UTM
UNIVERSITI TEKNOLOGI MALAYSIA

Project 4

SECJ1023-PROGRAMMING TECHNIQUE II

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Section 01

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VIDEO LINK: PT2 project.mp4

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INTRODUCTION

One of the most important issues facing our planet today is sustainable development, with Sustainable Development Goal 12 (SDG12) concentrating particularly on responsible production and consumption (UN Environment Programme, n.d.). Every aspect of society, including colleges and universities, must work together to achieve this goal. The aim of the project is to get students involved in SDG 12 by creating a calculator that measures and grades their environmental efforts.

Developing a tool to motivate students to engage in sustainable activities is the key objective of this project. Students can measure their energy use and recycling behaviours to get insights into their environmental effect and be inspired to make more sustainable decisions. The contribution score calculator, which evaluates students' performance based on their energy use and recycling efforts, is designed and implemented as described in this study.

The calculator is built on the principles of object-oriented programming, with different classes representing different recyclable materials and related items. Moreover, the calculator takes into account the energy consumption of electricity and water use and provides a comprehensive assessment of the contribution of each student to the promotion of sustainability. With this initiative, we hope to encourage a culture of environmental responsibility among students in the Faculty of Computing and significantly contribute to the achievement of Sustainable Development Goal 12.

PROBLEM STATEMENT

The challenge of responsible consumption and production transcends geographical and social boundaries, appearing as ineffective resource management, inefficient manufacturing, and unsustainable consumption. This cycle causes environmental degradation, social inequity, and economic instability. Rapid urbanisation, industry, and population increase have heightened the need of solving this issue.

SDG 12 - Responsible Consumption and Production - emphasises the need to solve these fundamental issues. SDG 12 strives to make the world more fair, resilient, and environmentally sustainable by promoting waste reduction, energy conservation, and sustainable resource management. However, as consumption exceeds global boundaries, environmental harm worsens, and trash production reaches new levels, the way we are heading is unsustainable. This jeopardises not only SDG 12's objectives, but also the larger goals of sustainable development.

Responsible consumption and production have an impact on every level of society, including income, public health, and generational equity. Unchecked production and consumption have serious environmental implications, including deforestation, habitat loss, climate change, and pollution. These unsustainable practices increase societal problems, particularly in excluded populations, by prolonging inequality, exploitation, and human rights violations.

To attain sustainability, production and consumption systems have to change considerably. Prioritising environmental preservation, social equality, and economic sustainability necessitates changes in attitudes, business practices, and public regulations. Collaboration amongst all stakeholders, including students, instructors, and staff, is important. Our project provides a method for promoting and tracking responsible consumption and production. By analysing recycling and energy consumption and providing scores and rankings, the system encourages users to adopt sustainable practices. This project promotes responsibility towards the environment, equitable society, and economic stability, which are consistent with the aims of SDG 12 and sustainable development.

PROPOSED SOLUTION

This project contributes to Sustainable Development Goal 12 (SDG 12) by encouraging responsible consumption and production through a user-friendly Eco-Calculator. The calculator, created using object-oriented programming techniques, allows users, including students and lecturers, to track recycling efforts and energy consumption. Tracking these activities provides users with insights into their environmental impact, encouraging them to adopt more sustainable behaviours.

The calculator works by allowing users to enter the weights of recyclable items including glass, paper, and plastic. It scores each material depending on its environmental impact, encouraging proper disposal procedures. Furthermore, users enter their monthly electric and water bills to obtain an energy consumption score, emphasising the environmental consequences of resource use.

Combining these scores generates a "contribution score," which is derived by subtracting the energy consumption score from the recycling score. A higher contribution score suggests a more beneficial environmental impact. To effectively engage users, the calculator gives feedback in the form of rankings and encouraging words, promoting continual development in sustainability habits.

Furthermore, the calculator includes a weekly recycling streak tracker to encourage constant participation and recognise ongoing recycling efforts. This feature encourages a sense of accomplishment and emphasises the necessity of long-term ecological responsibility among the user community.

