



**INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA**

**INFO 2304 - SYSTEM ANALYSIS AND DESIGN**

**SECTION 2**

**SEMESTER 2, 2023/2024**

**PROJECT TITLE: ENERGY TRACKING SYSTEM**

**GROUP NAME: BIT BYTE**

**GROUP MEMBERS:**

ROLE	NAME	MATRIC NO.
FACILITATOR	YUSUF MOHAMMAD YUNUS	2314467
RECORDER	WAN AHMED FAUZIZAFRY BIN WAN KHALID	2221141
COORDINATOR	TENGKU MUHAMMAD ABDUH BIN TENGKU MOHAMAD ZULKIFLI	2219029
RUNNER	AKIF ASYRANI BIN MOHAMAD IZANI	2201267

**LECTURER: TS. DR. ZAHIDAH BINTI ZULKIFLI**

## **1.1 GENERAL PROJECT INFORMATION**

Our project, titled "Energy Tracking System", aligns with the Sustainable Development Goal 7 (SDG 7) set forth by the United Nations in the 2030 Agenda for Sustainable Development. SDG 7 emphasizes the importance of ensuring universal access to affordable, reliable, and sustainable energy, acknowledging its pivotal role in broader sustainable development objectives. The company aims to create a cutting-edge system that facilitates access to modern and sustainable energy, contributing to economic growth. In line with the key components and targets of SDG 7, the project will focus on universal energy access, the promotion of renewable energy, building sustainable energy infrastructure, fostering research and innovation, and implementing Tracking and reporting mechanisms. Bit Byte Company's primary objective is centered on pioneering modern innovations that support these sustainable energy goals within university classroom environments.

## **1.2 ORGANIZATIONAL BACKGROUND**

Bit Byte is a team of dedicated people specializing in energy efficiency Tracking systems. We were founded with the mission of promoting sustainable and environmentally responsible energy consumption. The team comprises expertise, innovation, and a commitment to excellence to drive the transition towards a greener future. The company focuses on the 7th Sustainable Development Goal (SDG) which is affordable and clean energy, out of the 17 SDG goals. Therefore, the company targets to increase efficiency in energy consumption by Tracking its usage as a first step in achieving clean energy.

Executive leadership:

1. Tengku Abduh - CEO
2. Yusuf Mohammad Yunus - COO

Manager:

1. Akif Asyrani - Product Manager
2. Wan Fauzizafry - Marketing manager

Technical experts:

1. Akif Asyrani - Senior Software Engineer

Bit Byte Company's mission is centered on empowering individuals, businesses, and institutions to reduce energy consumption, cut costs, and contribute to a sustainable future with data-driven information. With the team's expertise and passion for energy conservation, we are the leading company in energy efficiency Tracking systems.

## **1.3 PROBLEM DESCRIPTION**

### **1.3.1 BACKGROUND OF THE PROBLEM**

The inefficiency of energy management within educational institutions poses a significant challenge, primarily due to the absence of reliable Tracking systems. This absence inhibits the identification of energy waste and inefficiencies. To foster a more sustainable and cost-effective educational environment, there's a pressing need to enhance Tracking and Tracking systems, raise public awareness, and prioritize energy-efficient practices.

### **1.3.2 PROBLEM STATEMENTS**

- 1. Lack of Real-Time Energy Tracking Systems:** Educational institutions lack sophisticated, real-time energy Tracking systems that detect areas of energy waste and inefficiency. These systems are necessary for institutions to understand their energy usage patterns and implement effective energy-saving measures, otherwise it leads to energy wastage. (Granderson & Piette, 2009).
- 2. Lack of Benchmarking and Performance Standards which leads to increased energy consumption and high bills:** The absence of clear benchmarking and performance standards for energy consumption in educational institutions makes it challenging to set realistic energy-saving goals and track progress (Sullivan & Gouldson, 2013).
- 3. Insufficient Awareness and Training:** There is a significant gap in awareness among stakeholders in educational institutions regarding the benefits and practices of energy efficiency. This lack of knowledge extends to both the financial advantages and environmental impacts of energy-saving measures (Thollander & Palm, 2010).

### 1.3.3 FISHBONE DIAGRAMS

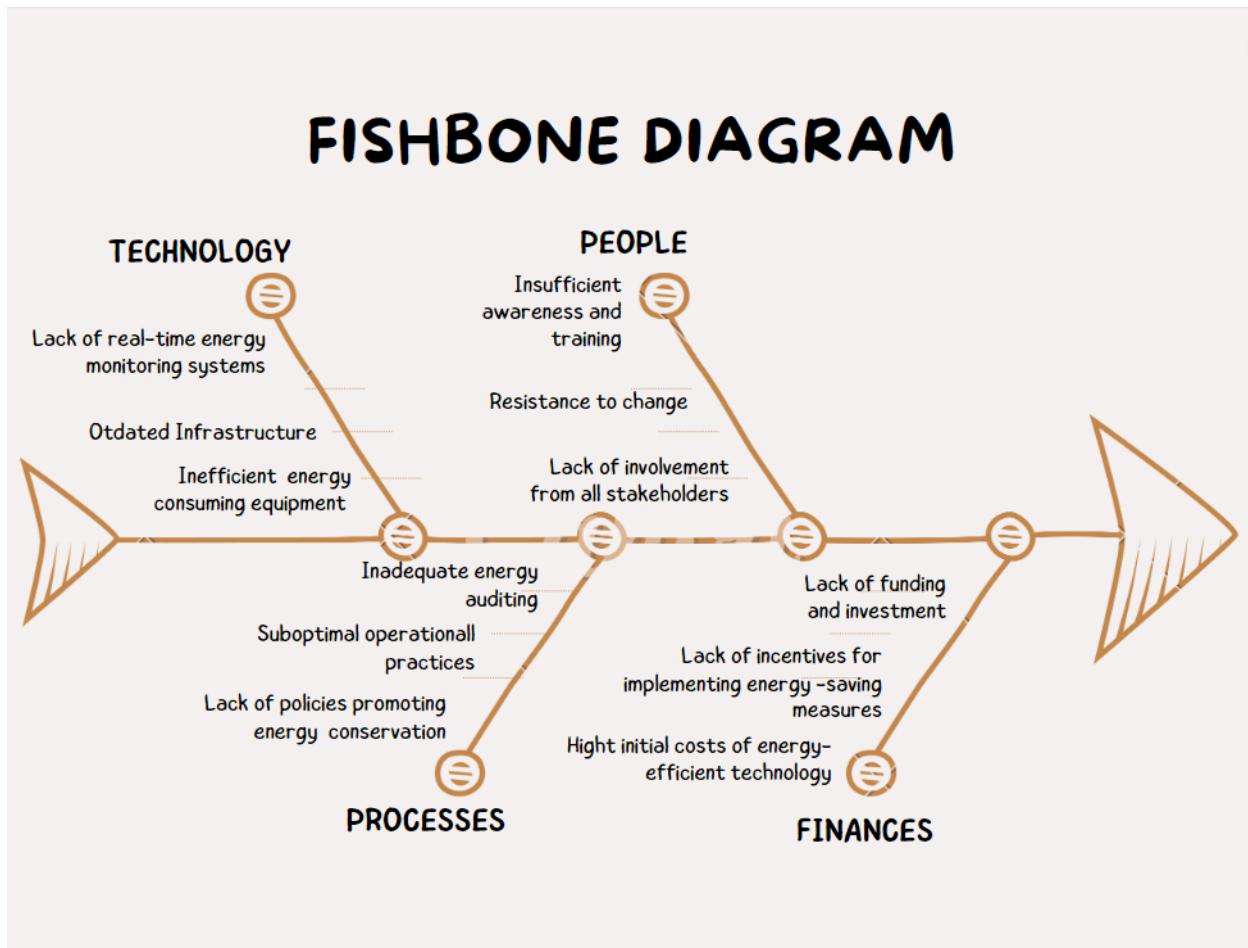


Figure 1: Fishbone Diagram for The Energy Tracking System

## **1.4 PROJECT OBJECTIVES**

The primary objective of our project is to create a system that keeps an eye on energy use. We want to stop wasteful energy habits and encourage using energy wisely, especially because of rapid global population growth and increased energy accessibility. We're worried that wasting energy could make it harder for some people to get the energy they need. Our main aim is to set up a simple way to watch how much energy is used and make sure it's used efficiently to help the environment.

To achieve this, our strategy involves developing a comprehensive energy tracking system capable of accurately tracking energy usage within various settings, such as classrooms or multipurpose halls. Instead of focusing solely on device deactivation, our system emphasizes real-time data collection and analysis coupled with artificial intelligence algorithms to optimize energy utilization within these spaces. By tracking energy usage patterns and identifying inefficiencies, our system enables proactive measures to minimize waste and promote sustainable energy practices.

## **1.5 PROJECT SCOPE**

### **1.5.1 TARGETED USERS**

#### **1. KICT Students**

**Description:** The KICT student body makes up this user group.

**Requirements:** They want energy-saving technologies like motion-activated lighting to improve their educational experience and encourage sustainability.

#### **2. Lecturers and Academic Staff of KICT**

**Description:** Professors, academic staff, and teaching staff in KICT are all included in this group.

**Requirements:** They value a system that uses less energy and improves the learning environment.

### **3. KICT Staff & Facility Managers (Daya Bersih)**

**Description:** This user group is made up of the janitorial and cleaning staff who are in charge of keeping KICT buildings neat and orderly.

**Requirements:** To perform their duties safely and efficiently, cleaning personnel need an energy-efficient system and a well-lit workplace.

### **4. General KICT Population**

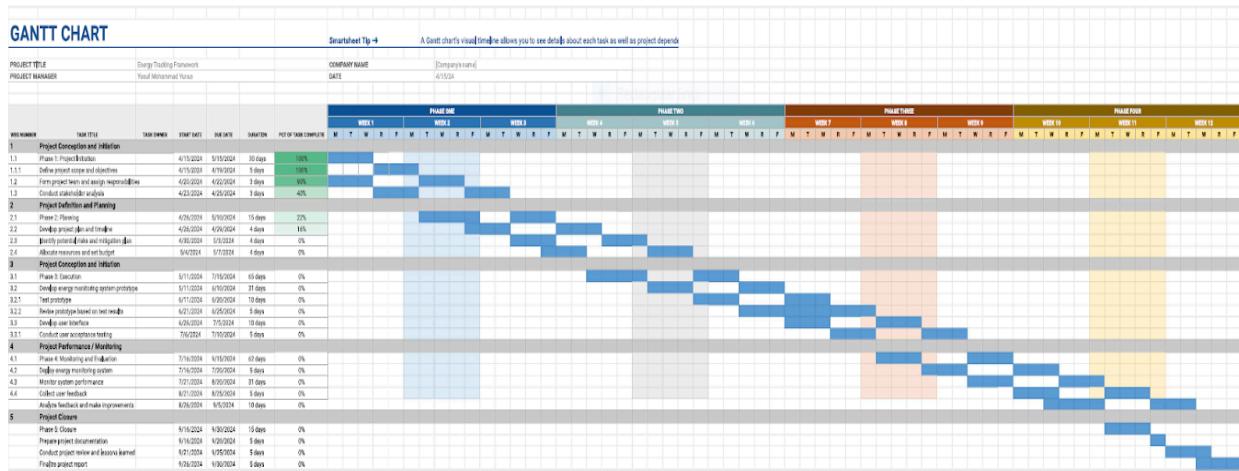
**Description:** All KICT individuals, including visitors and maintenance personnel.

**Requirements:** To maintain convenience and safety, they appreciate well-lit, energy-efficient environments in common areas and outdoor areas for example the hallway.

## **1.6 SIGNIFICANCE OF THE PROJECT**

This software project carries great importance for several reasons related to software. By optimizing energy use through software, educational institutions can achieve significant cost savings, enabling them to invest in improving infrastructure and resources. Additionally, software-driven energy waste reduction aligns with global initiatives aimed at reducing environmental impact, making a notable contribution to environmental sustainability. Furthermore, the cultivation of environmental responsibility is facilitated by introducing energy-efficient practices in schools and universities through software. This project not only promotes long-term sustainability goals but also establishes educational institutions as role models, inspiring similar initiatives across various industries. Hence, this software project has far-reaching implications for environmental sustainability, cost savings, and cultural change within educational institutions and beyond.

## 1.7 PROJECT DELIVERABLES & GANTT CHART



**(Click Here to View)**

## 2.0 PROJECT SUMMARY

The "Energy Tracking System" project by Bit Byte Company aims to create an innovative software solution to monitor and optimize energy usage in university classroom environments. This initiative aligns with the United Nations' **Sustainable Development Goal 7**, emphasizing affordable, reliable, sustainable, and modern energy for all. The project addresses the critical issue of inefficient energy management in educational institutions, where there is a lack of real-time energy tracking, benchmarking, and awareness of energy conservation practices. The proposed software solution includes AI capabilities to automatically control energy consumption by shutting off unnecessary digital systems when no human presence is detected, thus conserving energy. Target users include KICT students, lecturers, academic staff, facility managers, and the general KICT population, all of whom will benefit from an improved, energy-efficient educational environment.

### **Possible Challenges:**

1. Implementing an AI-based software system that accurately detects human presence and controls various digital systems could be technically challenging.
2. Resistance from staff and students accustomed to current practices may hinder the adoption of new software technologies.
3. The initial investment for developing and installing the energy efficiency management software may be significant.

### **Risks:**

1. The system's need to monitor human presence could raise data privacy concerns.
2. Dependence on the software for energy savings puts pressure on its reliability and uptime.
3. Rapid advancements in technology could render the software outdated if not regularly updated.

### **Mitigation Plan:**

The "Energy Tracking System" project proactively addresses potential challenges. Technical hurdles will be overcome with expert consultants and rigorous testing. User adoption will be fostered through educational workshops and clear communication of benefits. Funding will be secured via grants, incentives, and partnerships.

For long-term success, the project prioritizes maintainability through staff training, service contracts, and data security through legal compliance and advanced protocols. Redundancy features and contingency plans ensure software reliability. To minimize obsolescence, the software is designed for scalability and modularity. A pilot project will validate energy savings claims. This comprehensive strategy positions the project for success and paves the way for wider adoption in sustainable energy management.

## FILA FORM: INFO 2304

Group Name: Bit Byte

Group Members:	Yusuf Mohammad Yunus	2314467
	Wan Ahmed Fauzizafry bin Wan Khalid	2221141
	Tengku Muhammad Abdur bin Tengku Mohamad Zulkifli	2219029
	Akif Asyranji bin Mohamad Izani	2210267
	Ahmad Syawqi bin Wahid	2121347

Project Title: Energy Tracking Framework

This FILA form is for: Project Part 1

FACTS	IDEAS		ACTION
What do we know about the task/ problem? (information)	What do we need to find out?	Who is going to do it (put details and names here)	Deadline
General Information	Find objectives and purpose of the project.	Yusuf	16/4/2024
Sustainable Development Goal	Aligns with SDG7 that is to ensure access to clean and affordable energy, which is key to the development of agriculture, business, communications, education, healthcare and transportation.	Yusuf	16/4/2024
Company Background	Bit Byte specializes in energy efficiency tracking systems, committed to fostering	Yusuf	16/4/2024

Work Distribution	sustainable energy consumption aligned with SDG 7.	Yusuf	16/4/2024
Project Information	Distribute workload evenly amongst every group member.	Tengku	16/4/2024
Problem Statement	Bit Byte intends to create a system that tracks energy usage within university grounds.	Akif	16/4/2024
Project Objectives	Research the main causes leading to excessive usage of energy within the university and implement an efficient energy monitoring system for university classes.	Fauzi	16/4/2024
Fishbone Diagrams	To find the effects and causes of inefficient energy usage in educational institutions and propose a solution.	Fauzi	16/4/2024
Targeted Users	Illustrate a diagram to display the root causes of energy wastage	Akif	16/4/2024
	Students, professors, and administrative staff within university campus.		

Project Benefits	Reduced energy wastage, leading to more financial savings and healthier environment.	Tengku	16/4/2024
Gantt Chart	Key points/Milestones in the project's progress, schedules, and items to be completed at each stage.	Syawqi	16/4/2024

\*continue to the next page if the table is not enough

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### **3.0 Data Collection**

For our project, we exclusively rely on the questionnaire method, utilizing the accessibility and convenience of Google Forms to collect data from respondents. This approach ensures streamlined and easy data gathering and analysis processes. The questionnaire is made to take in perspectives from both students and staff members, gathering a complete understanding of the subject matter.

Our target audience only comprises individuals from the KICT department, aligning with the primary focus of our project. By narrowing our scope to this specific department, we aim to delve deep into issues and insights relevant to KICT's operations and community. The questionnaire, developed using Google Forms, was circulated among KICT-related groups such as ICTSS and KICT Batch 221, as well as shared among acquaintances within the KICT community via WhatsApp and Telegram.

