Hash Table Implementation

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This project provides a simple implementation of a hash table using linear probing in Python. The project is divided into two main files:

Files

`hash_table.py`

This file contains the `HashTableLinearProbing` class, which represents the hash table. The class includes methods for initializing the hash table, saving and loading data from a JSON file, calculating hash values, inserting, searching, deleting, and displaying key-value pairs in the hash table.

Class Methods:

- `__init__(self, size=0)`: Initializes the hash table with an optional size parameter.
- `save_to_json(self, filename="hash_table.json")`: Saves the hash table data to a JSON file.
- `load_from_json(self, filename="hash_table.json")`: Loads the hash table data from a JSON file.
- `calc_hash(self, key)`: Calculates the hash value for a given key.
- `insert(self, key, value)`: Inserts a key-value pair into the hash table if the key does not exists and update if the ket exists.
- `search(self, key)`: Searches for a key in the hash table and returns its associated value.
- `delete(self, key)`: Deletes a key-value pair from the hash table.
- `display(self)`: Displays the contents of the hash table.

`main.py`

This file serves as the main entry point for the hash table application. It provides a simple command-line interface for interacting with the hash table.

Functions:

- `get_valid_size()`: Prompts the user to enter a valid size for the hash table.
- `get_valid_key()`: Prompts the user to enter a valid string key.
- `display_menu()`: Displays the menu of available hash table operations.

- `main()`: Implements the main loop for user interaction, allowing the creation of a new hash table, loading and saving from/to JSON, and performing insert, search, delete, and display operations.

Usage

To run the program, execute the `main.py` script. Follow the on-screen prompts to perform various operations on the hash table.

Requirements

- Python 3.x

How to Run

1. Clone the repository to your local machine.
2. Open a terminal and navigate to the project directory.
3. Run the command: `python main.py`
4. Follow the on-screen prompts to interact with the hash table.

Image Gallery

create new hash table

```
PS E:\master\data structure> python .\main.py

Hash Table Operations:
1. Create a new hash table
2. Load from JSON
3. Save to JSON
4. Insert
5. Search
6. Delete
7. Display
8. Exit
Enter your choice (1-8): 1
Enter the size of the hash table: 5
New hash table created with size 5.

Hash Table Operations:
1. Create a new hash table
2. Load from JSON
3. Save to JSON
4. Insert
5. Search
6. Delete
7. Display
8. Exit
Enter your choice (1-8): 7
HashTable:
Index 0: Empty
Index 1: Empty
Index 2: Empty
Index 3: Empty
Index 4: Empty
```

delete from hash table

```
Hash Table Operations:
1. Create a new hash table
2. Load from JSON
3. Save to JSON
4. Insert
5. Search
6. Delete
7. Display
8. Exit
Enter your choice (1-8): 6
Enter key: ali
Key 'ali' deleted.

Hash Table Operations:
1. Create a new hash table
2. Load from JSON
3. Save to JSON
4. Insert
5. Search
6. Delete
7. Display
8. Exit
Enter your choice (1-8): 7
HashTable:
Index 0: Key = muhammad, Value = 01008550826
Index 1: Empty
Index 2: Empty
Index 3: Empty
Index 4: Empty
```

display hash table

```
Hash Table Operations:
1. Create a new hash table
2. Load from JSON
3. Save to JSON
4. Insert
5. Search
6. Delete
7. Display
8. Exit
Enter your choice (1-8): 7
HashTable:
Index 0: Key = muhammad, Value = 01008550826
Index 1: Key = ali, Value = 123456789
Index 2: Empty
Index 3: Empty
Index 4: Empty
```

insert into hash table (not a valid key)

```
Hash Table Operations:
1. Create a new hash table
2. Load from JSON
3. Save to JSON
4. Insert
5. Search
6. Delete
7. Display
8. Exit
Enter your choice (1-8): 4
Enter key: 9
Invalid input. Key must be a string.
Enter key:
```

insert into hash table (valid key)

```
PS E:\master\data structure> python .\main.py

Hash Table Operations:
1. Create a new hash table
2. Load from JSON
3. Save to JSON
4. Insert
5. Search
6. Delete
7. Display
8. Exit
Enter your choice (1-8): 1
Enter the size of the hash table: 5
New hash table created with size 5.

Hash Table Operations:
1. Create a new hash table
2. Load from JSON
3. Save to JSON
4. Insert
5. Search
6. Delete
7. Display
8. Exit
Enter your choice (1-8): 4
Enter key: muhammad
Enter value: 01203131319
Key-value pair inserted.
```

invalid choice

```
PS E:\master\data structure> python .\main.py

Hash Table Operations:
1. Create a new hash table
2. Load from JSON
3. Save to JSON
4. Insert
5. Search
6. Delete
7. Display
8. Exit
Enter your choice (1-8): 9
Invalid choice. Please enter a number between 1 and 8.
```

json file not found

```
PS E:\master\data structure> python .\main.py

Hash Table Operations:
1. Create a new hash table
2. Load from JSON
3. Save to JSON
4. Insert
5. Search
6. Delete
7. Display
8. Exit
Enter your choice (1-8): 2
Enter the JSON file name to load from: test2
JSON file not found or invalid. Using default hash table.
```

