UPY Gossip Platform: Data Structures Application

Valeria Nicol Hernández Leon
Data Engineering
Universidad Politécnica de Yucatán
Km. 4.5. Carretera Mérida — Tetiz
Tablaje Catastral 4448. CP 97357
Ucú, Yucatán. México
Email: 2309114@upy.edu.mx

Lorena Danae Perez Lopez
Data Engineering
Universidad Politécnica de Yucatán
Km. 4.5. Carretera Mérida — Tetiz
Tablaje Catastral 4448. CP 97357
Ucú, Yucatán. México
Email: 2309179@upy.edu.mx

Elisabeth Arelly Sulú Vela
Data Engineering
Universidad Politécnica de Yucatán
Km. 4.5. Carretera Mérida — Tetiz
Tablaje Catastral 4448. CP 97357
Ucú, Yucatán. México
Email: 2309212@upy.edu.mx

Julio Cesar De Aquino Castellanos
Data Engineering
Universidad Politécnica de Yucatán
Km. 4.5. Carretera Mérida — Tetiz
Tablaje Catastral 4448. CP 97357
Ucú, Yucatán. México
Email: 2309066@upy.edu.mx

Ricardo Daniel Horta Sánchez
Data Engineering
Universidad Politécnica de Yucatán
Km. 4.5. Carretera Mérida — Tetiz
Tablaje Catastral 4448. CP 97357
Ucú, Yucatán. México
Email: 2309122@upy.edu.mx

José Ángel Pech Xool
Data Engineering
Universidad Politécnica de Yucatán
Km. 4.5. Carretera Mérida — Tetiz
Tablaje Catastral 4448. CP 97357
Ucú, Yucatán. México
Email: 2309175@upy.edu.mx

Sara Jeanette Carrillo Ruiz
Universidad Politécnica de Yucatán
Km. 4.5. Carretera Mérida — Tetiz
Tablaje Catastral 4448. CP 97357
Ucú, Yucatán. México
Email: sara.carrillo@upy.edu.mx

Abstract

This project presents the design and implementation of the UPY gossip social network, which incorporates key data structures such as graphs, stacks, queues, and lists to efficiently manage user interactions and data. The platform allows users to post updates, connect with friends, and receive notifications in a streamlined interface, leveraging Python's standard libraries like `tkinter`, `csv`, and `os`, along with custom-built modules for specialized functionality. The use of fundamental data structures ensures that the platform can scale effectively, handle complex social network interactions, and offer a seamless user experience. This study demonstrates the importance of utilizing these structures in building an efficient, user-friendly social network system.

Index Terms

Data Structures, Graphs, Notifications, Post Handling, Queues, Stacks, Social Network, User Management

UPY Gossip Platform: Data Structures Application

I. Introduction

In the digital age, social networks have redefined how people connect and share. This project introduces a platform focused on gossip exchange, enabling users to post, share, receive notifications, and connect through efficient data structures like graphs, stacks, and queues.

II. Data Structures Review

1. Arrays

- **Description:** Stores elements of the same type in contiguous memory locations, accessed via numeric indices.
- **Key Points:**
  - Direct access ($O(1)$).
  - Fixed size, efficient memory use.
  - Difficult to resize; insertions/deletions require shifting elements.

2. Lists (Python)

- **Description:** Dynamic, indexed structure storing elements of any type.
- **Key Points:**
  - Supports $O(1)$ indexed access.
  - Flexible size with operations like `append` and `remove`.
  - Costly mid-insertions ($O(n)$).

3. Queues

- **Description:** FIFO structure, adding at the rear and removing from the front.
- **Key Points:**
  - Operations: `enqueue` (add) and `dequeue` (remove).
  - Implemented with lists or `deque`.
  - No random access.

4. Stacks

- **Description:** LIFO structure; last added element is removed first.
- **Key Points:**
  - Operations: `push` (add) and `pop` (remove).
  - Ideal for reversing data or undo operations.
  - Limited to top-element access.

5. Graphs

- **Description:** Non-linear structure with nodes (objects) and edges (connections).
- **Key Points:**
  - Types: Directed/undirected, weighted/unweighted.
  - Representations: Adjacency list (efficient) and matrix (fast lookups).

6. Hash Maps (Dictionaries in Python)

- **Description:** Key-value pairs for fast lookups, insertions, and deletions.
- **Key Points:**
  - Direct access ($O(1)$) via hash functions.
  - Flexible and dynamic.
  - High memory usage.

III. Methodology

The UPY gossip social network leverages fundamental data structures and Python's standard libraries—`tkinter`, `csv`, and `os`—alongside custom modules to manage core functionalities.

Libraries Used

- **`tkinter`:** Creates the graphical user interface (GUI) for login, registration, feed display, and notifications.
- **`csv`:** Stores essential data such as users (`users.csv`) and posts (`posts.csv`) for easy management without a database.
- **`os`:** Manages file system operations, ensuring compatibility across environments.

Custom Modules

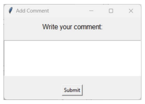
- **src.stack:** Implements a stack for notification management.
- **src.notifications:** Displays notifications in LIFO order using the stack.
- **src.login:** Handles user authentication and access to the post feed.
- **src.feed:** Manages post visualization and interaction.
- **src.signin:** Registers new users and stores their data in `users.csv`.

