP

Database Application Functionality

The database application will includes:

- Implement ata entry and monitoring features which is tailored for different types of users.
- Include functionalities to calculate and report the carbon reductions in electricity, water, waste, and recycled cooking oil consumption.
- Incorporate efficient tools that are capable of showing the carbon footprint within the MBIP region.
- Designate language that supports Bahasa Melayu in order to align with the user-friendly system goals.

7.0 Project Planning

7.1 Human Resource

- **Project Manager**

The entire project must be managed by the Project Manager. The manager's job scope involves planning, implementation, and wrapping up. They manage schedules and budgets, collaborate with various teams, make sure that the current project goals fulfills the organizational objectives and also interact with stakeholders.

- **Database Administrator**

The database system is monitored, handled and maintained by the Database Administrator. Their job is mainly to design, implement, and improvise the database structure. Other responsibilities of theirs also involve ensuring data accuracy, security and performance. They work along with programmers to incorporate the database into the whole system.

- **Software Developers (Frontend and Backend)**

Those who work in software development mainly focus on constructing the application. This team consists of front-end developers and back-end developers, whereas the front-end concentrates on the user interface and user experience. On the other hand, back-end developers manage server-side logic, database interactions, and system operation as a whole. With the teamwork of these two developers, a unified, efficient, and user-friendly application is created.

- **UI/UX Designer**

The UI/UX Designer job scope is mainly to design and manage user interface as well as the overall user experience. In this scope, they often collaborate with stakeholders in order to get feedback from them and comprehend users' needs and are able to create a more user-friendly

interface. This will also include wireframing, prototyping, and making sure that all of the visual components meet with the project's goals and also users' requirements.

- **Quality Assurance (QA) Tester**

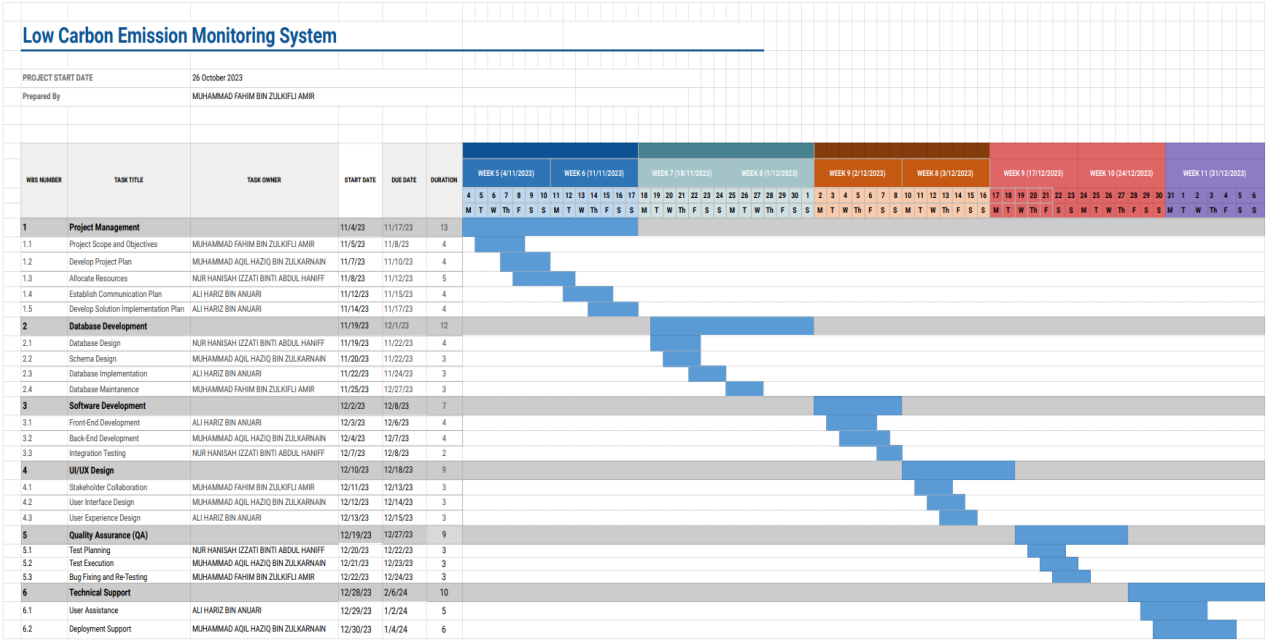
In order to make sure that the software has a good quality and is reliable to use, a Quality Assurance (QA) Tester is needed. By having them in the team, they can find and report any bugs in the software, design and implement test plans, and work with the development team to find the solutions for any issues found. A reliable and bug-free application can be achieved with the presence of QA testing, making this team to be an essential part.