Within the questionnaire, our objectives not only were to gather demographic information and awareness of energy consumption. We also sought to explore respondents' perspectives on various aspects related to our project idea. By inviting their insights and opinions, we aim to enrich our understanding of potential challenges, opportunities, and innovative solutions within the KICT department.

### 3.1 List of questions



## ENERGY TRACKING FRAMEWORK

AssalamuAlaikum ICTzens!

👉 We, students of the System Analysis & Design class, need your help! We're introducing a new system to make energy management in the KICT building better. With real-time energy tracking and occupancy analysis, we aim for a greener future. Your feedback will guide us! Let's work together for a smarter, more sustainable KICT! 🌱 Let's unite for a greener, smarter future! ☀️

fauzizafry21@gmail.com [Switch account](#) 

✉️ Not shared

Gender

Male

Female

Role

Student

Lecturer

Age

- 18 - 24
- 25 - 29
- 30 - 34
- 35 - 39
- 40 and above

Year of Study

Choose



Department

- Information Systems
- Computer Science

Are you aware of how much energy is being consumed within KICT?

- Completely unaware
- Somewhat aware
- Very aware

Would you like to save electricity in the KICT department? If so, why?

- Yes, to reduce negative impact on the environment
- Yes, to lower energy cost
- Yes, for both reasons
- No, not a priority
- Other: \_\_\_\_\_

Do you notice equipment such as air conditioner and lights switched on when there is no one present in the class?

- Never
- Rarely
- Often
- Always

Do you often turn off the equipment (lights etc.) if you are the last one to leave the class?

- Never
- Sometimes
- Often
- Always

Would you prefer a system that turns off automatically based on occupancy of the class?

- Yes
- Not sure
- No

Do you believe that this sensor based energy system is sustainable?

- Not sustainable at all
- Not very sustainable
- Somewhat sustainable
- Highly sustainable

What other features would you like to see in the new system?

- Automated scheduled on/off times
- Remote control through an application
- Receive AI-driven recommendations for optimizing energy consumption
- Other: \_\_\_\_\_

Thank you for taking your time to share your opinions!

As token of our gratitude, we wish you all success in your studies! Ameen.

### **3.2 Data collection results**

In summary, the outcomes from our Energy Tracking System questionnaire (as detailed in the Appendix) involved a total of 75 participants. Among them, 70 were students (93.3%) and 5 were lecturers (6.7%), all contributing valuable insights. In terms of demographics, the majority fell within the 18-24 age range (64.9%), with a relatively even split between genders (38.7% female, 61.3% male). Departmental representation was equally divided between Computer Science and Information Systems (each at 50.0%). As for study levels, the largest proportion was in Level 2 (43.8%), followed by Level 3 (24.7%) and Level 1 (20.5%).

When evaluating energy monitoring and awareness, a notable portion (34.7%) indicated frequent observations of equipment left on when not in use. Regarding awareness of energy usage in KICT, responses varied, with 14.7% stating high awareness, 40.0% moderate awareness, and 45.3% indicating no awareness at all. Concerning the practice of turning off equipment after class, 45.9% reported always committing to this practice, while 6.8% admitted to never doing so. A significant majority (69.3%) expressed a preference for an automated system that shuts off based on occupancy. 77.3% of participants generally believed that a sensor-based energy system is environmentally sustainable.

Regarding the inquiry about conserving electricity, 41.3% expressed a desire to conserve electricity for both environmental reasons and cost savings. Among desired features for the new system, the majority (83.8%) favored scheduling automated on/off times, while half of the respondents (50.0%) expressed interest in remotely controlling equipment via a mobile app. Notably, 14.9% showed interest in AI-generated recommendations for optimizing energy usage. These findings underscore the significance of incorporating user-friendly functionalities that support sustainability objectives.

To conclude, the detailed analysis of the Energy Tracking System questionnaire results provides valuable insights into the perspectives of both students and lecturers within the KICT building.

### **3.3 Summary**

This report presents the findings from a comprehensive data collection effort aimed at understanding energy consumption patterns and attitudes within KICT. Utilizing the questionnaire, the study gathered perspectives from students and staff..

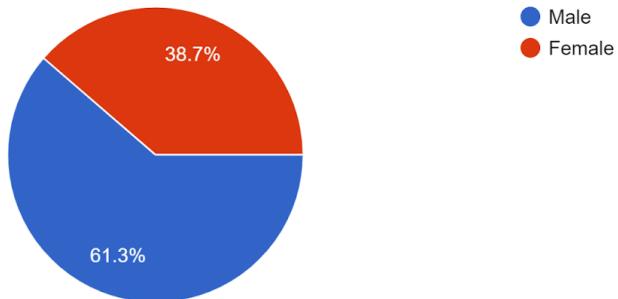
The questionnaire results with responses from 75 participants (70 students and 5 lecturers), provided a demographic breakdown and insights into energy awareness and behaviors. The majority of respondents were in the 18-24 age group, with a near-equal gender distribution, and were exclusively from the Computer Science and Information Systems departments. The findings indicate a significant awareness of energy consumption issues among the respondents, with varying degrees of observation and behaviors towards energy-saving practices. A notable interest in a sensor-based energy system was evident, with preferences for features like automated on/off scheduling, remote control via apps and AI-driven optimization recommendations.

In summary, the data collected paints a comprehensive picture of the current state of energy consumption at KICT. It highlights the awareness levels, attitudes, and behaviors towards energy usage among students and staff. The report suggests a strong foundation for developing an effective Energy Monitoring System, tailored to meet the specific needs and preferences of the KICT community. The study emphasizes the potential of technology-driven solutions in promoting sustainable energy practices in an educational environment.

## Appendix: Questionnaire for Energy Tracking System

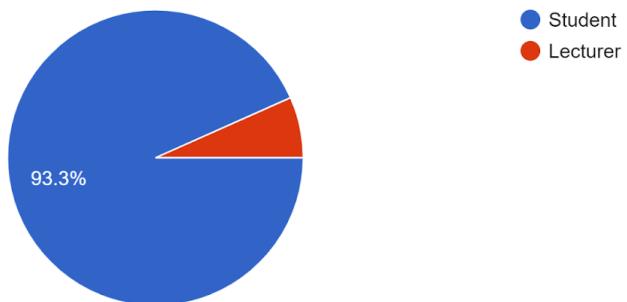
### Gender

75 responses



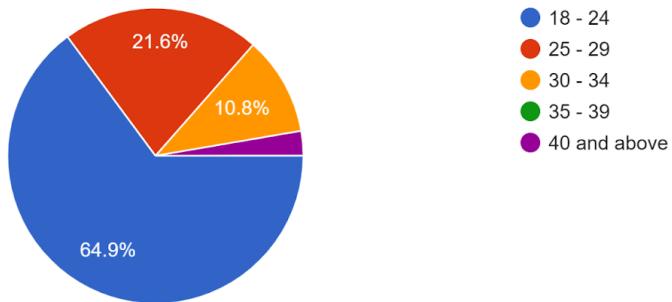
### Role

75 responses



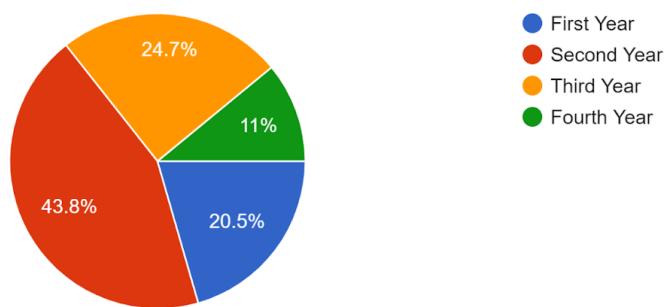
### Age

74 responses



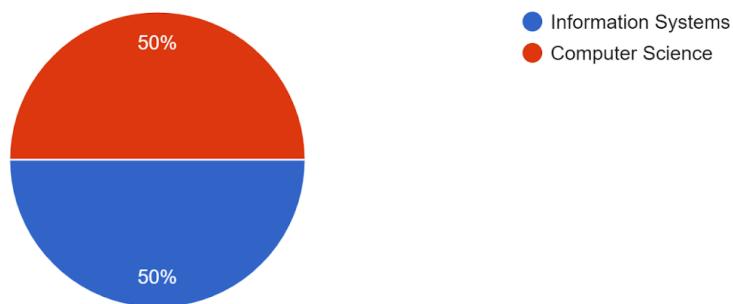
### Year of Study

73 responses



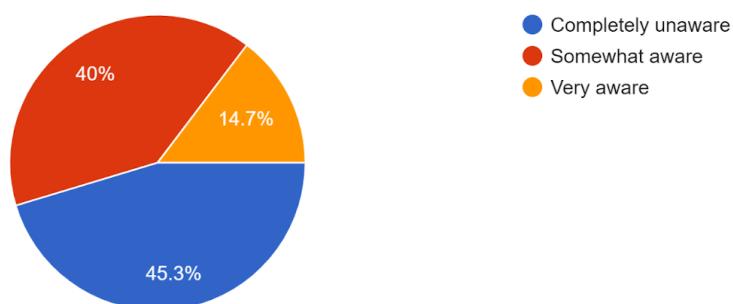
### Department

74 responses



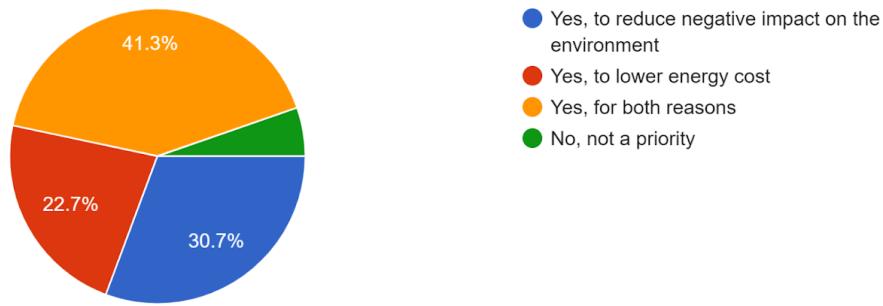
### Are you aware of how much energy is being consumed within KICT?

75 responses



Would you like to save electricity in the KICT department? If so, why?

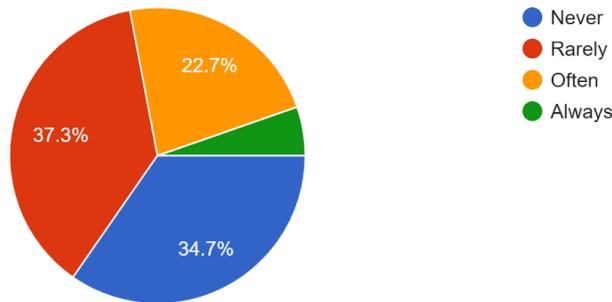
75 responses



- Yes, to reduce negative impact on the environment
- Yes, to lower energy cost
- Yes, for both reasons
- No, not a priority

Do you notice equipment such as air conditioner and lights switched on when there is no one present in the class?

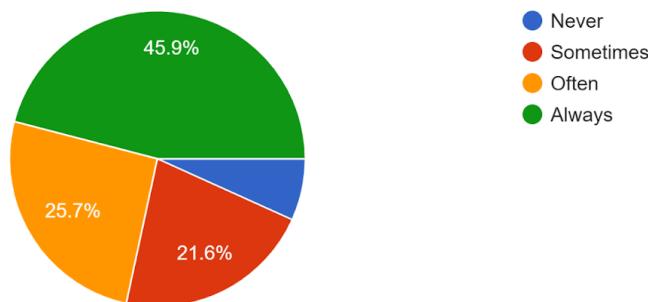
75 responses



- Never
- Rarely
- Often
- Always

Do you often turn off the equipment (lights etc.) if you are the last one to leave the class?

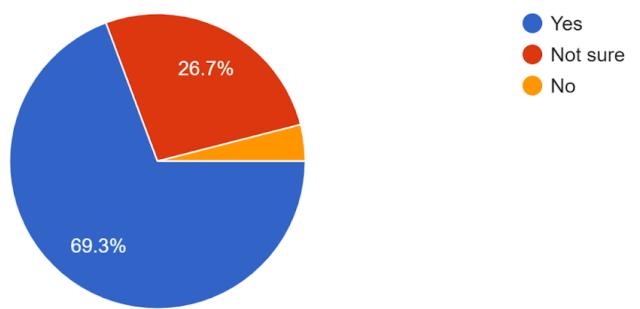
74 responses



- Never
- Sometimes
- Often
- Always

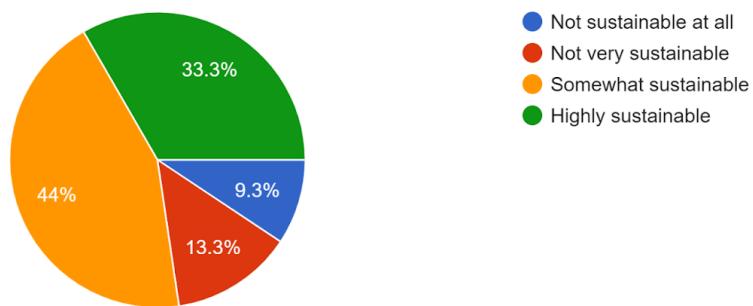
Would you prefer a system that turns off automatically based on occupancy of the class?

75 responses



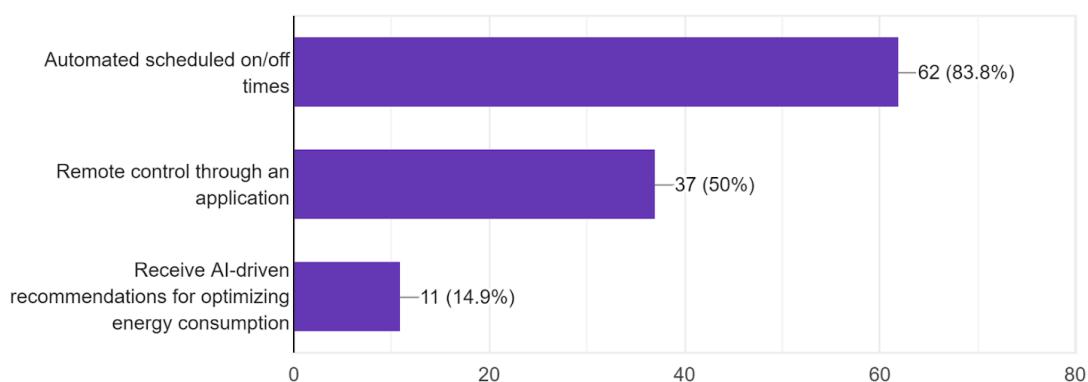
Do you believe that this sensor based energy system is sustainable?

75 responses



What other features would you like to see in the new system?

74 responses



## 1. Energy Tracking System Actors

No	Actor(s)	Synonym	Description
1	User	KICT Members	Individuals comprising KICT students, lecturers, and staff who interact with the energy monitoring system. They can register, view reports, and leave feedback on the system.
2	System Admin	Administrator	Authorized personnel responsible for managing and overseeing the energy monitoring system. Admins can register, activate the system, generate reports, and maintain its functionality.