Data Structures Used

- **Stacks:** Manage notifications (LIFO).
- **Lists:** Store user and post data for fast access.
- **Queues:** Handle friend requests in FIFO order.

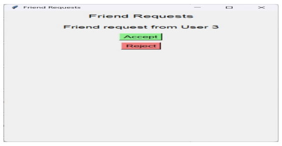
Test cases demonstrating

1) **Post Submission**:
   - **Data Structure Used:** *Stack.*
   - **Purpose:** User posts are managed using a stack to ensure the most recent posts are displayed first (LIFO - Last In, First Out).
2) **Friend Request Queue**:
   - **Data Structure Used:** *Queue.*


Add Comment

Write your comment:

Fig. 1. Post submission system using a stack (LIFO).

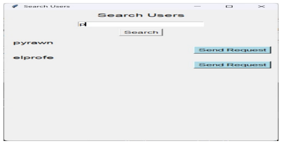

Friend Requests

Friend request from User 3

Fig. 2. Friend request queue managed in FIFO order.

- **Purpose:** Friend requests are handled in chronological order, following the FIFO (First In, First Out) principle.

3) **User Search and Indexed List**:
   - **Data Structure Used:** *Indexed List*.
   - **Purpose:** Enables efficient user searches by allowing access to elements through their indices.


Search Users

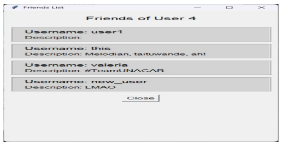
pyrawn

elprofe

Fig. 3. User search and indexed list for efficient navigation.

The user search feature uses an **indexed list** for efficient access.

4) **Logged-in User's Friends List**:
   - **Data Structure Used:** *Indexed List*.
   - **Purpose:** Stores the user's friends in a structure that allows quick traversal and basic operations such as search.


Friends List

Friends of User 4

Username: user1
Description:

Username: this
Description: Melodian, taituwande, ah!

Username: valeria
Description: #TeamUNACAR

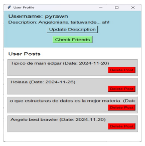
Username: new_user
Description: LMAO

Fig. 4. Logged-in user's friends list displayed as an indexed list.

The friends list is stored as an **indexed list** for fast traversal and search operations.

5) **User Information and Posts**:
   - **Upper Section (User Information):**
     - **Data Structure Used:** *Array*.
     - **Purpose:** Stores basic user information in a fixed and organized format.
   - **Lower Section (Posts):**
     - **Data Structure Used:** *Stack*.
     - **Purpose:** Displays posts in reverse order of creation, with the most recent first.

6) **Notification Stack**:
   - **Data Structure Used:** *Stack*.


User Profile

Username: pyrawn
Description: Angelonians, taituwande... ah!

User Posts

Tipico de main edgar (Date: 2024-11-26)

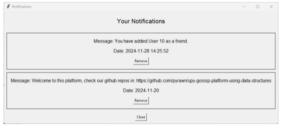
Holaaa (Date: 2024-11-26)

o que estructuras de datos es la mejor materia. (Date

Angelo best brawler (Date: 2024-11-20)

Fig. 5. User information (array) and posts (stack).

   - **Purpose:** Manages notifications so the most recent ones are shown first (LIFO).


Notifications

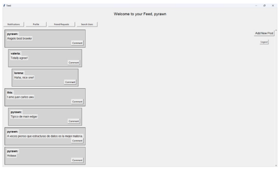
Your Notifications

Message: You have added User 10 as a friend.
Date: 2024-11-28 14:25:52

Message: Welcome to this platform, check our github repos in: https://github.com/pyrawn/upy-gossip-platform-using-data-structures
Date: 2024-11-20

Fig. 6. Notification stack showing the most recent notifications first.

7) **Post Feed Tree**:
   - **Data Structure Used:** *Binary Tree*.
   - **Purpose:** Organizes posts in the user's feed to facilitate searches and prioritization.


Feed

Welcome to your Feed, pyrawn

pyrawn:
Angelo best brawler

valeria:
Totally agree!

lorena:
Haha, nice one!

this:
t amo juan carlos uwu

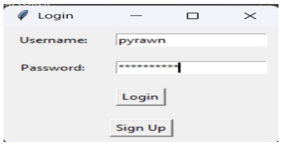
pyrawn:
Tipico de main edgar

pyrawn:
A veces pienso que estructuras de datos es la mejor materia.

pyrawn:
Holaaa

Fig. 7. Post feed organized using a binary tree.

8) **Login System**:
   - **Data Structure Used:** *Hash Map (Dictionary)*.
   - **Purpose:** Stores and validates user credentials, enabling fast and secure access.


Login

Username: pyrawn

Password: ***********

Fig. 8. Login system using a hash map (dictionary).

IV. Conclusion

The UPY gossip social network leverages fundamental data structures such as graphs, queues, stacks, and binary search trees to deliver core functionalities like user management, post handling, and friend recommendations. By integrating Python's standard libraries with custom modules, the platform ensures efficiency, scalability, and ease of use, providing a strong foundation for future development and enhancements.

References

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