1. **Innovative Features**

* Our To-Do List includes a **Delay Analysis** feature that detects overdue tasks and generates reports based on task categories. This helps users identify high-priority but incomplete tasks and optimize their time management, unlike most traditional To-Do Lists that only display tasks without systematic overdue analysis. It also supports **Local Data Persistence**, allowing users to save and load tasks in JSON or CSV formats, ensuring privacy without relying on cloud services. Users can easily export task data for further use, such as advanced analysis, which sets it apart from many apps that only support cloud storage.
* The application introduces **Flexible Task Categorization**, enabling users to create custom categories such as "Work" or "Personal," while uncategorized tasks are automatically assigned to "Uncategorized." It also supports multiple priority levels, offering better task organization than the rigid categorization and priority systems of many other apps. Additionally, our To-Do List boasts an **Intuitive GUI with Enhanced Usability**, designed using tkinter. The interface includes dynamic task visualization, such as highlighting overdue tasks with distinct colors, making it user-friendly even for non-technical users, unlike many overly complex traditional interfaces.
* Another standout feature is its **Offline Mode**, which ensures full functionality without internet connectivity. This makes it usable in any environment, a feature missing from most modern apps that rely heavily on cloud services. The application also supports **Task Editing and Import Features**, allowing bulk task imports from CSV files for scenarios with large task volumes and quick updates to task details, features that are rarely seen in standard To-Do Lists.
* Finally, the design of our To-Do List emphasizes **Potential for Future Expansion**, making it easy to add features such as task completion charts using matplotlib, email reminders, or calendar synchronization. This scalability sets it apart from other apps that often lack flexibility for upgrades.

1. **The functionalities and knowledge points of the code**

* **Application Overview**
* **Functionality**: A comprehensive **To-Do List application** for managing tasks with features like adding, editing, marking tasks as completed, and analyzing delays.
* **Key Libraries Used**:
  + tkinter: GUI development.
  + pandas: Data manipulation.
  + json and os: File handling for persistence.
  + datetime: Date and time operations.

## ****GUI Setup****

* **Components**:
  + **Main Window**: Configured with Tk(), set title, geometry, and background.
  + **Fonts**: Customized using tkinter.font.
  + **Widgets**: Labels, text input, dropdown menus, buttons, and a listbox.
* **Key Knowledge**:
  + Understanding widget hierarchy.
  + Using pack() for layout management.

## ****Task Management****

* **Features**:
  + **Add/Update Task**: Add new tasks or edit existing ones.
  + **Edit Task**: Populate fields for updating.
  + **Mark as Completed**: Track task completion and log the timestamp.
  + **Delete Task**: Remove selected tasks from the list.
* **Key Knowledge**:
  + listbox operations (e.g., curselection()).
  + Handling global variables for task storage.

## ****Data Persistence****

* **Features**:
  + **Load Tasks**: Load from tasks.json and tasks.csv.
  + **Save Tasks**: Save tasks in JSON and CSV formats for reusability.
* **Key Knowledge**:
  + File handling with os and json.
  + Reading and writing CSV files using pandas.

## ****Task Display****

* **Features**:
  + **Update Listbox**: Show task details (status, deadline, category).
  + **Clear Listbox**: Refresh task display after updates.
* **Key Knowledge**:
  + Conditional formatting for overdue tasks.
  + Iterating through task data to build UI.

## ****Delay Analysis****

* **Features**:
  + Analyze overdue tasks and provide reports.
  + Categorize overdue tasks and highlight delays.
* **Key Knowledge**:
  + Data filtering and aggregation with pandas.
  + Date calculations using datetime.

## ****Data Import/Export****

* **Features**:
  + Import tasks from an external CSV file.
  + Export current tasks to a user-defined CSV file.
* **Key Knowledge**:
  + File dialog operations with askopenfilename and asksaveasfilename.
  + Efficient use of pandas for I/O.

## ****Advanced Features****

* **Category Handling**:
  + Tasks are categorized (e.g., Work, Personal).
  + Tasks without categories default to "Uncategorized".
* **Priority Levels**:
  + Tasks have priority settings: High, Medium, Low.
* **Key Knowledge**:
  + Handling optional fields gracefully.
  + Dropdown menus with OptionMenu.