**Project Title: PedalPredict**

**Project Description**

PedalPredict is a machine learning-based project aimed at accurately forecasting bike rental demand. The primary goal is to provide bike rental businesses with actionable insights to optimize bike availability, reduce wait times, and improve overall user satisfaction.

**Objectives**

1. **Forecast Demand**: Predict the number of bikes needed at different times and locations.
2. **Optimize Resource Allocation**: Ensure optimal distribution of bikes across stations to meet predicted demand.
3. **Enhance User Experience**: Reduce wait times and increase availability, improving the convenience and satisfaction of bike-sharing users.
4. **Support City Planning**: Provide data-driven insights to city planners for better infrastructure development and traffic management.

**Key Features**

1. **Data Collection and Integration**:
   * Historical bike rental data (timestamps.)
   * Weather data (temperature, humidity, and wind speed.)
   * Temporal data (day of the week, holidays.)
2. **Data Preprocessing**:
   * Cleaning and handling missing values
   * Feature engineering (e.g., extracting day of the week, peak hours)
   * Normalization and scaling of data
3. **Exploratory Data Analysis (EDA)**:
   * Visualize rental patterns over time
   * Analyze the impact of weather conditions on bike rentals
   * Identify trends and seasonality in bike rental data
4. **Model Building and Evaluation**:
   * Machine learning models (I intend to use Linear Regression)
5. **Demand Prediction**:
   * Predict daily and hourly bike rental demand
   * Generate demand forecasts for different times
6. **Visualization and Reporting**:
   * Interactive dashboards using Power BI
   * Visualize actual vs. predicted demand
7. **Optimization and Recommendations**:
   * Recommend optimal bike distribution strategies
   * Provide insights for improving infrastructure

**Problem Statement**

Bike rental businesses face the challenge of balancing supply and demand. During peak hours or special events, bike shortages can lead to user frustration and operational inefficiencies. PedalPredict aims to address this issue by accurately forecasting bike demand, enabling better resource management and enhancing the user experience.

**Workflow**

1. **Data Collection**: Gather historical data on bike rentals, weather, and other relevant factors.
2. **Data Preprocessing**: Clean and preprocess the data to ensure it is suitable for modeling.
3. **Exploratory Data Analysis**: Understand the data through visualizations and summary statistics.
4. **Model Building**: Develop and train various forecasting models.
5. **Model Evaluation**: Assess model performance and select the best model for deployment.
6. **Demand Prediction**: Generate demand forecasts using the selected model.
7. **Visualization and Reporting**: Create interactive dashboards to present findings.
8. **Optimization and Recommendations**: Provide actionable insights and recommendations for bike distribution and infrastructure planning.

**Deliverables**

1. **Forecasting Models**: Trained models capable of predicting bike demand with high accuracy.
2. **Interactive Dashboards**: Visualizations showing demand patterns, forecasts, and recommendations.
3. **Reports**: Detailed reports outlining findings, model performance, and strategic recommendations.
4. **Codebase**: Well-documented code for data preprocessing, model training, and evaluation.

**Potential Impact**

PedalPredict can significantly improve the efficiency and user satisfaction of bike-sharing systems. By leveraging data-driven insights, bike rental businnesses can optimize their operations, reduce costs, and provide a better service to their users.