- **Technical Support Staff**

End-users will often receive support from Technical Support Staff. Their job scope is to assist with any troubleshooting problems, handle and answer user inquiries, and make sure that everything can function properly in the system. This also includes giving deployment assistance in order to maintain user satisfaction.

7.2 Work Breakdown Structure

7.3 Gantt Chart



Low Carbon Emission Monitoring System

PROJECT START DATE	26 October 2023
Prepared By	MUHAMMAD FAHIM BIN ZULKIFLI AMIR

WBS NUMBER	TASK TITLE	TASK OWNER	START DATE	DUE DATE	DURATION
1	**Project Management**		11/4/23	11/17/23	13
1.1	Project Scope and Objectives	MUHAMMAD FAHIM BIN ZULKIFLI AMIR	11/5/23	11/8/23	4
1.2	Develop Project Plan	MUHAMMAD AQIL HAZIQ BIN ZULKARNAIN	11/7/23	11/10/23	4
1.3	Allocate Resources	NUR HANISAH IZZATI BINTI ABDUL HANIFF	11/8/23	11/12/23	5
1.4	Establish Communication Plan	ALI HARIZ BIN ANUARI	11/12/23	11/15/23	4
1.5	Develop Solution Implementation Plan	ALI HARIZ BIN ANUARI	11/14/23	11/17/23	4
2	**Database Development**		11/19/23	12/1/23	12
2.1	Database Design	NUR HANISAH IZZATI BINTI ABDUL HANIFF	11/19/23	11/22/23	4
2.2	Schema Design	MUHAMMAD AQIL HAZIQ BIN ZULKARNAIN	11/20/23	11/22/23	3
2.3	Database Implementation	ALI HARIZ BIN ANUARI	11/22/23	11/24/23	3
2.4	Database Maintanence	MUHAMMAD FAHIM BIN ZULKIFLI AMIR	11/25/23	12/27/23	3
3	**Software Development**		12/2/23	12/8/23	7
3.1	Front-End Development	ALI HARIZ BIN ANUARI	12/3/23	12/6/23	4
3.2	Back-End Development	MUHAMMAD AQIL HAZIQ BIN ZULKARNAIN	12/4/23	12/7/23	4
3.3	Integration Testing	NUR HANISAH IZZATI BINTI ABDUL HANIFF	12/7/23	12/8/23	2
4	**UI/UX Design**		12/10/23	12/18/23	9
4.1	Stakeholder Collaboration	MUHAMMAD FAHIM BIN ZULKIFLI AMIR	12/11/23	12/13/23	3
4.2	User Interface Design	MUHAMMAD AQIL HAZIQ BIN ZULKARNAIN	12/12/23	12/14/23	3
4.3	User Experience Design	ALI HARIZ BIN ANUARI	12/13/23	12/15/23	3
5	**Quality Assurance (QA)**		12/19/23	12/27/23	9
5.1	Test Planning	NUR HANISAH IZZATI BINTI ABDUL HANIFF	12/20/23	12/22/23	3
5.2	Test Execution	MUHAMMAD AQIL HAZIQ BIN ZULKARNAIN	12/21/23	12/23/23	3
5.3	Bug Fixing and Re-Testing	MUHAMMAD FAHIM BIN ZULKIFLI AMIR	12/22/23	12/24/23	3
6	**Technical Support**		12/28/23	2/6/24	10
6.1	User Assistance	ALI HARIZ BIN ANUARI	12/29/23	1/2/24	5
6.2	Deployment Support	MUHAMMAD AQIL HAZIQ BIN ZULKARNAIN	12/30/23	1/4/24	6

Gantt Chart link :
https://docs.google.com/spreadsheets/d/1DwWi6hEBuEHxayyXZ8pPEtKwrvZI1eHF_yPs1QxBVc0/edit?usp=sharing