OBJECTIVES

To ensure that the goal of the study is met, the following objectives are formulated:

- Involve students in understanding and contributing to Sustainable Development Goal 12 by creating a calculator that measures their environmental efforts.
- Motivate students to adopt more sustainable habits through the use of a contribution score calculator.
- Encourage students to engage in sustainable activities by offering insights into their environmental impact.
- Foster a culture of environmental responsibility among students in the Faculty of Computing.
- Contribute to the achievement of Sustainable Development Goal 12 by promoting responsible consumption and production practices.

SCOPES

1. User Scope:

- Target Users: The calculator was designed for students and staff in the Faculty of Computing.
- Interaction: Users will engage with an easy command-line interface (CLI) to enter weekly recyclable data and monthly energy consumption.

2. System Scope:

- Functionality: The calculator monitors recyclables (glass, paper, and plastic) collected weekly and calculates their environmental effect score using determined weight-to-score ratios.
- Energy Consumption: Users enter their monthly electric and water bills to calculate the energy consumption impact.
- Output: Provides a contribution score reflecting combined recycling efforts and energy consumption reduction.

3. Technology Scope:

- Languages: Developed using C++ for efficiency.
- Object-oriented: Uses object-oriented programming methods to handle data encapsulation and flexible design.
- Requirements: Runs on normal hardware and is compatible with popular operating systems like Windows and Linux.

4. Impact Scope:

- Educational Motivation: Encourages students and staff to embrace sustainable practices by providing real-time feedback on their recycling and energy-saving efforts.
- Environmental Responsibility: The purpose is to develop an environmental responsibility culture within the Faculty of Computing, which aligns with SDG 12 goals.