Table 1: List of Business Actors in The New Proposed System

## 2. Energy Tracking System Use Cases

Use Case name	Description	Participating Actors and Roles	Subsystem
Register/Login	This use case describes the event of a user or admin registering in the energy monitoring system.	User Admin	
View Report	This use case describes the event of a user viewing energy consumption reports.	User	
Leave Feedback	This use case describes the event of a user providing feedback on the energy monitoring system.	User	
Activate System	This use case describes the event of an admin activating the energy monitoring system.	Admin	Admin Management

Maintain the System	This use case describes the event of an admin maintaining the overall functionality of the energy monitoring system.	Admin	Admin Management
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Table 2: List of Business Requirements of the Energy Monitoring System

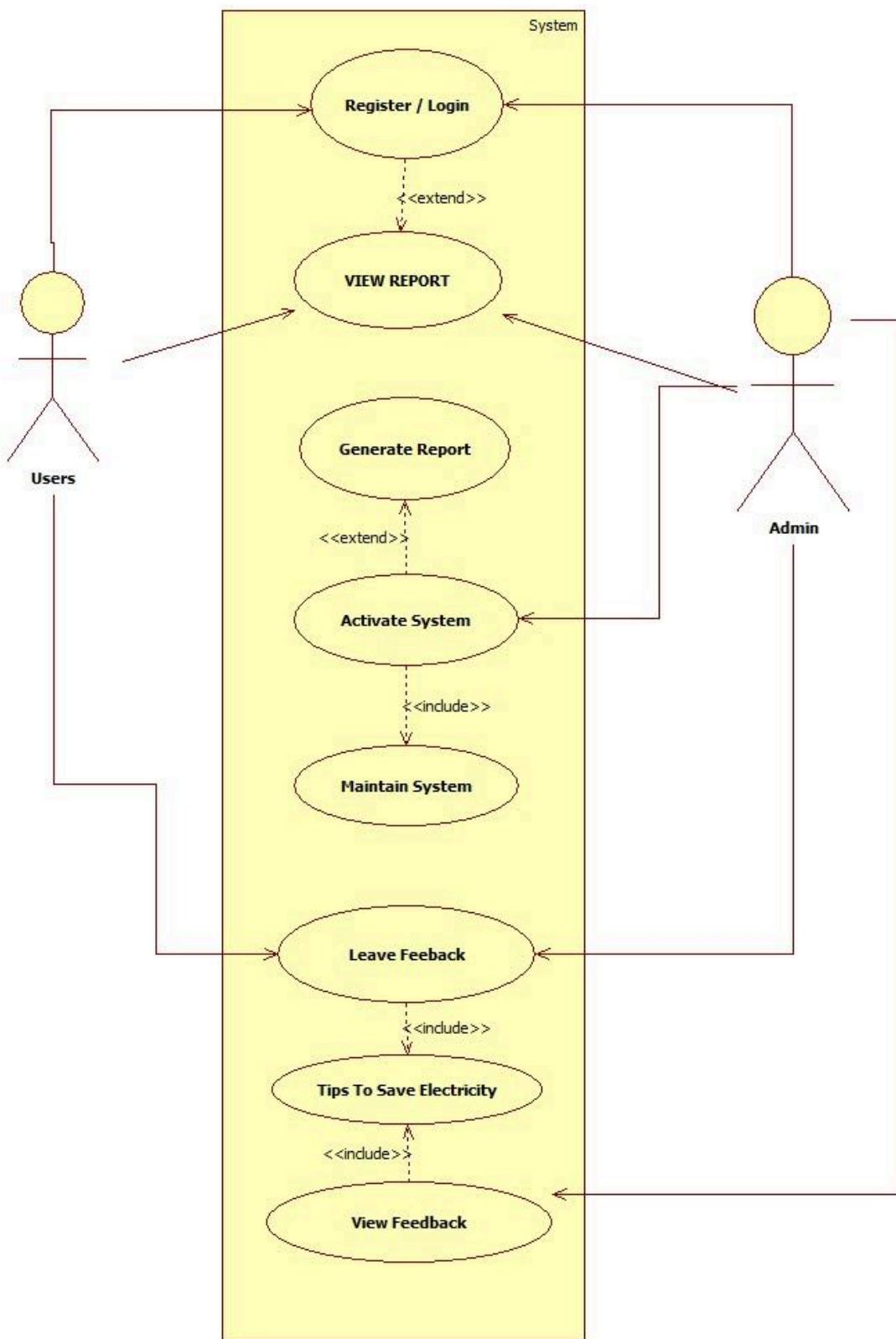


Figure 1.0 : Use Case Diagram of the Energy Tracking System

### 3. Use Case Narratives

**Table 3.1: Register/Login**

### ENERGY TRACKING SYSTEM

**Author:** Yusuf Mohammad Yunus

**Date:** 23rd May 2024

<b>USE CASE NAME:</b>	Register/Login	<b>USE CASE TYPE</b>
<b>USE CASE ID:</b>	ETS-01	Business Requirements: <input type="checkbox"/> System Analysis: <input type="checkbox"/> System Design: <input type="checkbox"/>
<b>PRIORITY:</b>	High	
<b>SOURCE:</b>	Admin	
<b>PRIMARY BUSINESS ACTOR:</b>	User	
<b>PRIMARY SYSTEM ACTOR:</b>	System Admin	
<b>OTHER PARTICIPATING ACTORS:</b>	None	
<b>OTHER INTERESTED STAKEHOLDERS:</b>	None	
<b>DESCRIPTION:</b>	Event where a user or admin want to register/login	
<b>PRE-CONDITION:</b>	User/Admin not registered or login yet	
<b>TRIGGER:</b>	Selection of 'Register' and 'login' option	
<b>TYPICAL COURSE OF EVENTS:</b>	<b>Actor Action</b>	<b>System Response</b>
	<b>Step 1:</b> User selects the 'Register' or 'Login' option.	<b>Step 2:</b> System displays registration form. If user wants to login, systems displays the login form
	<b>Step 3:</b> User enters required information.	<b>Step 4:</b> System validates the information.
	<b>Step 5:</b> User submits the form.	<b>Step 6:</b> System registers/login the user and displays a confirmation message.
<b>ALTERNATE COURSES:</b>	None	
<b>CONCLUSION:</b>	Registration/login successful	
<b>POST-CONDITION:</b>	User/admin can access the system	
<b>BUSINESS RULES</b>	<ol style="list-style-type: none"> <li>1. All fields must be completed to register.</li> <li>2. Passwords must meet security requirements.</li> <li>3. Users must accept the Terms and Conditions.</li> </ol>	
<b>IMPLEMENTATION CONSTRAINTS AND SPECIFICATIONS</b>	System must support concurrent users	
<b>ASSUMPTIONS:</b>	Internet access is available for system registration.	
<b>OPEN ISSUES:</b>	None	

**Table 3.2: View Report****ENERGY TRACKING SYSTEM****Author:** Wan Ahmed Fauzizafry bin Wan Khalid**Date:** 23rd May 2024

<b>USE CASE NAME:</b>	<b>View Report</b>	<b>USE CASE TYPE</b>
<b>USE CASE ID:</b>	ETS-02	Business Requirements: <input type="checkbox"/>
<b>PRIORITY:</b>	Low	System Analysis: <input type="checkbox"/>
<b>SOURCE:</b>	Admin	System Design: <input type="checkbox"/>
<b>PRIMARY BUSINESS ACTOR</b>	User	
<b>PRIMARY SYSTEM ACTOR</b>	User	
<b>OTHER PARTICIPATING ACTORS:</b>	Admin	
<b>OTHER INTERESTED STAKEHOLDERS:</b>	None	
<b>DESCRIPTION:</b>	View report function is to giving user viewing the energy consumption reports in the system	
<b>PRE-CONDITION:</b>	1. The user registered to the system 2. The Energy Monitoring System is operational	
<b>TRIGGER:</b>	Admin provided the report of the Energy Monitoring System usage to the user	
<b>TYPICAL COURSE OF EVENTS:</b>	<b>Actor Action</b>	<b>System Response</b>
	<b>Step 1:</b> The use case starts when the user register up in the system	<b>Step 2:</b> The system verifies the credentials and grants access to the application
	<b>Step 3:</b> The user selects the "View Reports" in the menu selection	<b>Step 4:</b> The system navigates to the report page
	<b>Step 5 :</b> The user viewing the report of the system	<b>Step 6:</b> The system provided the report of the energy consumption reports and all records in the system
<b>ALTERNATE COURSES:</b>	If the specified parameters are invalid, the system provides feedback to the admin, allowing them to correct the inputs.	
<b>CONCLUSION:</b>	The user can view the reports of the Energy Monitoring System to make sure they follow up with all of the records in the system.	
<b>POST-CONDITION:</b>	The generated report is stored for future reference.	
<b>BUSINESS RULES</b>	The report can only be authorized and perform by the admin of the system	
<b>IMPLEMENTATION CONSTRAINTS AND SPECIFICATIONS</b>	The user can leave and create reports for the system	
<b>ASSUMPTIONS:</b>	User is allowed to view the reports	
<b>OPEN ISSUES:</b>	Providing live report for the user to make sure they keep getting follow up and notice with the system	

**Table 3.3: Leave Feedback****ENERGY TRACKING SYSTEM**

**Author:** Tengku Muhammad Abduh  
bin Tengku Mohamad Zulkifli

**Date:** 23rd May 2024

<b>USE CASE NAME:</b>	Leave Feedback		<b>USE CASE TYPE</b>		
<b>USE CASE ID:</b>	ETS-03		Business Requirements: <input type="checkbox"/>		
<b>PRIORITY:</b>	Medium		System Analysis: <input type="checkbox"/>		
<b>SOURCE:</b>	Survey		System Design: <input type="checkbox"/>		
<b>PRIMARY BUSINESS ACTOR</b>	User				
<b>PRIMARY SYSTEM ACTOR</b>	Energy Monitoring System				
<b>OTHER PARTICIPATING ACTORS:</b>	Admin				
<b>OTHER INTERESTED STAKEHOLDERS:</b>	None				
<b>DESCRIPTION:</b>	The primary objective for this use-case is collecting feedback provided by users who have interacted with the application.				
<b>PRE-CONDITION:</b>	The user must have interacted with the application at least once.				
<b>TRIGGER:</b>	User decides to leave feedback.				
<b>TYPICAL COURSE OF EVENTS:</b>	<b>Actor Action</b>	<b>System Response</b>			
	<b>Step 1:</b> User access and interacts with the feedback option	<b>Step 2:</b> The application displays the feedback form to the user			
	<b>Step 3:</b> User provides any sort of feedback	<b>Step 4:</b> Application records the feedback			
	<b>Step 5:</b> User submits the feedback response	<b>Step 6:</b> EMS Stores the feedback for further analysis by admin.			
<b>ALTERNATE COURSES:</b>	If a user decides to modify their feedback, perhaps due to a change of mind or grammatical correction, they can edit their feedback after submission.				
<b>CONCLUSION:</b>	The application successfully receives the feedback and stores it so that it can be viewed.				
<b>POST-CONDITION:</b>	User's feedback is stored in the system				
<b>BUSINESS RULES</b>	Feedback must be authentic				
<b>IMPLEMENTATION CONSTRAINTS AND SPECIFICATIONS</b>	Admin can develop a user-friendly feedback interface				
<b>ASSUMPTIONS:</b>	User is allowed to leave feedback				
<b>OPEN ISSUES:</b>	Having suitable database management for all the feedback received and stored.				

**Table 3.4 Activate system**

## **ENERGY TRACKING SYSTEM**

**Author:** Akif Asyran bin Mohamad Izani

**Date:** 23rd May 2024

USE CASE NAME:	Activate System	USE CASE TYPE
USE CASE ID:	ETS-04	Business Requirements: <input type="checkbox"/> System Analysis: <input type="checkbox"/> System Design: <input type="checkbox"/>
PRIORITY:	High	
SOURCE:	Admin	
PRIMARY BUSINESS ACTOR	Admin	
PRIMARY SYSTEM ACTOR	Energy Tracking System	
OTHER PARTICIPATING ACTORS:	None	
OTHER INTERESTED STAKEHOLDERS:	None	
DESCRIPTION:	The system is for admin to activate the monitoring system	
PRE-CONDITION:	The system is off	
TRIGGER:	The activate button in system activation	
TYPICAL COURSE OF EVENTS:	Actor Action	System Response
	Step 1: Admin log in into the system	Step 2: System authenticate Admin credentials
	Step 3: Admin open system activation panel	Step 4: System navigate to and display the activation panel
	Step 5: Admin activates the system button.	Step 6: System is activated
ALTERNATE COURSES:	1. The admin wrongly input the login credentials and denied access. 2. The system was not deactivated or stayed on	
CONCLUSION:	The admin has control to activate and deactivate the system	
POST-CONDITION:	The system is on and admin is able to monitor real time energy consumption	
BUSINESS RULES	The system must always be deactivated when classes are all done	
IMPLEMENTATION CONSTRAINTS AND SPECIFICATIONS	Only the admin has access over the activation of the system	
ASSUMPTIONS:	The admin must activate and deactivate the system	
OPEN ISSUES:	The admin forgot to deactivate the system and energy consumption is overload	

**Table 3.5: Maintain the System****ENERGY TRACKING SYSTEM** 23/May/2024

<b>USE CASE NAME:</b>	Maintain the system	<b>USE CASE TYPE</b>
<b>USE CASE ID:</b>	ETS-06	Business Requirements: <input type="checkbox"/> System Analysis: <input type="checkbox"/> System Design: <input type="checkbox"/>
<b>PRIORITY:</b>	High	
<b>SOURCE:</b>	Admin	
<b>PRIMARY BUSINESS ACTOR</b>	Admin	
<b>PRIMARY SYSTEM ACTOR</b>	Admin	
<b>OTHER PARTICIPATING ACTORS:</b>	None	
<b>OTHER INTERESTED STAKEHOLDERS:</b>	None	
<b>DESCRIPTION:</b>	This use case encompasses the activities related to the ongoing maintenance and management of the energy monitoring system by the admin.	
<b>PRE-CONDITION:</b>	<ol style="list-style-type: none"> <li>1. The admin is logged into the system.</li> <li>2. The energy monitoring system is operational.</li> </ol>	
<b>TRIGGER:</b>	Admin identifies the need for system maintenance, updates, or enhancements.	
<b>TYPICAL COURSE OF EVENTS:</b>	<b>Actor Action</b>	<b>System Response</b>
	<b>Step 1:</b> The use case starts when the admin opts to perform system maintenance	<b>Step 2:</b> The system provides access to maintenance tools and functionalities.
	<b>Step 3:</b> Admin reviews system logs and identifies any potential issues or areas for improvement.	<b>Step 4:</b> The system presents detailed logs and diagnostic information.
	<b>Step 5:</b> Admin applies updates or patches to ensure the system's security and performance.	<b>Step 6:</b> The system updates its components and notifies the admin upon completion.
	<b>Step 7:</b> Admin monitors system performance and addresses any identified issues.	<b>Step 8:</b> The system provides confirmation and status updates.
<b>ALTERNATE COURSES:</b>	If the admin identifies critical issues, they may initiate emergency maintenance procedures, temporarily taking the system offline if necessary.	
<b>CONCLUSION:</b>	The admin concludes the maintenance activities, ensuring that the energy monitoring system is in optimal condition.	
<b>POST-CONDITION:</b>	<ol style="list-style-type: none"> <li>1. The energy monitoring system has undergone the necessary maintenance or updates.</li> <li>2. The system remains operational and stable.</li> </ol>	
<b>BUSINESS RULES</b>	Maintenance tasks should be performed during low system usage periods to minimize disruption.	
<b>CONSTRAINTS AND SPECIFICATIONS</b>	Maintenance activities should align with system architecture and specifications.	
<b>ASSUMPTIONS:</b>	The admin has the necessary permissions and knowledge to perform system maintenance.	
<b>OPEN ISSUES:</b>	Regular backups are in place to mitigate data loss during maintenance.	

