Donnie Minnick
CS727 - Deliverable 5 Solution Readme File
2025-04-30

Value Measurement Database Application

Overview

The Value Measurement Database Application is a Python-based graphical user interface (GUI) designed to manage transformation initiatives via a connected MySQL database. Built with Tkinter, it features a tabbed, user-friendly interface supporting CRUD operations across multiple tables.

Features

- **UI Generation:** Creates input fields based on database schema.
- **Full CRUD Support:** Create, read, update, and delete records for all tables.
- **Scrollable Table View:** Treeview widget with vertical scrolling for large datasets.
- **NULL Handling:** Safely handles empty fields with automatic NULL insertion.
- **Secure DB Connectivity:** Uses mysql.connector with a config.ini for credential management.
- **Built-in Error Handling:** Exceptions are caught and displayed directly in the GUI.
- **Custom Query Execution:** Users can store, run, and download results of complex SQL queries.

Installation

Prerequisites

- Python 3.x
- MySQL Server
- Required Python Packages: `configparser, datetime, logging, mysql-connector, os, re, tkcalendar, tkinter, uuid`

Database Setup

1. Create a MySQL database named `value`.
2. Add the following tables:
    - `initiative`
    - `event`
    - `metric`
    - `plan`
    - `event_plan`
    - `global_metric_value`
    - `plan_metric_value`
    - `user_query`
3. Edit `config.ini` with your database credentials.

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Separate `create_value_database.sql` file contains MySQL-compliant scripts to generate normalized database tables with indexes.

Usage

Running the Application

Execute the following command:

```
python app.py
```

GUI Guide

- **Switch Tabs:** Each tab maps to a different database table.
- **Add Record:** Fill in inputs and click Add.
- **Update Record:** Select a row, edit inputs, then click Update.
- **Delete Record:** Select a row and click Delete.
- **Refresh:** Reload the latest data from the database.
- **Run Queries:** Save, execute, and download SQL queries from within the GUI.

File Structure

- `app.py` - Main GUI application.
- `database.py` - Core database interaction class.
- `downloader.py` - Export query results to csv.
- `messenger.py` - Centralized logging and user feedback.
- `widget_binder.py` - Syncs widget values across forms.
- `config.ini` - Stores database connection details (never commit sensitive credentials!)