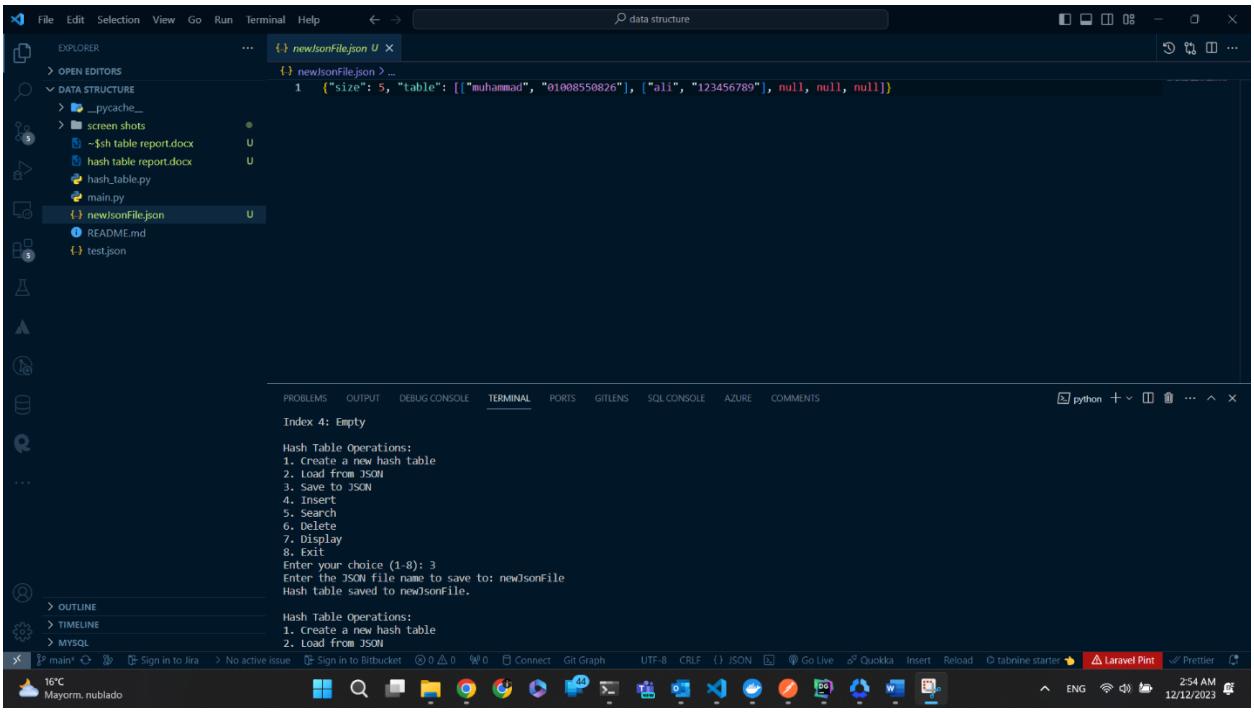
load from json file

```
PS E:\master\data structure> python .\main.py

Hash Table Operations:
1. Create a new hash table
2. Load from JSON
3. Save to JSON
4. Insert
5. Search
6. Delete
7. Display
8. Exit
Enter your choice (1-8): 2
Enter the JSON file name to load from: test.json
Hash table loaded from JSON.

Hash Table Operations:
1. Create a new hash table
2. Load from JSON
3. Save to JSON
4. Insert
5. Search
6. Delete
7. Display
8. Exit
Enter your choice (1-8): 7
HashTable:
Index 0: Key = m, Value = 789
```

save to json file



search for a key

```
New hash table created with size 5.

Hash Table Operations:
1. Create a new hash table
2. Load from JSON
3. Save to JSON
4. Insert
5. Search
6. Delete
7. Display
8. Exit
Enter your choice (1-8): 4
Enter key: muhammad
Enter value: 01203131319
Key-value pair inserted.

Hash Table Operations:
1. Create a new hash table
2. Load from JSON
3. Save to JSON
4. Insert
5. Search
6. Delete
7. Display
8. Exit
Enter your choice (1-8): 5
Enter key: muhammad
Value for key 'muhammad': 01203131319
```

update value in hash table

```
Enter your choice (1-8): 5
Enter key: muhammad
Value for key 'muhammad': 01203131319

Hash Table Operations:
1. Create a new hash table
2. Load from JSON
3. Save to JSON
4. Insert
5. Search
6. Delete
7. Display
8. Exit
Enter your choice (1-8): 4
Enter key: muhammad
Enter value: 01008550826
Key is already in the table, and is updated successfully
Key-value pair inserted.

Hash Table Operations:
1. Create a new hash table
2. Load from JSON
3. Save to JSON
4. Insert
5. Search
6. Delete
7. Display
8. Exit
Enter your choice (1-8): 5
Enter key: muhammad
Value for key 'muhammad': 01008550826
```