8.0 Requirement Analysis

Entities

1. **ResidentialUsers:**
    - Attributes:
        i. UserID(int)
        ii. TypeOfHouse(string)
        iii. ElectricityConsumption(float)
        iv. WaterConsumption(float)
        v. RecycledCookingOilConsumption(float)
2. **Institutions:**
    - Attributes:
        i. InstitutionID(int)
        ii. EnergyConsumption(float)
        iii. ResourceConsumption(float)
        iv. DataFeasibility(string)
3. **DivisionsMBIP:**
    - Attributes:
        i. DivisionID(int)
        ii. DataContribution(string)
        iii. DigitalCarbonFootprint(float)
4. **StaffMBIP:**
    - Attributes:
        i. StaffID(int)
        ii. PersonalCarbonFootprint(float)
        iii. CorporateCarbonFootprint(float)
5. **AdministrativeUsers:**
    - Attributes:
        i. AdminID(int)
        ii. AccessControl(string)
        iii. SystemConfiguration(string)

Relationships

ResidentialUsers - Institutions:

- ResidentialUser will contribute its data to Institutions.
- Cardinality: One-to-Many relationship.

DivisionsMBIP - Institutions:

- DivisionsMBIP will contribute its data to Institutions.
- Cardinality: One-to-Many relationships.

StaffMBIP - DivisionsMBIP:

- Both StaffMBIP are associated with DivisionsMBIP.
- Cardinality: Many-to-One relationships.

User views:

1. Residential User View:
   - Access to ElectricityConsumption, WaterConsumption, WasteProduction, RecycledCookingOilConsumption data.
2. Institution View:
   - Access to FeasibilityData, EnergyConsumption, ResourceConsumption data.
3. MBIP Divisions View:
   - Access to ContributionData, CarbonFootprint data.
4. MBIP Staff View:
   - Access to PersonalCarbonFootprint, CorporateCarbonFootprint data.
5. Administrative Users View:
   - Access to AccessControl, SystemConfiguration data.

(Details for user view is shown in '6.0 Scope' - page 7)

Data Types:

- Integer(int)
    - Used for unique identifiers
    - UserID, InstitutionID, DivisionID, StaffID, AdminID.
- String(string)
    - Used for textual data
    - HouseType, FeasibilityData, AccessControl, SystemConfiguration.
- Float(float)
    - Used for numeric data
    - ElectricityConsumption, WaterConsumption, WasteProduction, RecycledCookingOilConsumption, EnergyConsumption, ResourceConsumption, PersonalCarbonFootprint, CorporateCarbonFootprint, CarbonFootprint.

8.1 Current business process (scenarios/workflow)

Initiation of Low Carbon Initiatives:

MBIP initiates the Iskandar Puteri Low Carbon Calendar in order to promote awareness among the community while also addressing the electricity and energy consumption issues as well as managing wastage.

Data Collection Initiatives:

MBIP gathers information on the individual's contribution in reducing the energy consumption, from various user categories which include:

- Residential users
- Institutions
- MBIP divisions
- MBIP staff
- Administrative users

Residential Users

- Users in residential area will give information on:
  - Electricity consumption
  - Water consumption
  - Recycled cooking oil consumption
  - Waste production
- A user-friendly interface which allows users to easily provide and monitor their information on carbon footprint

Institutions

- Institutions will give information on:
  - Feasibility Data
  - Energy consumption
  - Resource Consumption
- Institutions will be provided with a tailored interface so that they can track feasibility as well as energy and resource consumption.

MBIP Divisions

- MBIP divisions will give information on:
    - Their personal contribution to low-carbon initiatives which includes data on contribution and carbon footprint.
- A special interface is provided to MBIP divisions so that they can track and report on their personal contributions.

MBIP Staff

- MBIP staff will gives information on:
    - Their personal carbon footprint
    - Corporate carbon footprint
- A designated user interface is created specifically for MBIP Staff so that they can manage the tracking system, monitoring individual, and organizational carbon footprints.

Administrative Users

- Administrative Users will be provided with tools in order to manage and monitor the whole database application.
- Only Administrative Users are authorized to manage access control and system configuration through their interface.

Challenges in the Current Process

Data Entry

- There will is an inconsistency and ineffeciency in the data entry process as the method is manually done.

Data Validation

- The validation result is apparently limited which will leads to inaccuracies and unreliability of information.

Data Modification

- In order to perform data modifications, a manual intervention is an essential part. This will most likely cause some delays and potential inaccuracies.

Data Retrieval

- It takes a lot of time and efforts just to retrieve specific datasets or generate reports because of the absence of an integrated system.

Reporting

- The absence of standardized formats in the report will leads to a ‘messy’ and inconsistent report which will makes it harder to analyze the data

Analytical Capabilities

- The lack of real-time analytics reporting tools will leads to an inefficient decision-making and analysis process

Urgency for system upgrage

The current business process makes it cleas how urgent and crucial it is to implement an integrated system which can guarantees data integrity, speeds up data entry process, improves the data retrieval capabilities, and reporting features are customized to meet the various requirements of the MBIP community.