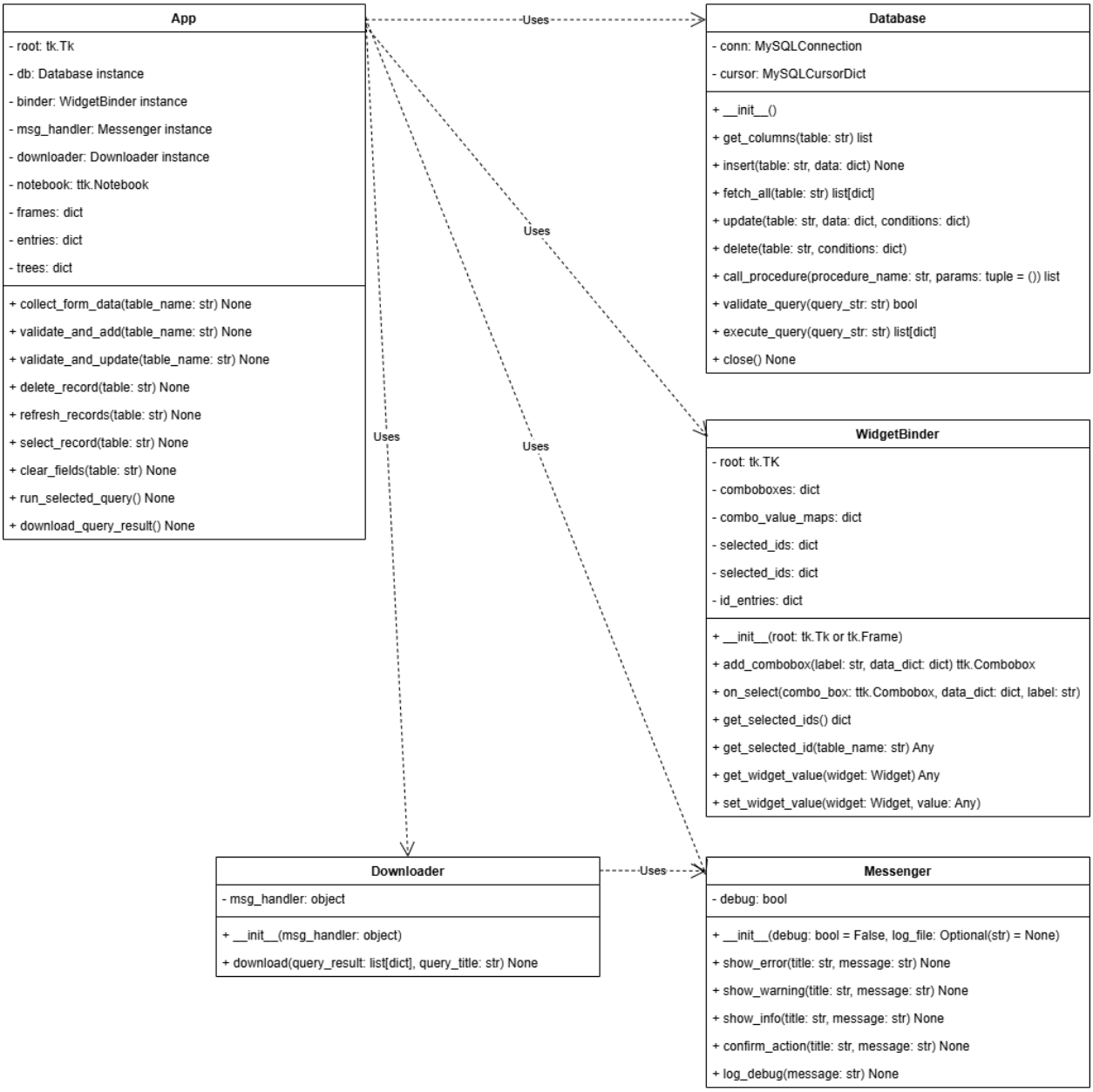
Config.ini File Format

This file stores MySQL login credentials and connection details in a structured format under a section named [value]. Each line represents a key-value pair used to establish a connection to a MySQL database:

- **`host = localhost`:** Specifies that the MySQL server is running on the local machine.
- **`user = XXXXXXXX`:** The username used to connect to the MySQL server.
- **`password = XXXXXXXX`:** Placeholder for the actual password associated with the user.
- **`database = value`:** The name of the database to connect to.

This file can be securely read by the `database.py` using `configparser`.

Keep it outside version control (e.g., in .gitignore).



Class Structure Diagram

The following diagram provides a clear visual map of the applicationb structure: its classes, attributes, methods, and relationships.

Error Handling

Exception messages are raised from `database.py` and other classes, and displayed in the application using the functionality of `messenger.py`.

To accomplish this, database calls and other functions are wrapped in try-except blocks and any error messages are displayed via message boxes.

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SQL Integration

Database Connection

The Database class connects to MySQL using credentials from `config.ini`.

Method Summary

Method	Purpose	Example
get_columns(table)	Fetch column names	db.get_columns("users")
insert(table, data)	Insert record with auto-id handling	db.insert("users", {"name", "Alice"})
fetch_all(table)	Retrieve all rows	records = db.fetch_all("users")
update(table, data)	Update specific rows	db.update("users", {"email", ...}, {...})
delete(table, conditions)	Delete rows by condition	db.delete("users", {"id", 1})
validate_query(query_str)	Validate query before execution	db.validate_query("SELECT * FROM users")
execute_query(query_str)	Execute query string	db.execute_query("SELECT * FROM users")
close()	Close the connection	db.close()

Error Handling

- All database interactions are enclosed in try-except blocks.
- Errors are raised and displayed using `messenger.py`.
- Enhances traceability and ensures GUI responsiveness during failures.

Security Considerations

- Use environment variables or secrets managers in production.
- Never hardcode credentials.
- Sanitize and validate all user inputs.
- Consider role-based permissions in MySQL.

Future Enhancements

- User authentication and access control.
- Advanced filtering and search functionality.

License

Author

Developed by Donnie Minnick for Deliverable 5 – CS727: Relational Database Implementation and Applications, IIT Master's in Data Science Program.