#### 4. Activity Diagram

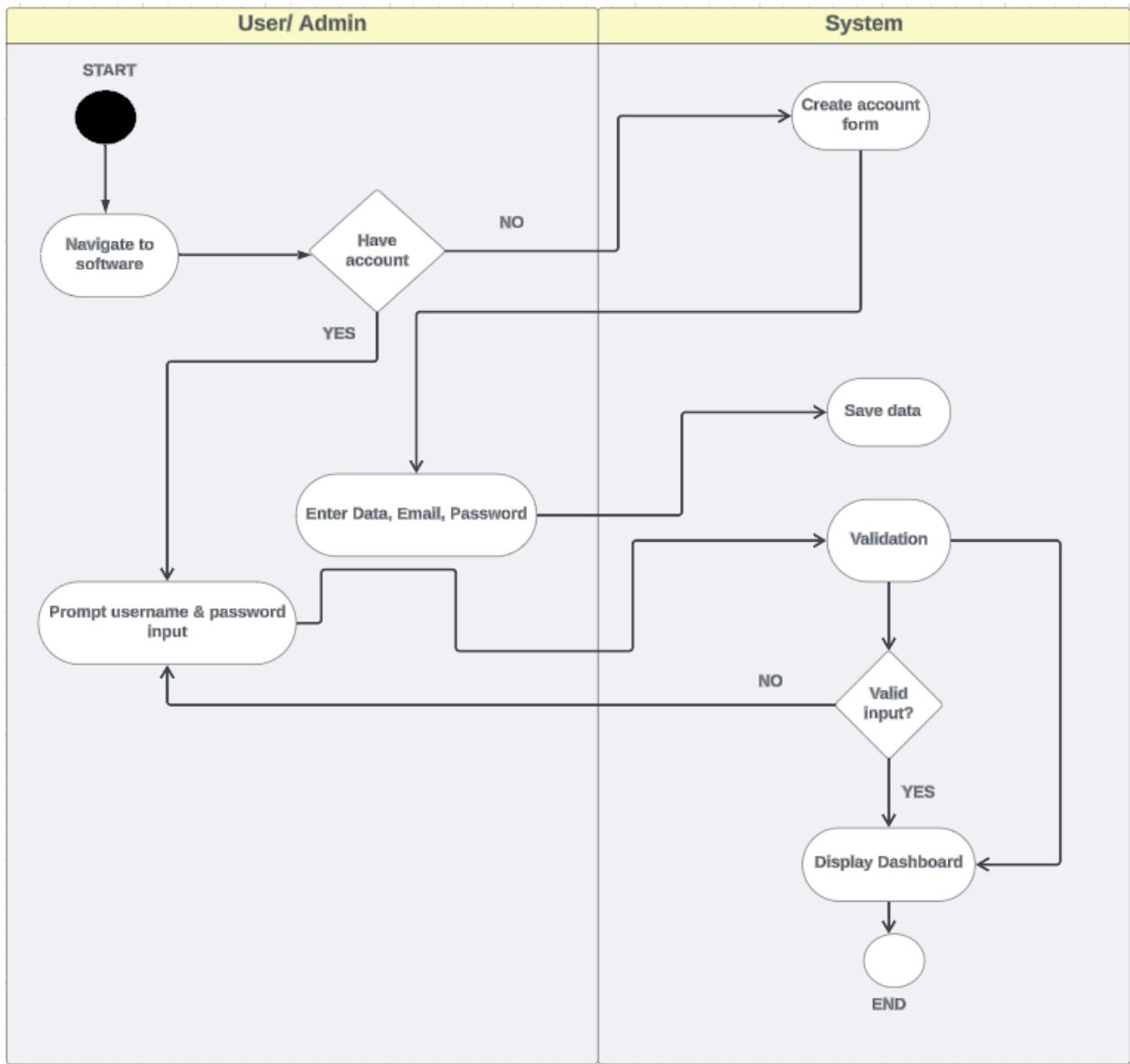


Figure : Register Activity Diagram

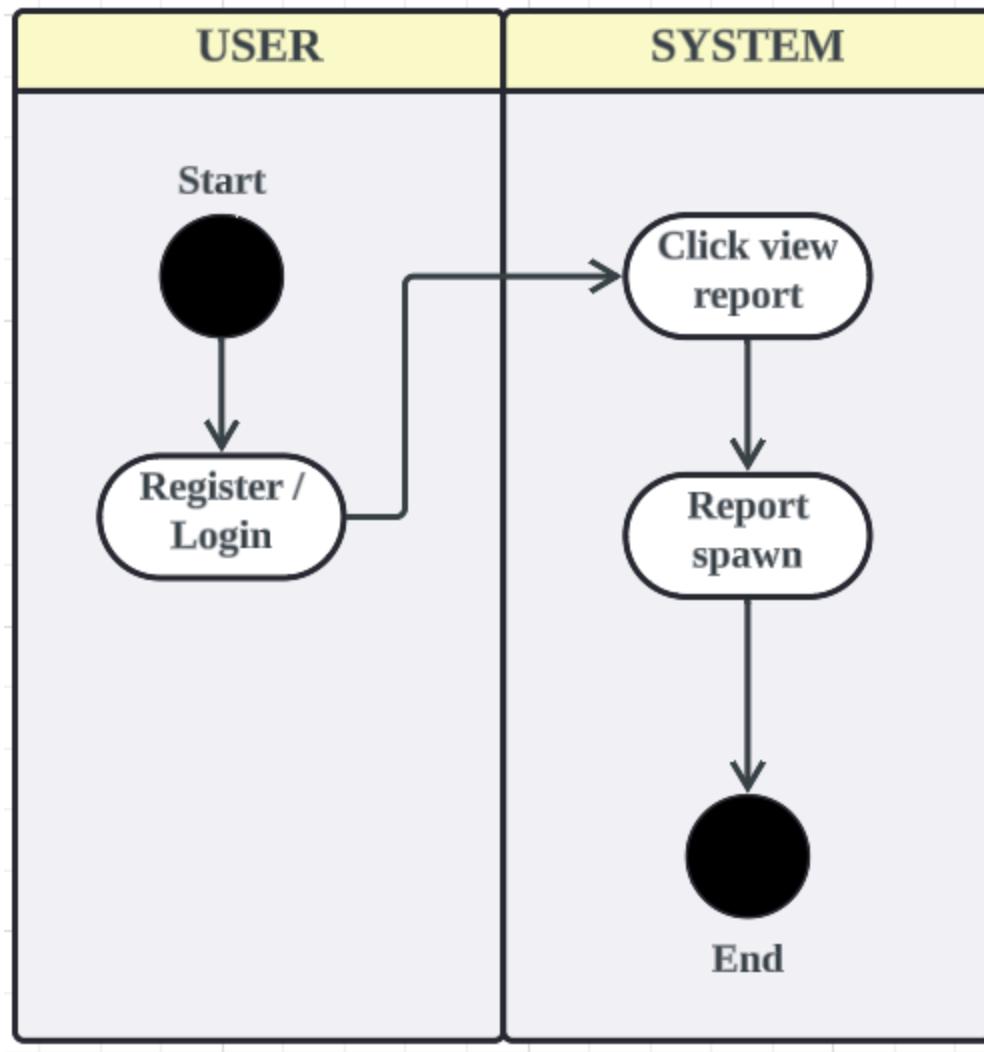
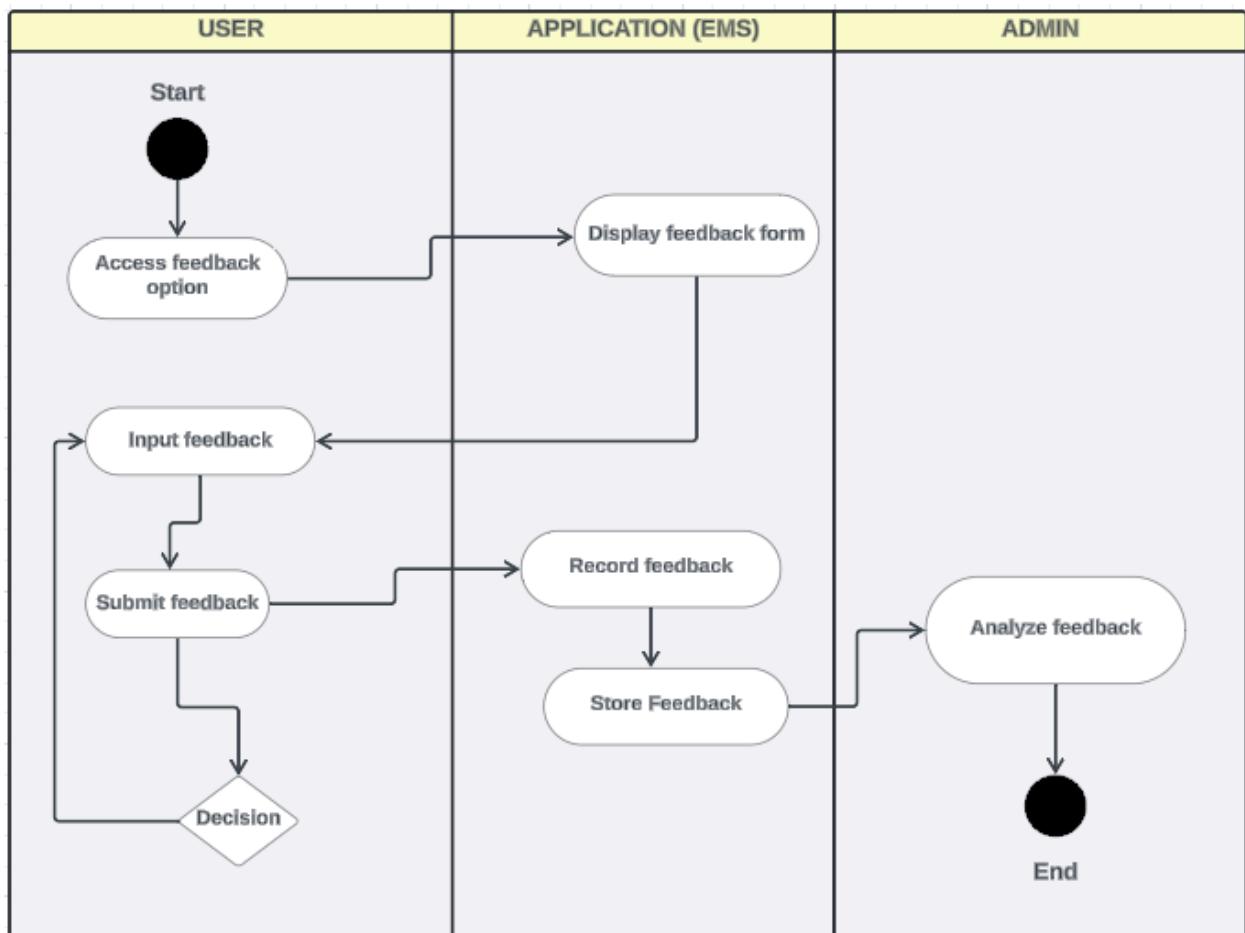


Figure : View Report Activity Diagram



**Figure : Leave Feedback Activity Diagram**

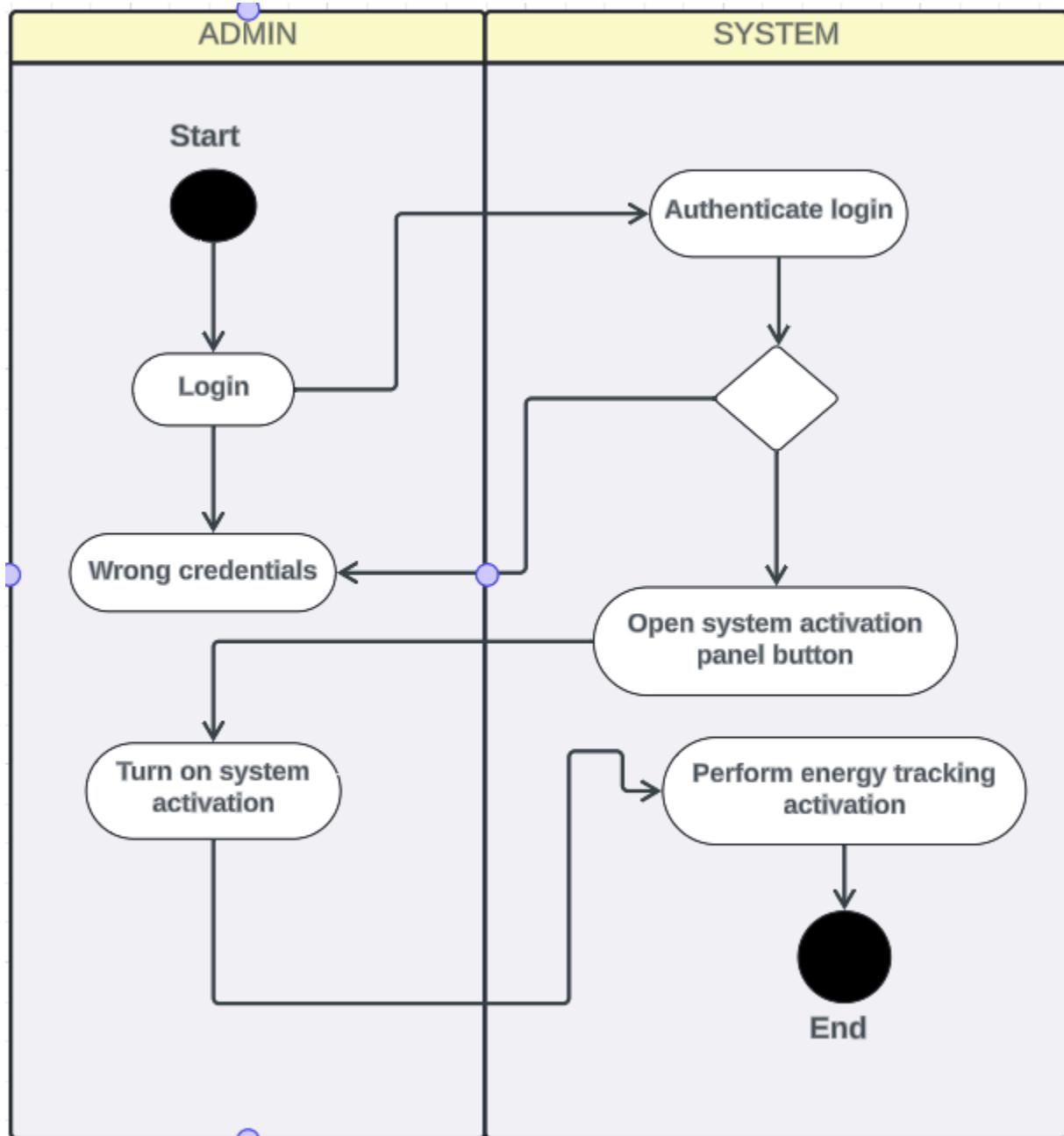


Figure : Activate system activity diagram

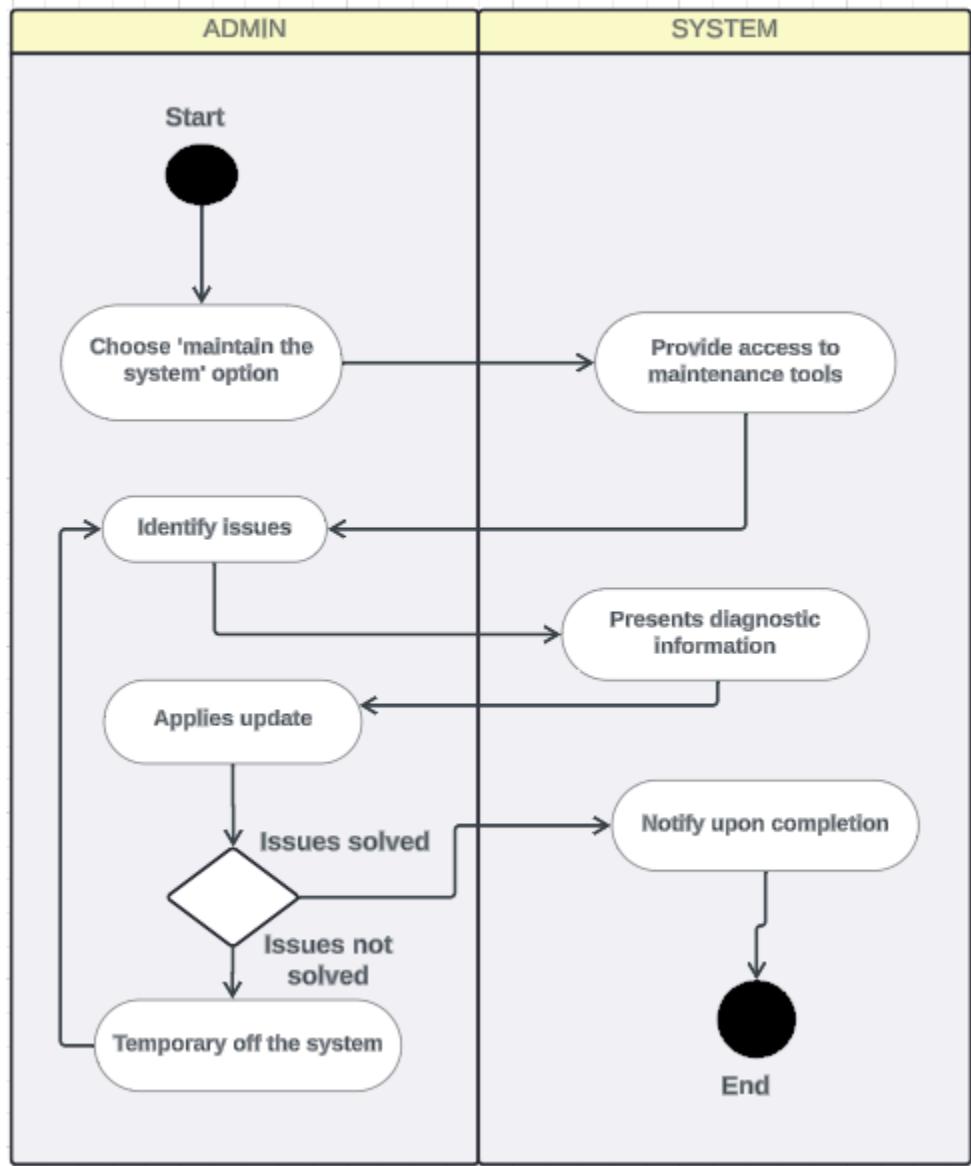


Figure : Maintain the System Activity Diagram

## 1. Class Type

Entities are structures for system data, including names like ‘User’ as well as ‘System Admin.’ They are used to describe users and administrators in the system.

Interfaces are interfaces that are created to have interaction with system actors and are a boundary of an interface.