PROJECT DESIGN

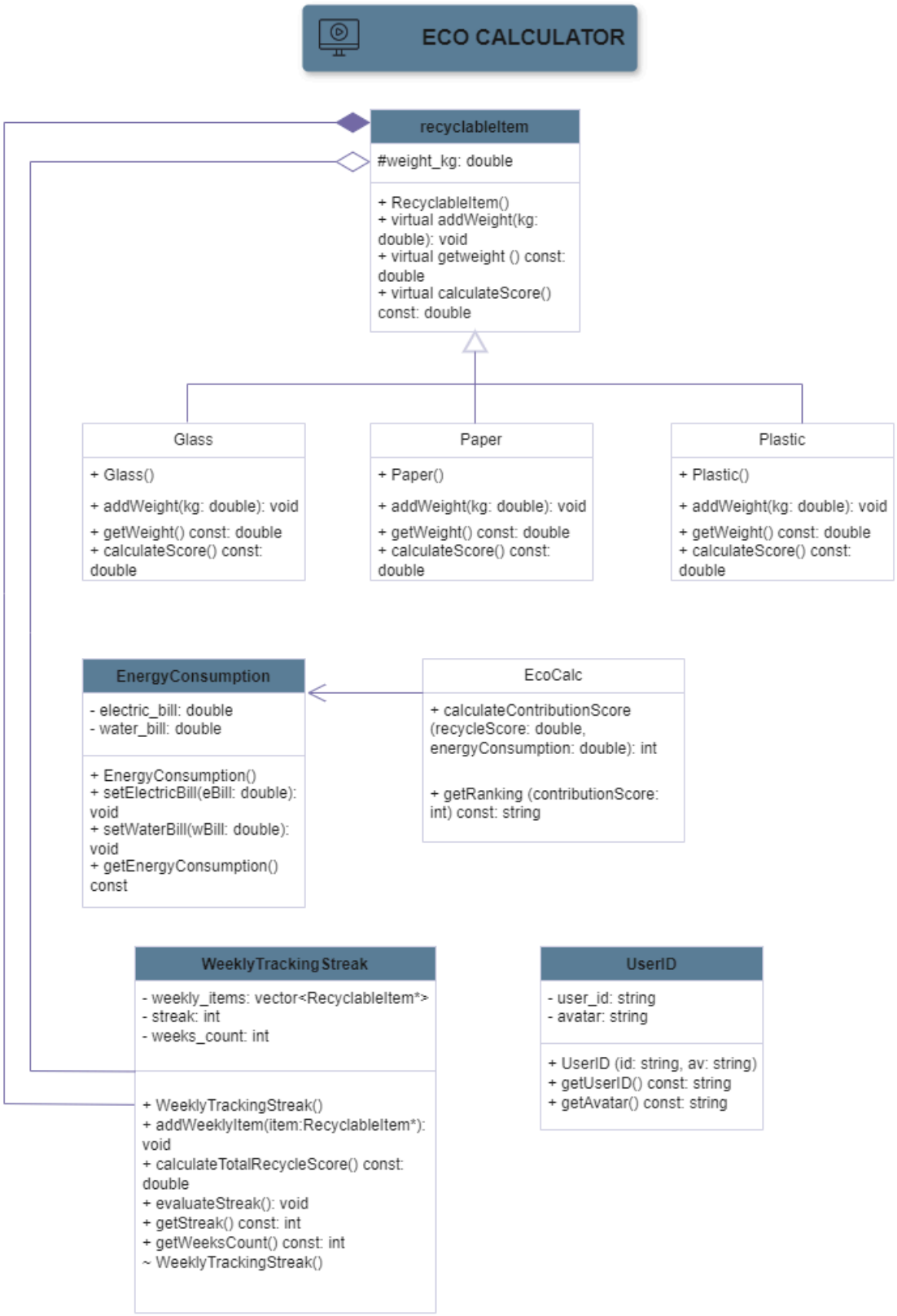

Figure 1 UML Diagram

PROJECT RESULT

1. User Initialisation:

```
Enter your user ID: A23CS0195
Choose your avatar (e.g., EcoWarrior, GreenGuardian): MintyBlue
```

Figure 2

Figure 2 shows that the user enters their unique ID “A23CS0195” and selects an avatar “MintyBlue”

2. Welcome Message:

```
----------------------------------------------------------------
Welcome to the Sustainability Tracker!
Track your recycling and energy usage and make progress in SDG-12
----------------------------------------------------------------
```

Figure 3

Figure 3 shows the welcome message

3. Week 1, Input 1:

```
Week 1, Input 1:
Enter the number of kilograms of glass: 1
Enter the number of kilograms of paper: 2
Enter the number of kilograms of plastic: 3
```

Figure 4

Figure 4 shows user entered 1kg for glass, 2kg for paper and 4kg for plastic for the first session of week 1

4. Week 1, Input 2:

```
Week 1, Input 2:
Enter the number of kilograms of glass: 3
Enter the number of kilograms of paper: 2
Enter the number of kilograms of plastic: 1
```

Figure 5

Figure 5 shows user entered 3kg for glass, 2kg for paper and 1kg for plastic for the second session of week 1,

5. Weekly Tip (Week 1):

```
Weekly Tip: Explore the benefits of solar panels to tap into clean, renewable energy from the sun.
------------------------------------------------------------
```

Figure 6

Figure 6 shows that the program provides weekly tips randomly to encourage sustainable habits.

6. Weekly Streak and Prompt (Week 1):

```
Weekly Streak: 1
Do you want to continue to the next week? (yes/no): yes
```

Figure 7

In the Figure 7, it indicates the current weekly streak (1 week) and prompts the user whether they want to continue to Week 2.

7. Week 2, Input 1:

```
Week 2, Input 1:
Enter the number of kilograms of glass: 1
Enter the number of kilograms of paper: 3
Enter the number of kilograms of plastic: 2
```

Figure 8

Figure 8 shows user entered 1kg for glass, 3kg for paper and 2kg for plastic for the first session of week 2.