9.0 Transaction requirement (data entry, data update/delete, data queries)

The proposed system's transactional features revolves around efficient and safe data handling, particularly focusing on back-end operations

- **Data Entry**
  - **Data Input Mechanisms**. Establish robust mechanisms for data input, which ensures a structured and integration of various data sources. This takes account of various user profiles and categories within the MBIP community.
  - **Backend Data Validation.** Implementing strict data validation protocols during data entry to guarantee accuracy and consistency of data, preventing errors or incomplete data from entering the system.
  - **Normalization and Storage.** Develop data storage strategy based on normalized database structures to avoid redundancy and ensure efficient storage and retrieval of data.

- **Data Update/Delete**
  - **Controlled Modification.** Define protocols for controlled data modification, allowing specific authorized users to update or delete data within specified constraints to maintain data integrity.
  - **Implementation of Audit Trail.** Implement an audit trail mechanism to track all changes made to the database. This will include details of modifications, timestamps and user identities for accountability and reference.

- **Data Queries**
  - **Efficient Query Processing.** Design and implement an efficient querying processing system to handle complex and large data retrieval requests effectively.
  - **Custom Reporting Capabilities.** Develop a function for generating customized reports for diverse user needs within the MBIP community. This will include generating reports related to carbon footprint mapping, consumption trends and carbon emission identification based on parameters defined by the user.

These transactional requirements aim to ensure the robustness, security and efficiency of data operations within the proposed system, focusing on the backend functionalities to cater the specific needs of the MBIP community.

10.0 Benefit and Summary of Proposed System:

1. **Efficiency improvement:**

- By simplifying data entry and analysis steps, the time and effort demanded will be reduced, ending problems from the previous competition.

2. **Boosted User Experience:**

- The tool provides to the various profiles of residents, institutions, MBIP divisions, and staff by concentrating upon different community categories. This helps make the experience more user-friendly.

3. **Promoting language inclusivity:**

- Since Iskandar Puteri has various races, by making Bahasa Melayu the primary language it elevates accessibility and allows deeper community engagement and literacy.

4. **In depth Carbon Reduction Monitoring:**

- The system is going to calculate reductions in carbon dioxide related to waste, water, electricity, and the consumption regarding recycled cooking oil. In addition to that, it will map the carbon footprint, pin down areas with high emission levels of CO2, and even supply users with a self-monitoring dashboard.

Summary:

- In conclusion, in compliance with Malaysia's much bigger objectives for sustainable development, the proposed solution not only breaks down previous challenges but also creates an unrestricted effective, and inclusive platform for tracking and significantly reducing carbon emissions in the Iskandar Puteri region.

11.0 Summary

- The Johor government's Low Carbon Blueprint for Iskandar Malaysia 2025 and the Low Carbon Cities Framework (LCCF) are a couple examples of ways in which Malaysia, particularly the state of Johor, is actively engaged in sustainability initiatives. By 2025, the latter looks to decrease carbon intensity by 58%. Low carbon practices are being made more commonly recognized as well as educated about from campaigns like the Johor Education Department's e-Lestari system and the Iskandar Malaysia Eco Life Challenge. By addressing challenges raised by the Iskandar Puteri Low Carbon Calendar Competition, the Iskandar Puteri City Council (MBIP) aims to further enhance its Iskandar Puteri Low Carbon (IPRK) initiative. Similar to the e-Lestari system, MBIP plans to develop a new platform for collecting and examining data that will be used by numerous community categories to map carbon footprints, generate reductions, and develop a self-monitoring dashboard in Bahasa Melayu.

12.0 References

7.1 Human resources:

- Project manager: https://www.indeed.com/career-advice/finding-a-job/what-is-data-project-manager

- Database administrator: https://www.indeed.com/hire/job-description/database-administrator

- Software Developers (Frontend and Backend): https://au.indeed.com/career-advice/finding-a-job/front-end-vs-back-end-developer#:~:text=A%20back%2Dend%20and%20front,application%27s%20database%2C%20server%20and%20framework.

- UI/UX Designer: https://www.indeed.com/hire/job-description/ux-designer

- Quality Assurance (QA) Tester: https://in.indeed.com/career-advice/finding-a-job/qa-tester-job-description

- Technical Support Staff: https://www.indeed.com/hire/job-description/technical-support-specialist