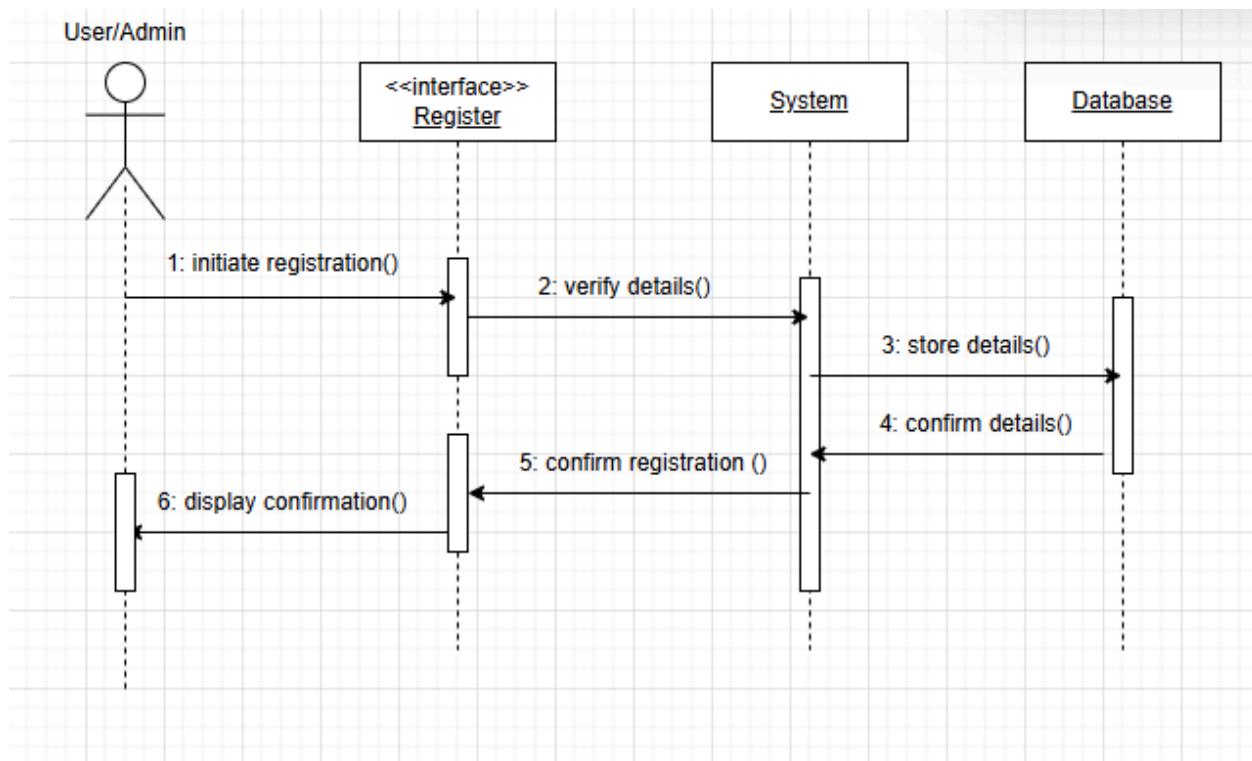
A controller is an object that lies between the interface and the entity in the system. They coordinate the implementation of activities that are initiated by the boundary through issuing out commands. They respond to the different requests and calls made by the users or administrators and perform functions such as user creation, updates, and deletion, system updates and checks, feedback and reports, and activation of the system.

In this system, the actions are done by the two roles, namely the “User” and the “System Admin” who are the users of the system.

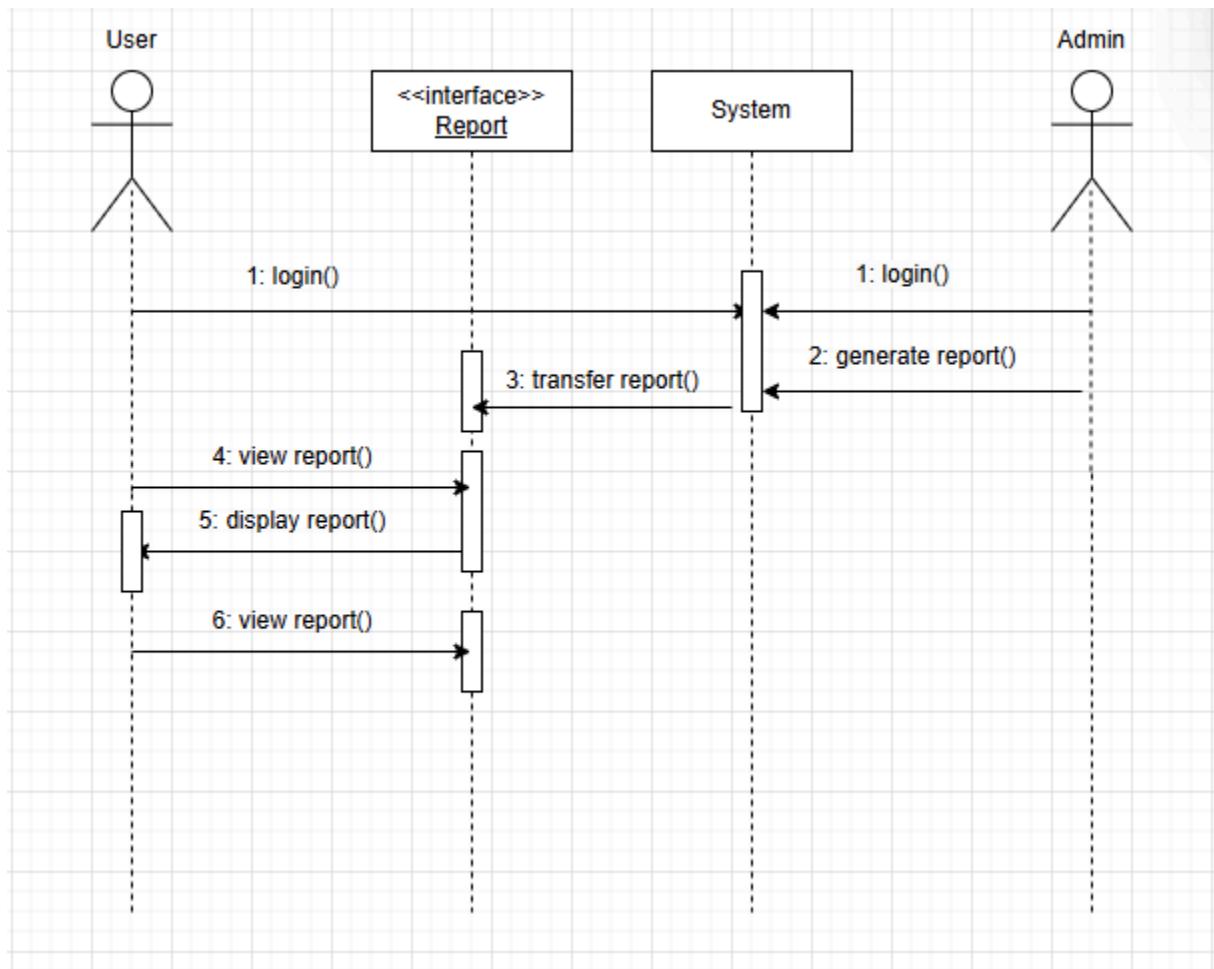
Class	Class Type
User	Entity
Admin	Entity
Register / Login	Control
Maintain System	Control
Activate System	Control
View Report	Interface
View Feedback	Interface
Leave Feedback	Control
System	Control
Tips	Interface