8. Week 2, Input 2:

```
Week 2, Input 2:
Enter the number of kilograms of glass: 2
Enter the number of kilograms of paper: 3
Enter the number of kilograms of plastic: 1
```

Figure 9

Figure 9 shows user entered 2kg for glass, 3kg for paper and 1kg for plastic for the second session of week 2.

9. Weekly Tip (Week 2):

```
Weekly Tip: Enjoy shorter showers to help save water and energy.
---------------------------------------------------------------
```

Figure 10

Figure 10 shows that the program provides weekly tips randomly to encourage sustainable habits.

10. Weekly Streak and Prompt (Week 2):

```
Weekly Streak: 2
Do you want to continue to the next week? (yes/no): yes
```

Figure 11

In the Figure 11, it indicates the current weekly streak (2 weeks) and prompts the user whether they want to continue to Week 3.

11. Week 3, Input 1:

```
Week 3, Input 1:
Enter the number of kilograms of glass: 2
Enter the number of kilograms of paper: 3
Enter the number of kilograms of plastic: 4
```

Figure 12

Figure 12 shows user entered 2kg for glass, 3kg for paper and 4kg for plastic for the first session of week 3.

12. Week 3, Input 2:

```
Week 3, Input 2:
Enter the number of kilograms of glass: 4
Enter the number of kilograms of paper: 3
Enter the number of kilograms of plastic: 2
```

Figure 13

Figure 13 shows user entered 4kg for glass, 3kg for paper and 4kg for plastic for the second session of week 3.

13. Weekly Tip (Week 3):

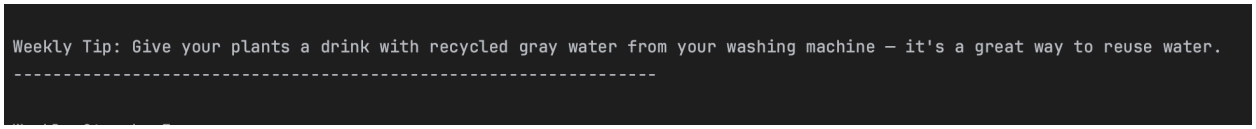

Figure 14

Figure 14 shows that the program provides weekly tips randomly to encourage sustainable habits.

14. Weekly Streak and Prompt (Week 3):

Figure 15

In the Figure 15, it indicates the current weekly streak (3 weeks) and prompts the user whether they want to continue to Week 4.

15. Week 4, Input 1:

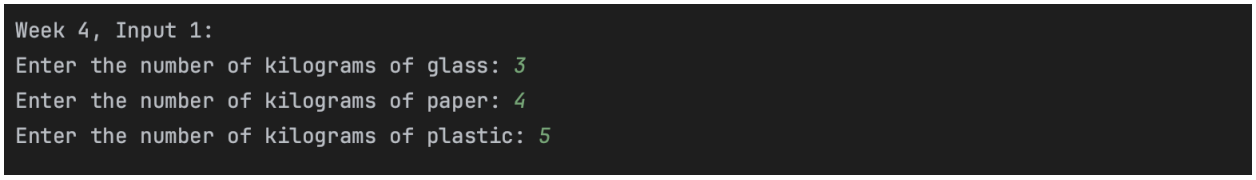

Figure 16

Figure 16 shows user entered 3kg for glass, 4kg for paper and 5kg for plastic for the first session of week 3.

16. Week 4, Input 2:

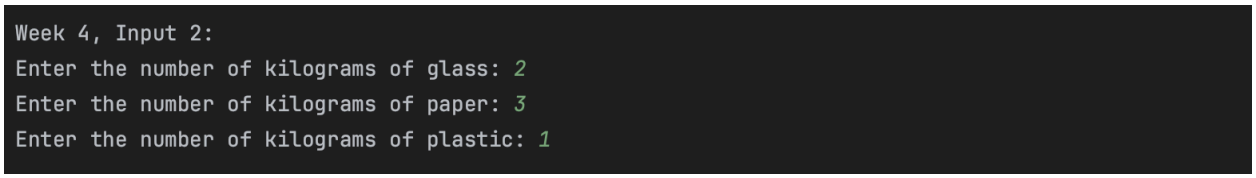

Figure 17

Figure 17 shows user entered 2kg for glass, 3kg for paper and 1kg for plastic for the second session of week 3.

