15 Day Report Part-1

1. What theme have you decided for your project?

   Public welfare

2. What is your problem statement?

   Develop a Smart Waste Management System to optimize waste collection routes, predict bin fill levels, and ensure efficient data management. The system aims to minimize travel distances for collection vehicles, prioritize bins needing attention, and support real-time updates for effective waste management and environmental impact reduction.

3. What is the scope of your project?

   - Bin Management: Users can input information about waste bins, including their ID, fill level, and waste type. The system stores this data for further processing.
   - Connection Management: Users can define connections between waste bins, specifying the distance between them. This allows for the creation of a network of interconnected bins.
   - Fill Level Tracking: The system keeps track of the fill level of each waste bin, allowing users to update this information as bins are filled or emptied.
   - Next Bin Prediction: Based on the fill levels of the bins, the system predicts the next bin that needs to be collected. This prediction is made by prioritizing bins with lower fill levels.

- Additional Functionalities: Users can perform additional operations such as viewing all bins and their details, finding the shortest path.

4. What data structure have you decided to use and why?

1. **Graph** for route optimization:
    i. represent graph bin location
    ii. dijkstra's algorithm
2. **Priority Queue** for fill prediction:

    to prioritize bin filling

    efficient routing

3. **Hash Table** for data storages

5. Did you think of any other data structures with similar functionality required for your project? Why did you not choose them instead?

Graph for Bin Connections:

Why I chose it: Graphs are great for representing relationships between objects, making them perfect for modeling connections between waste bins. I needed a structure that could efficiently store connections and allow for pathfinding algorithms to find the shortest route between bins.
Alternative Consideration: I thought about using an adjacency matrix or list, but I ultimately went with a graph because it offers better performance for sparse connections, which is more realistic for waste bin networks.

Trie for Waste Type:

Why I chose it: Tries are excellent for storing and searching string keys, making them ideal for waste types which are typically strings. Since waste types might share common prefixes (e.g., "organic" and "recyclable"), tries provide efficient prefix-based searching.
Alternative Consideration: Hash tables or sets could have been alternatives, offering constant-time lookup. However, I chose a

trie for its suitability for prefix-based searches, which aligns well with the problem of waste types.

Priority Queue for Predicting Next Bin:

Why I chose it: Predicting the next bin for collection based on fill levels requires prioritization. Priority queues allow for efficient retrieval of the item with the highest (or lowest) priority. I chose heapq, which is a simple implementation based on binary heaps, for its ease of use and efficiency.

Alternative Consideration: Binary heaps or balanced binary search trees (BSTs) could have been alternatives. While both offer efficient priority queue operations, heapq provides a straightforward implementation that suited my needs without unnecessary complexity.

6. Have you started working on your project and what all did you accomplish in the past 2 weeks?
    - decided problem statement
    - data structure to be used
    - assigning work to team members
    - basic code with methods
7. Did you face any problems in these 15 days and were you able to resolve them?

    No problem we faced as of now. Deciding the problem statement was the most crucial part and dividing the work among team members.

8. Did you initiate a conversation with your mentor? How has the mentor helped you in finalizing your them and problem statement?

    yes we did initiate conversation with our mentor over gmeet and whatsapp group formation. Our mentor was helpful and guided us over choosing the better problem statement and data structures which we should use .