## 2. Sequence Diagram

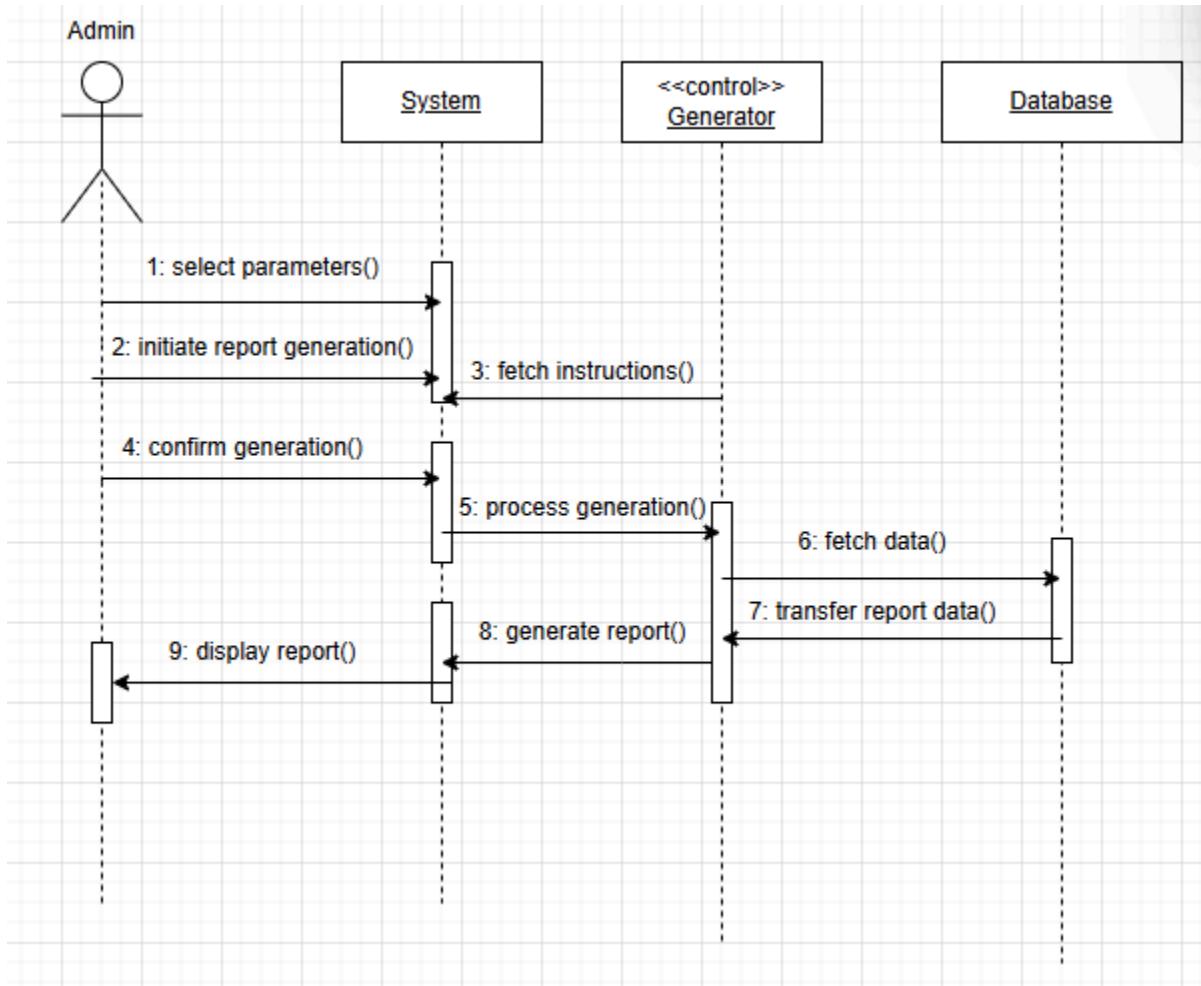
### 2.1 Registration



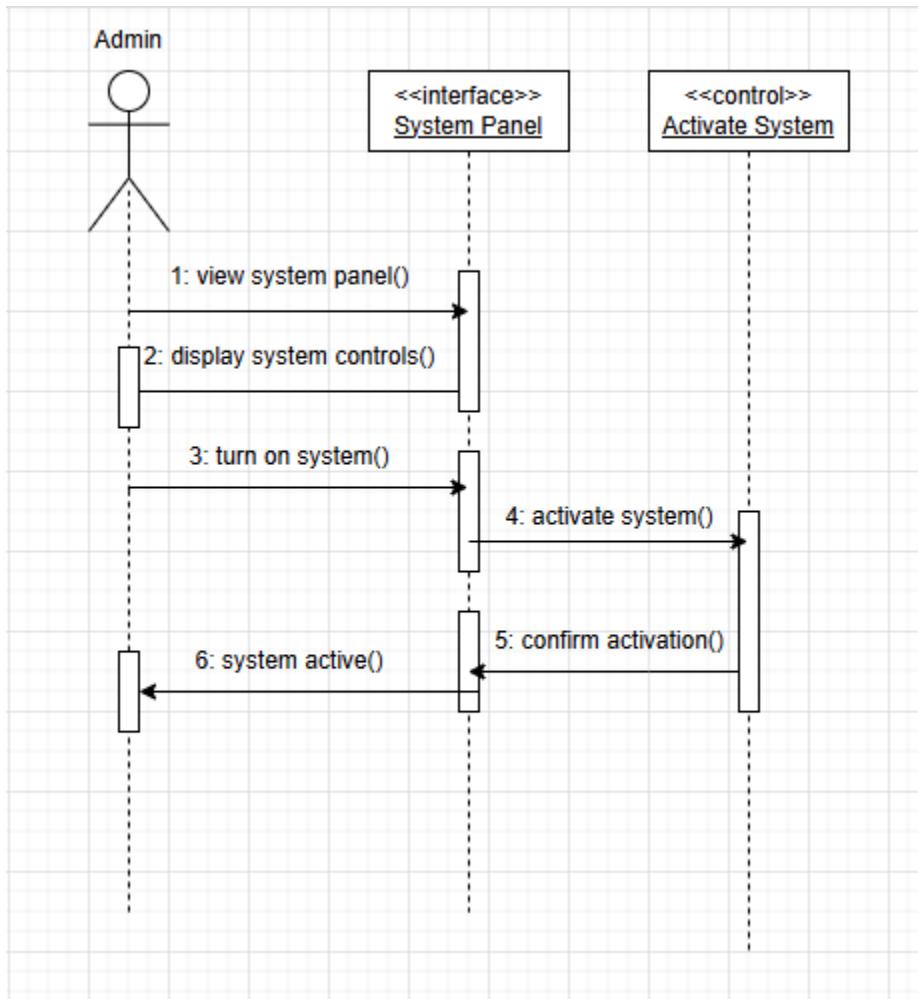
## 2.2 View Report



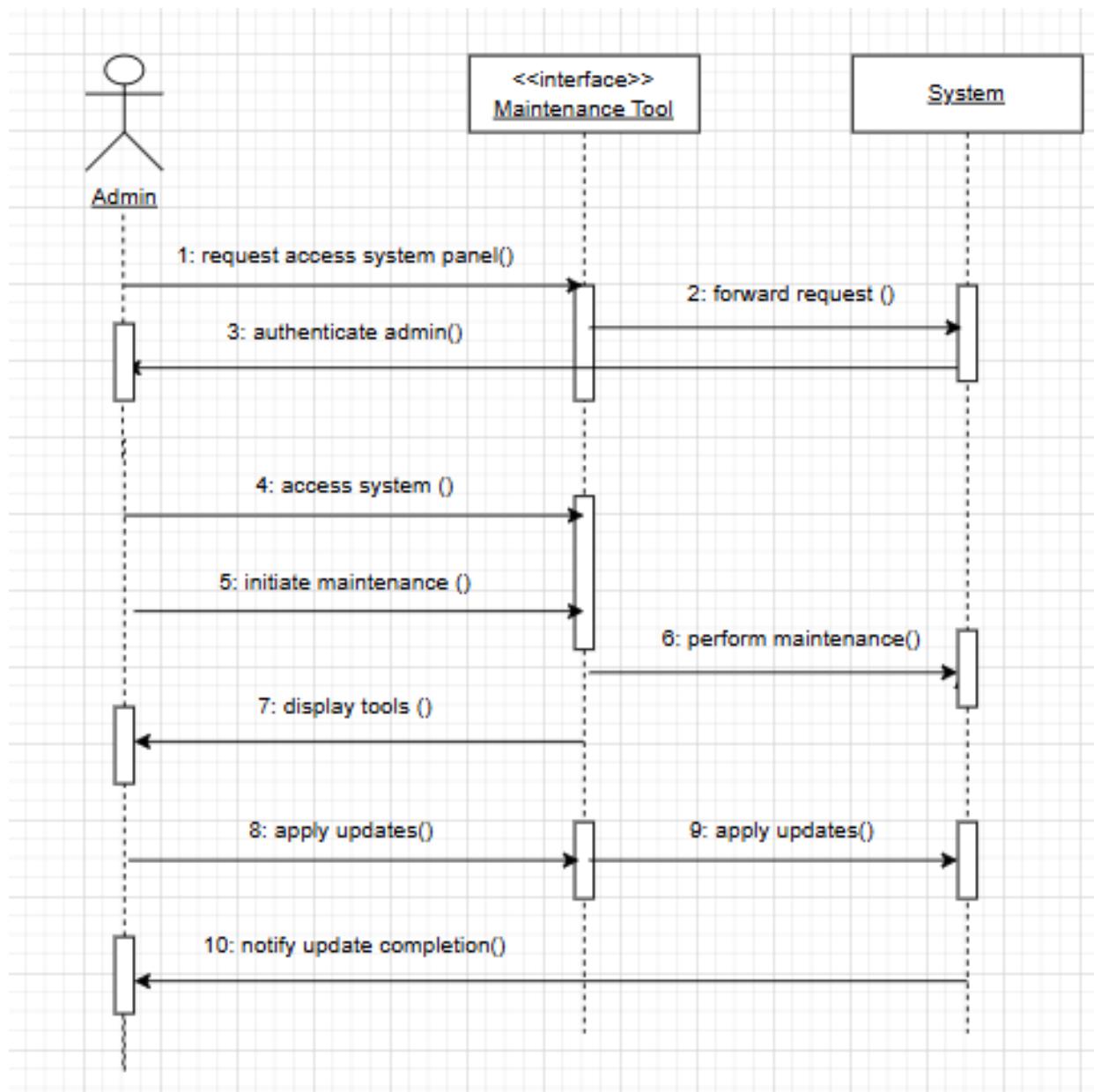
## 2.3 Generate Report



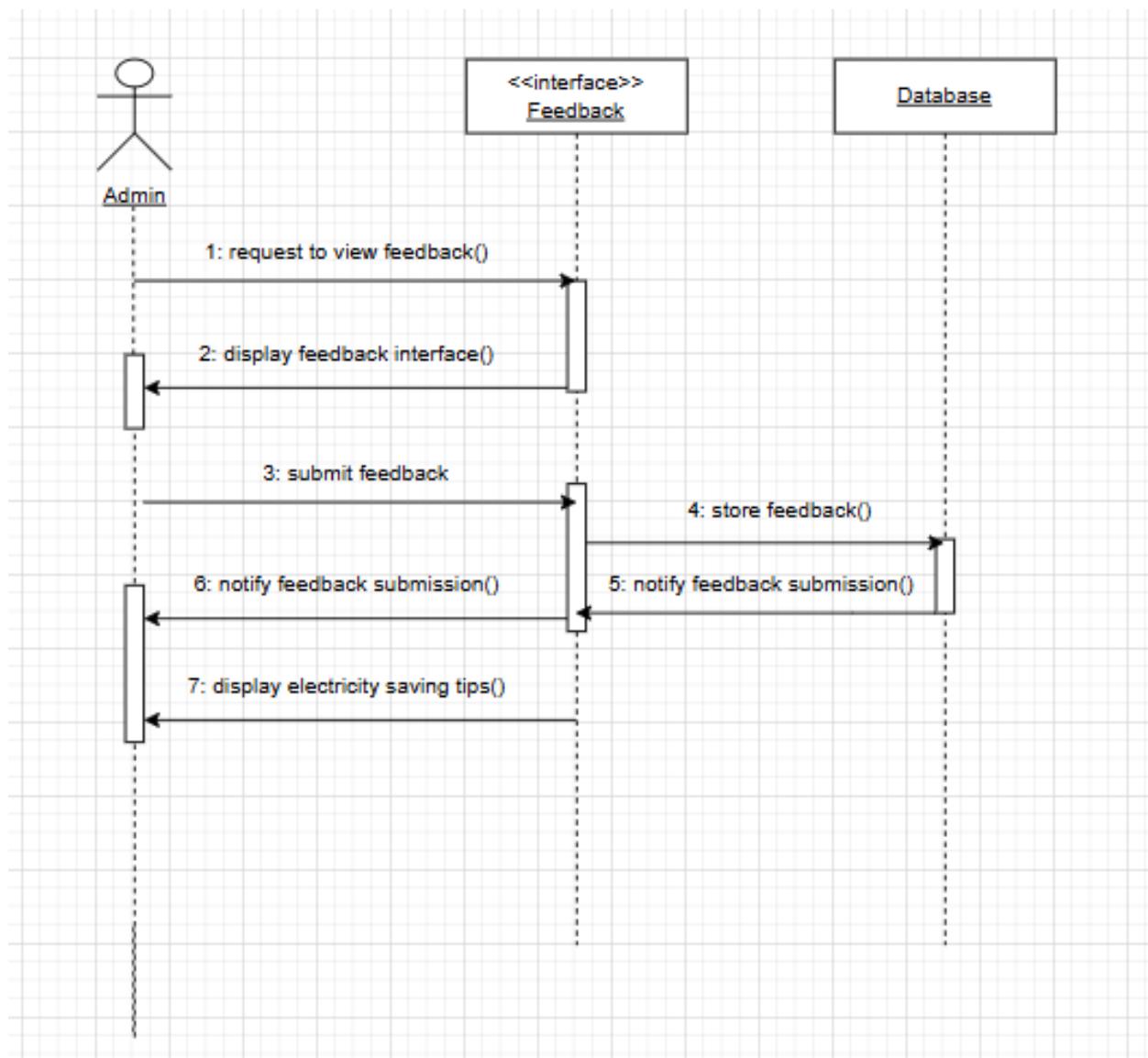
## 2.4 Activate System



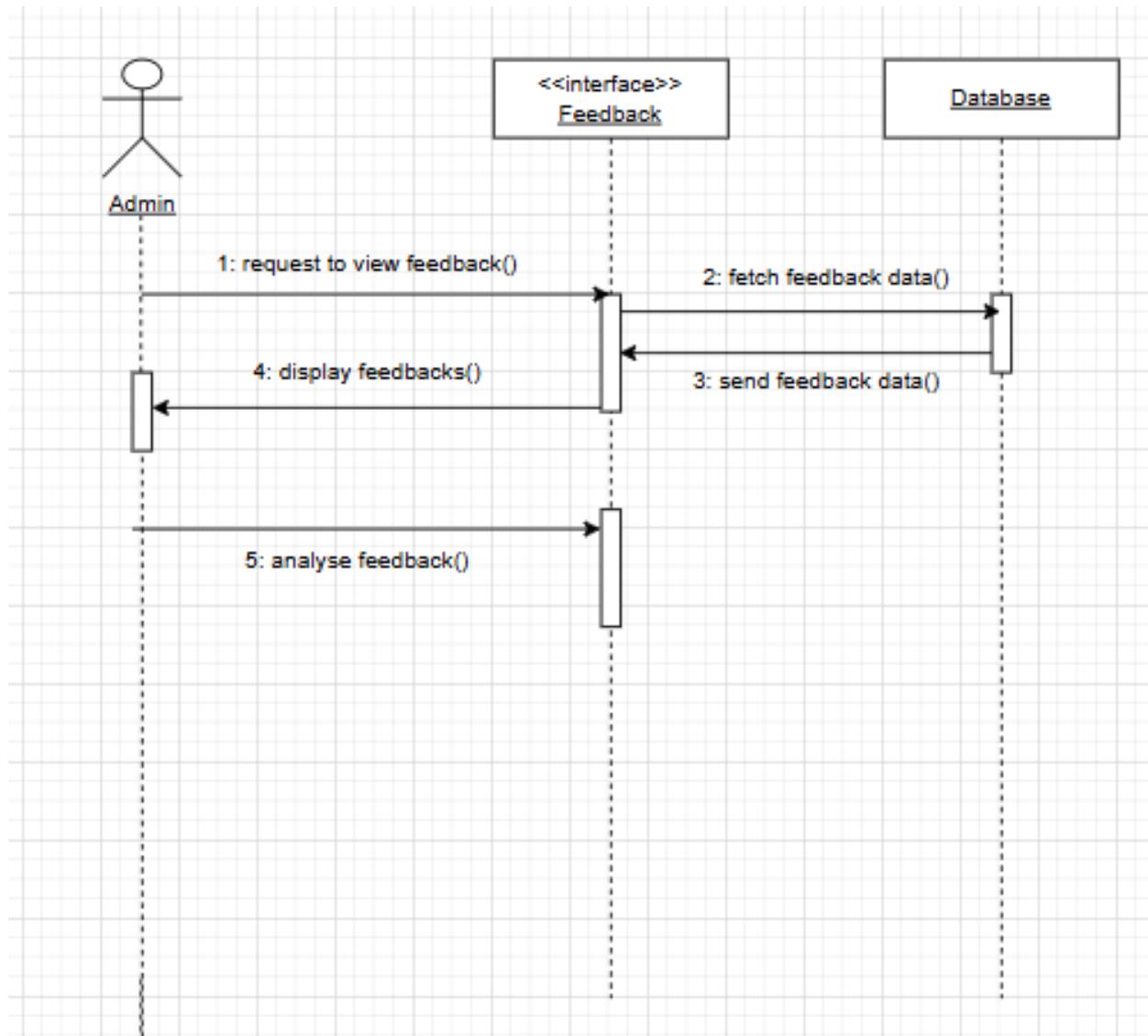
## 2.5 Maintain System



## 2.6 Leave Feedback



## 2.7 View Feedback



## Class Diagram

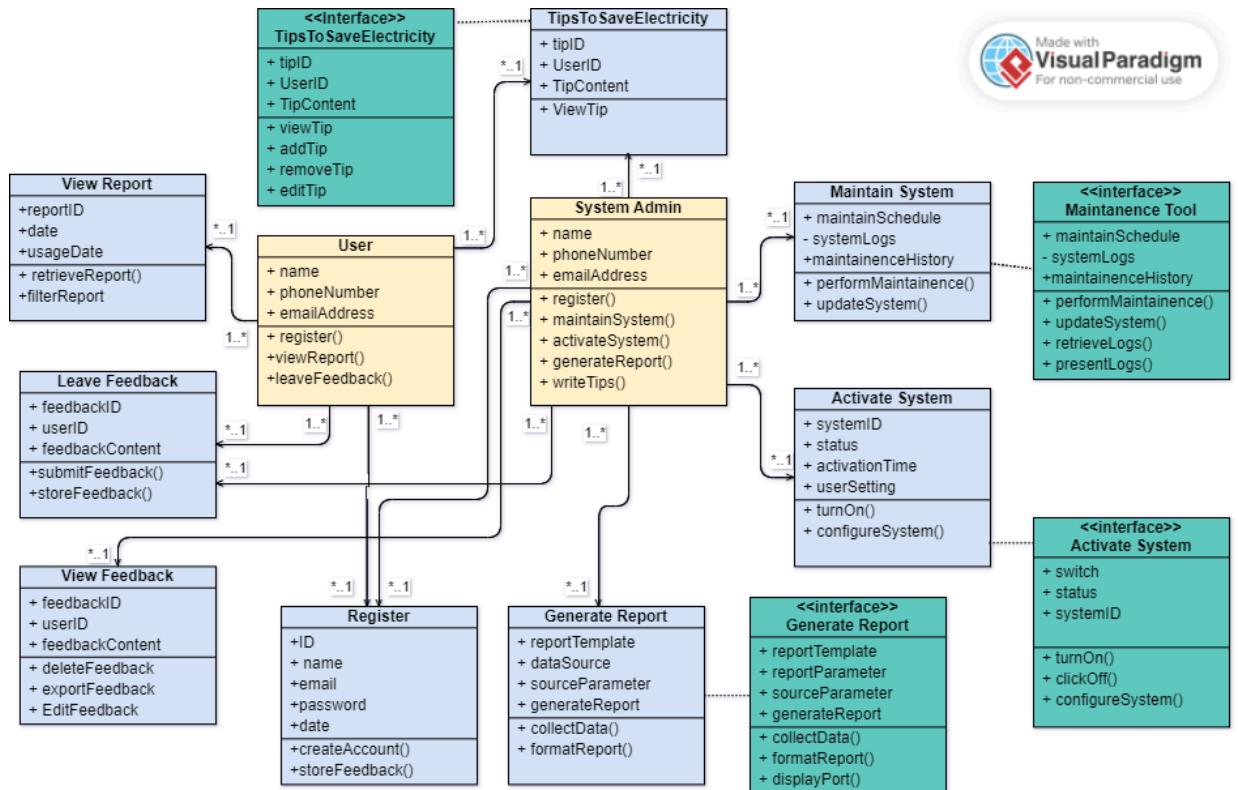
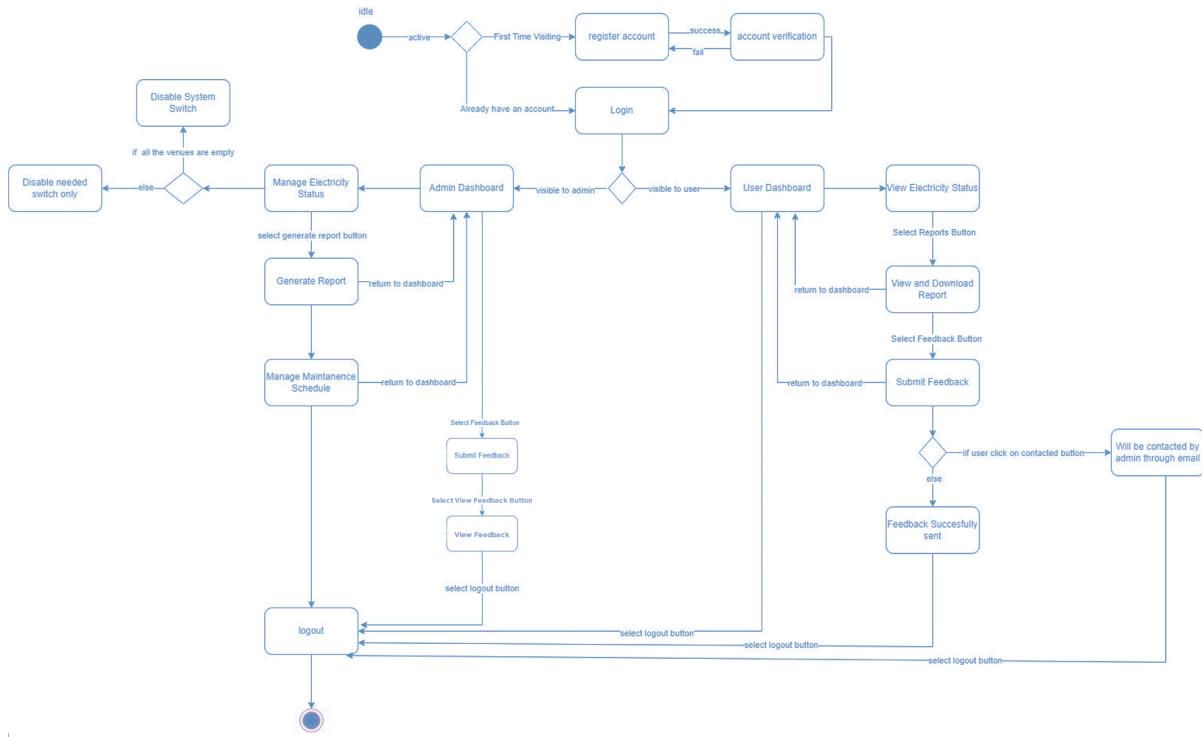