17. Weekly Tip (Week 4):

```
Weekly Tip: Explore the benefits of solar panels to tap into clean, renewable energy from the sun.
------------------------------------------------------------
```

Figure 18

Figure 18 shows that the program provides weekly tips randomly to encourage sustainable habits.

18. Electric and Water Bill Input (Week 4):

```
Enter your electric bill consumption (RM): 60
Enter your water bill consumption (RM): 50
```

Figure 19

Figure 19 shows that the user entered the electric and water bill which is RM 60 and RM 50 respectively.

19. Score Calculation (Week 4):

```
Total Recycle Score: 195
Total Energy Consumption: 42.5
Contribution Score: 152
```

Figure 20

Figure 20 shows the score for Total Recycle Score, Total Energy Consumption and Contribution Score.

20. Achievement Unlocked (Week 4):

```
Excellent Job! You are very responsible in consumption and production. Keep up the great work!

------------------------------------------------------------

Congratulations! You've completed 4 weeks of tracking!
Achievement Unlocked: Consistency is Key!

Weekly Streak: 4
```

Figure 21

Figure 21 shows the feedback where the user are commented on whether or not they are doing a great job in managing waste and energy consumption. Then Congratulations comments will be displayed to applaud the user's streak. The streak is now 4.

21. Final Prompt and Conclusion:

```
Do you want to continue to the next week? (yes/no): no
Thank you for using the Sustainability Tracker, MintyBlue (A23CS019)!
Keep up the great work in promoting sustainability!
```

Figure 21

Figure above shows that the user is given a choice to continue, and upon finishing, thanks the user(‘MintyBlue’) for using the Sustainability Tracker and encouraging continued sustainability efforts.

BENEFIT AND SUMMARY OF THE PROPOSED SYSTEM

The Eco-Calculator proposed here considerably improves sustainability efforts in the Faculty of Computing and promotes progress towards SDG 12. The calculator assists students and staff in understanding their environmental effect by requiring them to track recycling and energy use. Users receive quick feedback in the form of a contribution score, encouraging them to engage in environmentally responsible behaviours that help both the campus and global sustainability goals.

In essence, the Eco-Calculator is an essential tool for encouraging green habits among students and faculty. It analyzes recycling activities for materials such as glass, paper, and plastic, as well as the environmental impact of energy consumption as reported on monthly bills. This integrated method provides clear insights into each user's environmental footprint, encouraging continual improvement in sustainable practices at the Faculty of Computing.

Furthermore, the Eco-Calculator is consistent with the university's environmental goals and global initiatives like SDG 12. It teaches users about environmental conservation and encourages active participation with features such as a weekly recycling streak tracker. By instilling a sense of accomplishment and responsibility, the calculator contributes to a collaborative effort towards a more sustainable future, with its design emphasizing responsible consumption and manufacturing principles.

CONCLUSION

Conclusively, it can be said that our project fulfills the need of Sustainable Development Goal 12 (SDG 12) by leading students to responsible consumption and production with the help of a calculator of contribution points. Designed to monitor recycling and energy consumption, the calculator encourages computer science students to adopt sustainable behavior and assess their environmental impact. Integrating object-oriented programming principles with real-time recycling and energy use data, our tool not only evaluates individual contributions, but also promotes a culture of environmental protection among students.

Continued collaboration between students, faculty, and administrators is essential to expanding the scope and impact of this initiative. By promoting sustainable practices and using technology to increase student engagement, we aim to significantly advance the goals of SDG 12 and move towards a more sustainable future for all.

APPENDIX

Link for the program:

Untitled1.ipynb

https://drive.google.com/file/d/15xzE9j31R_fhDaQnrZcpFww1J4KP-2q5/view?usp=share_link

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