Python Report Generator

**Overview**

This system is designed as a report generator for customized report generation. User can upload CSV/Excel data, visualize it using different chart types (such as line charts, bar charts, and pie charts), and export both the data and visual reports into a comprehensive PDF document. The system has a user-friendly graphical interface (GUI) built with **Tkinter**, making it easy to data explore, chart and report generate. Although the system may do not have all the wanted characteristics, but with this skeleton new function is easily added.

**Key Objectives:**

1. **Data Upload:** User can upload datasets in CSV or Excel formats through an interactive interface
2. **Charting Options**:

* Line charts for tracking trends over time.
* Bar charts for comparing categories.
* Pie charts for showing proportional data.

1. **Dynamic Data Selection and visualization**: User can choose specific columns for the X-axis and Y-axis to generate visualizations, the selected data to display is shown as a chart on canvas within application, with each selection canvas is based on selected data and chart types
2. PDF Export: Users can export data, statistics and visualization into a PDF report. This app allows users to append multiple reports and images into a single PDF document.

**Technology Stack:**

* **Tkinter** for the graphical user interface.
* **Pandas** for data manipulation and summary generation.
* **Matplotlib** for data visualization.
* **FPDF** for creating and managing PDF reports.
* **Pathlib** for file system operations.

**Workflow:**

1. **Data Upload**: The user selects a CSV or Excel file to upload. The system reads and displays the data for further processing

A screenshot of a computer

Description automatically generated

Data Upload

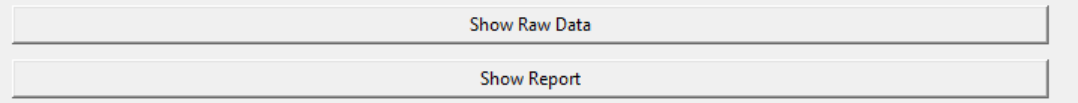
1. Column Selection:

* The user selects the X-axis from the automatically detected columns.
* For the Y-axis, user can choose from a multiple-choice list, selected columns are highlighted and can be cancelled with single click.
* The chart type (line, bar, or pie) is also selectable, providing flexibility

Column Selection


Column Choosing

1. Raw Data and Data Report: Apart from the visualization, user can also view the raw data by clicking the show raw data button, the report here contains count, mean std, min and distribution of data.



Raw Data and Show Report Button

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Example Raw Data

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Example Report

1. Save to Report: User can choose the raw data, data report or visualization to be included into PDF report.

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Save Visualization to PDF

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Save Raw Data to PDF

A screenshot of a computer

Description automatically generated

Save Visualization to PDF

1. PDF Generation: After all the selected report loaded to PDF, user can download the PDF to desired location.A screenshot of a chart

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**System Components**

**1. Graphical User Interface (GUI)**: By using Tinker, a library, the GUI give user access with the application through intuitive windows, buttons, and dialogs. A canvas is used to display charts.

**2. Data Handling**: Data uploaded in CSV or Excel format is processed using Pandas. System automatically fetches the columns for selection, user can generate visualization with parsed dataset.

**3. Visualization**: Using Matplotlib, the system supports the choice of line charts, bar charts, and pie charts.

**4. PDF Export**: Reports, including statistical summaries and charts, are exported into PDF format using FPDF.

**Application to the Bridge Inspection Project**

The system can play a role of report generation for our bridge inspections project. after the inspectors collect data related to a CSV or Excel file, this can be easily uploaded to system, the system file in this system allows multiple datasets.

 Trend **Analysis with Line Charts**:  
Over timely Track changes in bridge health data and metrics such as structural integrity, material wear, and stress levels.

 Comparative **Analysis with Bar Charts**:  
Compare the performance of various structural elements, such as beams and piers, to identify potential weaknesses.

 Proportion **Analysis with Pie Charts**:  
Visualize the proportion of different damage types such as crack and erosion to find the most in need ones.

 Comprehensive **Reporting**:  
After multiple inspections, the system can generate a detailed PDF report that could includes visualizations, raw data, and analysis. The system helps stakeholders to have a clear understanding of the current status

 Long**-Term Maintenance Planning**:  
The system can track inspection cycles, enabling engineers to review historical data and plan future inspections or repairs based on long-term trends.

Summary

This **Report Generator Tool** is highly applicable for out Bridge Inspection Projects, it is extendable to new changes such as new form of report generation and able to upload inspection data, visualize key metrics, and generate comprehensive reports for stakeholders with a customizable field.