Figure 17: Whole Class Diagram

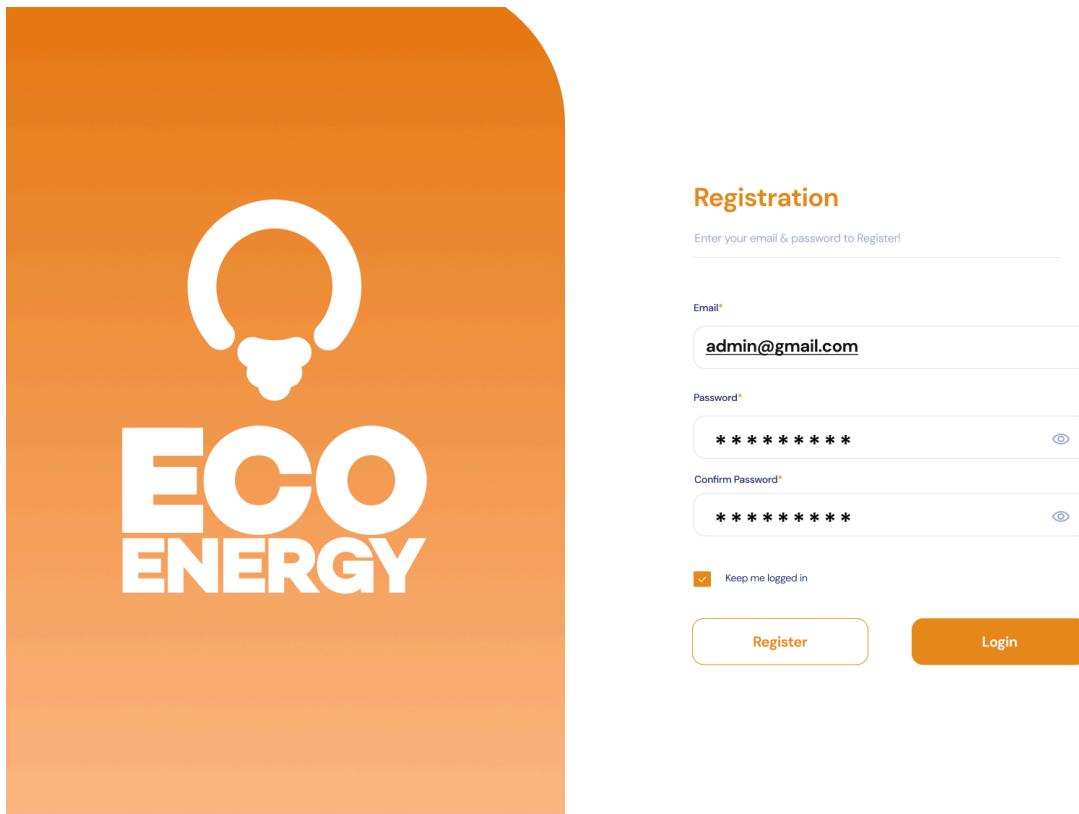
## 1. Interface Dialogue Chart



**Figure 18: State Chart Diagram**

## **2. Screenshots of the system prototype**

### **Register page**



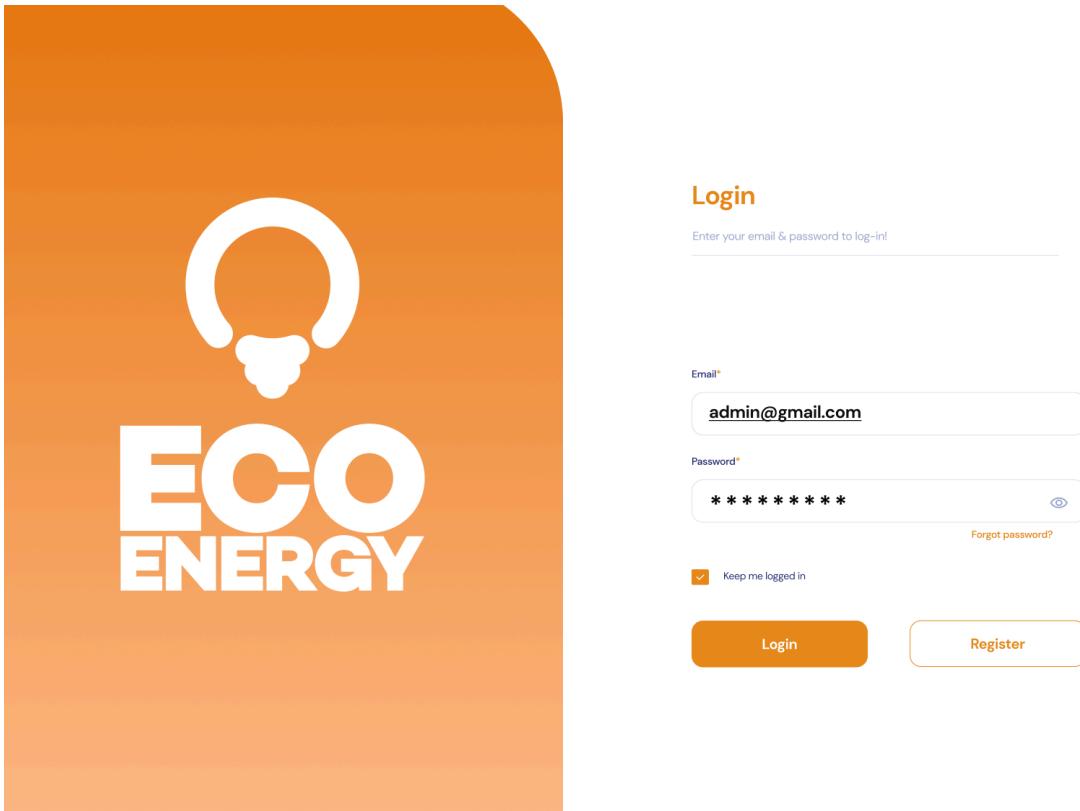
The screenshot shows the registration page for the ECO ENERGY system. The left side features a large orange background with a white stylized lightbulb icon and the words "ECO ENERGY" in a bold, white, sans-serif font. On the right, there is a white registration form with the following fields:

- Registration**: The title of the form.
- Email\***: A text input field containing "admin@gmail.com".
- Password\***: A password input field showing masked text "\*\*\*\*\*".
- Confirm Password\***: A password input field showing masked text "\*\*\*\*\*".
- Keep me logged in**: A checked checkbox with a small checkmark icon.
- Register**: An orange button with white text.
- Login**: A white button with orange text.

**Figure: Register Page**

On the registration page, users are asked to provide their information in order to create an account.

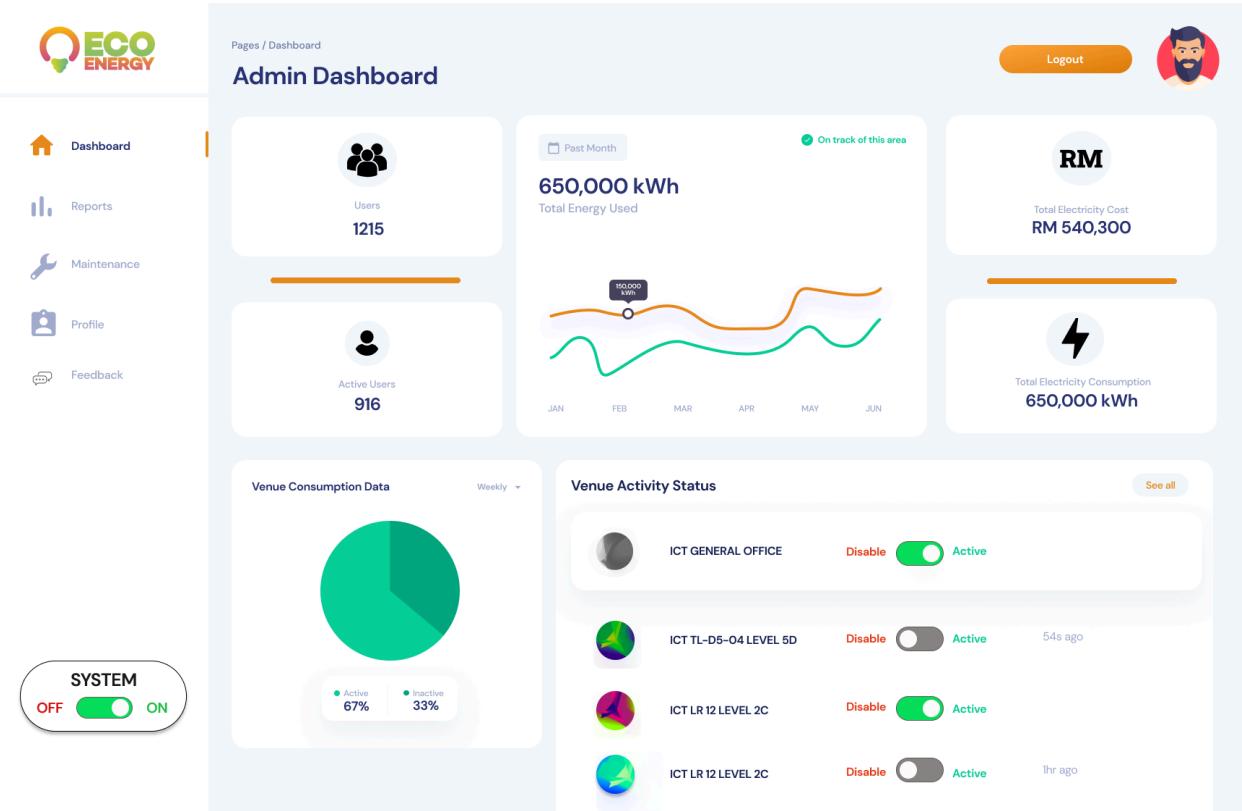
## Login page



**Figure : Login page**

A login page that simply asks for user details or offers the option to log in with Google or Facebook accounts.

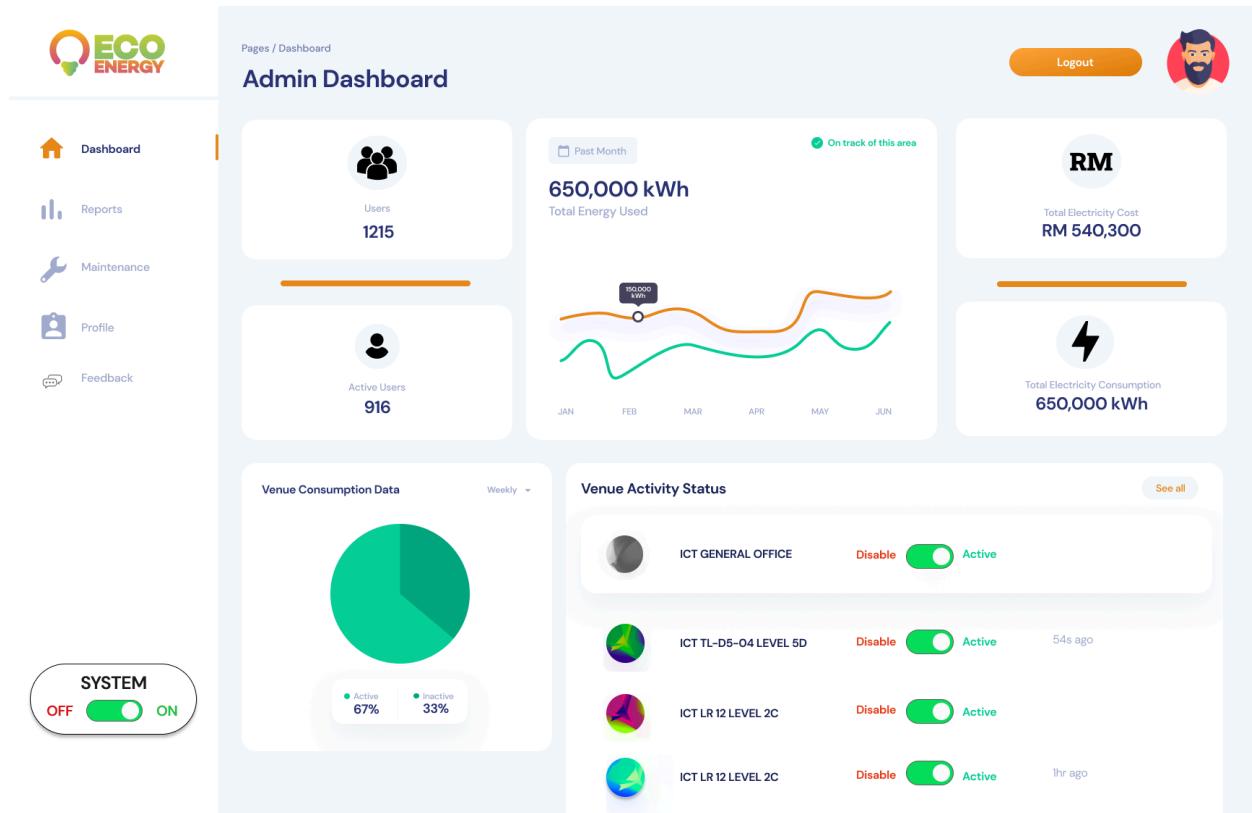
## Admin dashboard



**Figure : Admin Dashboard**

The admin dashboard provides an overview of total power usage, budget consumption, and the status of classrooms (active or inactive). It also features a system switch to enable or disable electricity in all rooms.

## Admin dashboard (active)



**Figure: Admin Dashboard**

An example of the dashboard where the power is enabled in all classrooms.

## Admin dashboard (inactive)

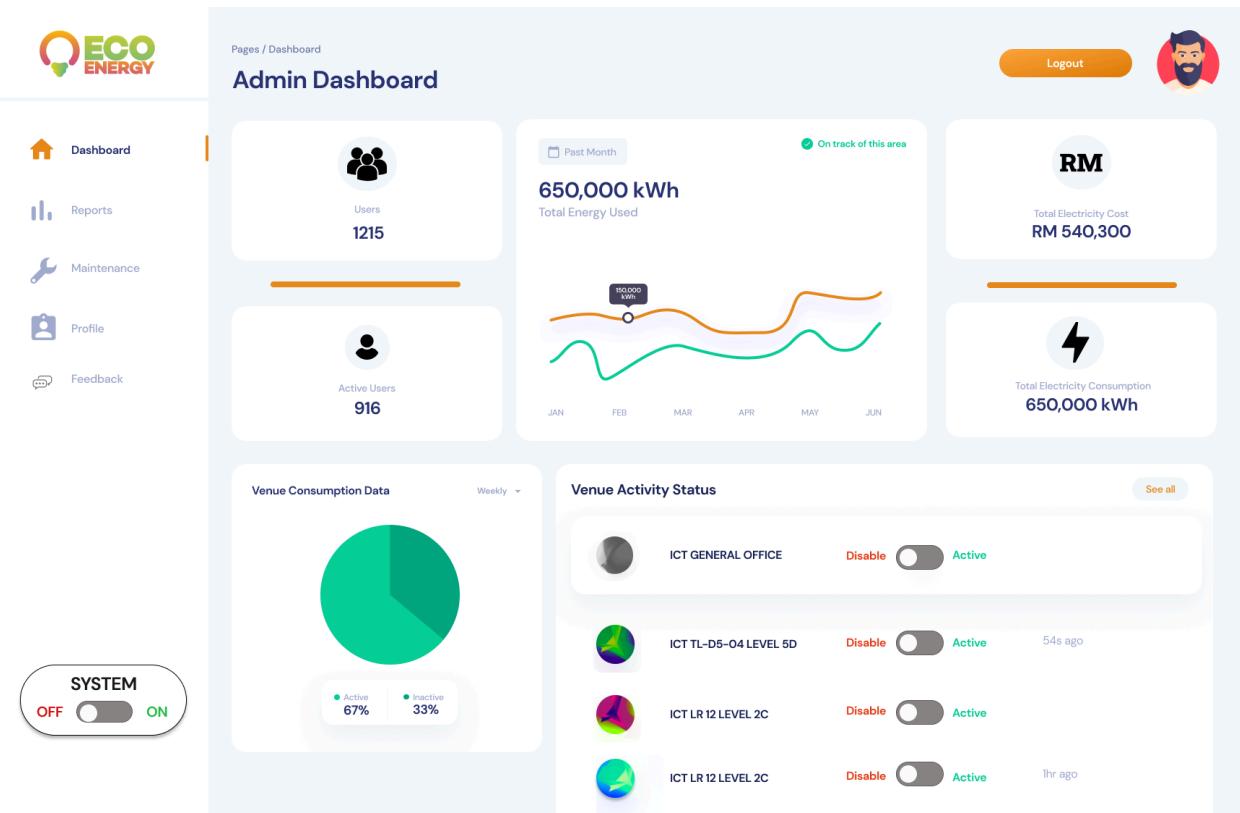


Figure: Admin Dashboard (inactive)

An example of the dashboard with all classrooms having their power disabled.

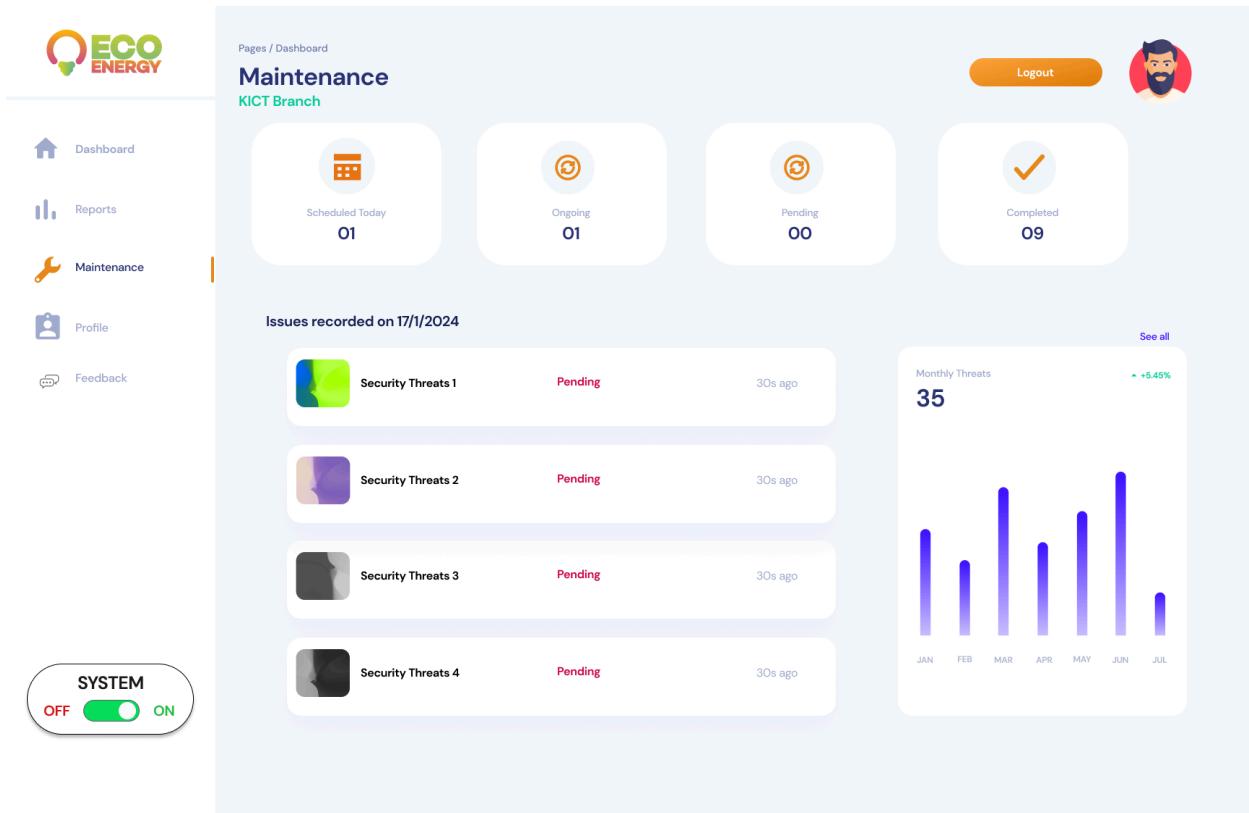
## Admin report page

The screenshot displays the 'Reports' section of the ECO ENERGY admin interface. On the left, a sidebar lists navigation options: Dashboard, Reports (which is the active tab), Maintenance, Profile, and Feedback. The main content area has a header 'Pages / Reports' and 'Reports'. It includes filter inputs for 'Date Start' (01/05/2024) and 'Date End' (31/05/2024), a 'Venue' dropdown set to 'KICT MAIN HALL', and a prominent green 'Generate Report' button. A central text block explains the function of generating reports for daily, weekly, and monthly periods across various venues. To the right is a stylized illustration of a person holding a laptop, standing next to a large screen displaying charts and a megaphone, symbolizing data analysis and reporting.

**Figure: Generate Report Page**

The report page enables admins to generate reports, which can include details such as room type, types of electronics, and selected dates. The reports can also be produced in various output formats.

## Admin maintenance page



**Figure: System Maintenance Page**

The maintenance page for admins allows them to identify areas needing maintenance and directly contact a technician to address the issues. Manuals are also provided.

## Admin Profile page

The screenshot shows the 'Profile' section of the ECO ENERGY application. At the top, there's a navigation bar with the 'Logout' button and a user icon. On the left, a sidebar lists 'Dashboard', 'Reports', 'Maintenance', 'Profile' (which is selected and highlighted in blue), and 'Feedback'. Below the sidebar is a system toggle switch labeled 'SYSTEM' with 'OFF' and 'ON' options. The main content area has a yellow header bar with the text 'Your Profile'. It features a circular profile picture of a man with a beard, with an 'Edit Picture' button below it. To the right of the picture, the user's details are listed:

Admin ID:	A-15832
Name:	Amar Hamza (Admin)
Address:	Selangor, Malaysia
Contact No.:	0168372941
Email:	Ahamza12@gmail.com
Password:	*****

**Figure: Admin Profile page**

On the user profile page, users can update their information to maintain an accurate account.

## Leave Feedback Admin page

The screenshot shows the 'Leave Feedback' page within the 'Feedback Admin' section of the ECO ENERGY application. The left sidebar includes links for Dashboard, Reports, Maintenance, Profile, and Feedback & Tips. The main content area has a title 'Leave Feedback' and a 'View Feedback' button. It features sections for 'Feedback Type' (Software Type selected), 'Address' (CISCO LAB LVL 4), and 'Electronics & Other Information' (checkboxes for Lights, PC, Projectors, Air-Conditioners, and Other). A large text area for feedback contains the following text: 'The CISCO LAB LVL 4 has several issues that need urgent attention. The air conditioning system is not functioning properly, leading to an uncomfortable environment, especially during peak hours. These issues significantly hinder productivity & need to be addressed as soon as possible.' Below this text is a note: 'You have 300 words left!'. At the bottom are a 'SYSTEM' toggle switch (set to ON) and a 'Submit Feedback' button.

**Figure: Leave Feedback Admin page**

On the Leave Feedback Admin page, administrators can submit their own feedback or comments regarding the system or user experiences.

## View Feedback Admin page

The screenshot shows the 'View feedback' section of the ECO ENERGY admin dashboard. At the top right, there is a 'Logout' button and a user profile icon. On the left, a sidebar menu includes 'Dashboard', 'Reports', 'Maintenance', 'Profile', and 'Feedback & Tips'. A toggle switch at the bottom left is labeled 'SYSTEM' with 'OFF' and 'ON' options. The main content area has a title 'View feedback' and a 'Leave Feedback' button. It features sorting options for 'Date:' (Ascending) and 'Type:' (Descending). Below these are three feedback entries:

- User ID: A-93813  
Date: 09/06/2024  
Feedback Type: Data Accuracy  
Venue: ICL LR 12 LVL 2C  
Other Info: Lights
- User ID: 54315  
Date: 10/06/2024  
Feedback Type: Performance  
Venue: -  
Other Info: System
- User ID: 21845  
Date: 11/06/2024  
Feedback Type: Usability  
Venue: -  
Other Info: -

At the bottom right of the content area, there is a 'Page 1 ▶' button.

**Figure: View Feedback Admin page**

On the View Feedback Admin page, administrators can browse and manage all feedback submitted by users.

## View Individual Feedback Admin page

The screenshot shows the 'View feedback' section of the Admin dashboard. At the top right, there are 'Logout' and user profile icons. On the left, a sidebar includes 'Dashboard', 'Reports', 'Maintenance', 'Profile', and 'Feedbacks & Tips'. A 'SYSTEM' toggle switch is at the bottom left. The main area has a title 'View feedback' and a 'Leave Feedback' button. It displays two feedback entries. The first entry, highlighted with a red border, is for User ID 54315 on 10/06/24. It describes system lag during peak hours. The second entry, partially visible, is for User ID 21845 on 11/06/24, categorized as Usability feedback. A 'Page 1' indicator is at the bottom right.

User ID	Date	Feedback Type	Venue	Other Info
54315	10/06/24	Data A	ICT LR 12 LVL 20	Lights
21845	11/06/24	Usability	-	-

**Figure: View Individual Feedback Admin**

On the View Individual Feedback Admin page, administrators can review detailed feedback submitted by users.

## Login User Page

The screenshot shows the login page for 'ECO ENERGY'. On the left, there is a large orange background featuring the company's logo, which consists of a white stylized 'Q' shape above the words 'ECO ENERGY' in a bold, white, sans-serif font. To the right of the logo is the login form.

**Login**

Enter your email & password to log-in!

Email\*

alif12@gmail.com

Password\*

\* \* \* \* \*

Keep me logged in

[Forgot password?](#)

[Login](#) [Register](#)

**Figure: Login User Page**

On the Login User page, users can enter their credentials to access their account.

## Register User page



The page features a large orange header area containing the "ECO ENERGY" logo. The logo consists of a white stylized lightbulb icon above the words "ECO" and "ENERGY" in a bold, white, sans-serif font.

**Registration**

Enter your email & password to Register!

Email\*

Password\*

Confirm Password\*

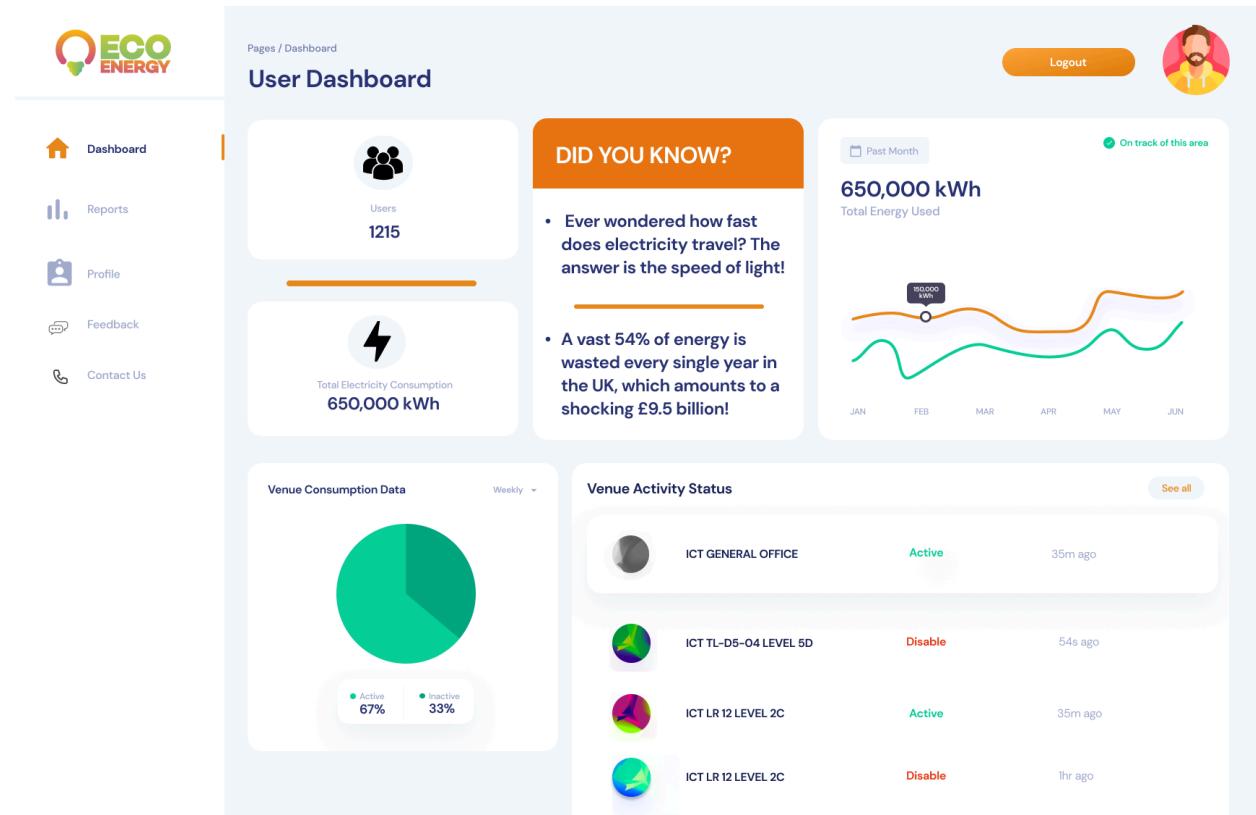
Keep me logged in

**Register** **Login**

**Figure: Register User page**

On the Register User page, users can provide their information to create a new account.

## User dashboard



**Figure: User Dashboard**

This page is the user dashboard. Unlike the admin dashboard, it does not provide full privileges such as disabling power in a room. However, it allows users to view power usage, budget, various facts, and the status of rooms (active/inactive).

## User report page

The screenshot shows the 'Reports' section of the ECO ENERGY application. At the top, there's a navigation bar with the 'ECO ENERGY' logo, a 'Logout' button, and a user profile icon. On the left, a sidebar menu includes 'Dashboard', 'Reports' (which is currently selected), 'Profile', 'Feedback', and 'Contact Us'. The main content area is titled 'Recent Reports' and shows one item: 'June\_Monthly\_Report' (PDF, Processing, 5m ago). Below this is a section titled 'All Reports' containing six items: 'January\_Monthly\_Report', 'February\_Monthly\_Report', 'March\_Monthly\_Report', 'April\_Monthly\_Report', and 'May\_Monthly\_Report', each with a PDF icon.

**Figure: View Reports Page**

This feature allows users to view reports generated by the admin.

## Profile User page

The screenshot shows the 'Profile' section of the ECO ENERGY application. At the top, there's a navigation bar with the ECO ENERGY logo, the text 'Pages / Profile', 'Profile', 'BIT 2nd Year', a 'Logout' button, and a user icon. On the left, a sidebar lists 'Dashboard', 'Reports', 'Profile' (which is selected and highlighted in blue), 'Feedback', and 'Contact Us'. The main content area has a yellow header bar with the text 'Your Profile'. Below it is a circular placeholder for a profile picture, with an 'Edit Picture' button underneath. To the right, the user's information is displayed in a table format:

User ID:	<b>44507</b>
Name:	<b>Alif Hakim</b>
Address:	<b>Selangor, Malaysia</b>
Contact No.:	<b>0168372941</b>
Email:	<b>Alif12@gmail.com</b>
Password:	<b>*****</b>

**Figure: User Profile page**

On the user profile page, users can update their information to maintain an accurate account.

## User feedback page

The screenshot shows the 'Feedback' section of the ECO ENERGY application. The left sidebar includes links for Dashboard, Reports, Profile, Feedback (which is highlighted), and Contact Us. The main content area has a title 'Submit Feedback'. It contains fields for 'Feedback Type' (set to 'Critical Feedback'), 'Address' (set to 'ICT Lab Lvl 4'), and 'Electronics & Other Information' (checkboxes for Lights, PC, Projectors, Air-Conditioners, and Other). A large text area for 'Feedback' contains a sample text about lighting and air conditioning issues. A note at the bottom says 'You have 300 words left!'. A prominent orange 'Submit Feedback' button is at the bottom.

**Figure: User Feedback Page**

The user feedback page enables users to provide feedback for the admin to review. Users can specify the type of feedback, location, and any electronics involved. They must also give a detailed explanation of their feedback and indicate if they would like to be notified about any follow-up actions.

## Submit Feedback page

The screenshot shows the 'Submit Feedback' page. At the top left is the ECO ENERGY logo. The top right features a 'Logout' button and a user profile icon. The header includes 'Pages / Dashboard', 'Feedback', and 'BIT 2nd Year'. On the left sidebar, there are links for 'Dashboard', 'Reports', 'Profile', 'Feedback' (which is highlighted in orange), and 'Contact Us'. The main content area has a title 'Submit Feedback'. On the left, a sidebar shows 'Feedback Type' (selected 'Critical Feedback'), 'Electronics & Other Information' (checkboxes for 'Lights' and 'PC' - 'Lights' is checked), and a feedback text area: 'The ICT Lab on Level 1 is insufficient, making it hard for students to see their work clearly. The environment, especially at night, is uncomfortable and need to be addressed as soon as possible.' Below this is a note 'You have 300 words left!'. In the center, a large box displays 'Feedback Submitted!' with a red 'X' icon in the top right corner. To the right of this box are two empty text input fields. At the bottom is an orange 'Submit Feedback' button.

**Figure: Submit Feedback page**

On the Submit Feedback page, users are invited to provide their comments and suggestions to help improve our services.

**This is for future updates (Not included in any of the above diagram)**

## Contact Us User page

The screenshot shows the 'Contact Us' page of a web application. At the top, there's a navigation bar with the 'ECO ENERGY' logo, a 'Logout' button, and a user profile icon. Below the navigation is a sidebar with links: 'Dashboard', 'Reports', 'Profile', 'Feedback', and 'Contact Us' (which is highlighted with an orange border). The main content area has a title 'Contact Us' and a sub-section 'Electronics & Other Information' with checkboxes for 'Lights', 'PC', 'Projectors', 'Air-Conditions', 'Other', and 'URGENT'. There are dropdown menus for 'What can we help you with?' (Type of problem) and 'Location' (ICT Lab Lvl 5). A text area titled 'More About The Subject' contains the following text: 'The lighting is insufficient, making it hard for students to see their work clearly. Additionally, the air conditioning system is not functioning properly, leading to an uncomfortable environment, especially during peak hours. These issues significantly hinder productivity and need to be addressed as soon as possible.' A note at the bottom says 'You have 300 words left!'. At the bottom right is a large orange 'SUBMIT' button.

**Figure: Contact Us User Page**

On the Contact Us page, users can reach out with any questions, concerns, or inquiries they may have. In future updates, we will introduce additional features to enhance this page, providing users with more comprehensive support options. Further details on these improvements will be provided as they become available.

### **3. Summary**

The Energy Monitoring System project is a strategic change project that targets to solve energy problems in educational facilities, covering areas like energy usage, comparison, and increasing energy awareness among the stakeholders. This project relates to the United Nations Sustainable Development Goal 7, which aims at affording accessible, reliable, sustainable and modern energy for all. Using methods like Fishbone diagrams, it points to issues like absence of sophisticated monitoring systems, low awareness, and no well-defined reference levels on energy use.

The project not only points out these problems but also offers a new management system that includes such elements as real-time dashboards, occupancy analytics, and individual reports. To achieve this, it conducts comprehensive assessments and interviews with the key stakeholders to acquire a rich insight into the existing energy situation in educational facilities. The envisioned system, which includes the interfaces that are easy to use and some of the features such as occupancy detection, is a complete revolution in the current methods of energy management.

The engagement of stakeholders is core to the project as is evident from survey data, which shows that there is a collaborative approach towards changing energy practices in learning institutions. Finally, it is expected that this project will contribute greatly to improving sustainability and utilising resources to the maximum extent, thus introducing an era of energy-saving schools and universities.

## REFERENCES

1. Thollander, P., & Palm, J. (2010). *Improving energy efficiency in industrial energy systems: An interdisciplinary perspective on barriers, energy audits, energy management, policies, and programs*. Springer Science & Business Media.
2. Granderson, J., & Piette, M. A. (2009). *Energy information systems (EIS): Technology costs, benefits, and best practice uses*. Ernest Orlando Lawrence Berkeley National Laboratory, LBNL Paper LBNL-1975E.
3. Sullivan, R., & Gouldson, A. (2013). *Ten years of corporate action on carbon reduction: What do we have to show for it?* Energy Policy, 60, 733-740.