Rental Bike Share Prediction.

High Level Design Documentation ( HLD ).

**Project for : iNeuron**

**Project Name : Rental Bike Share Prediction**

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13. **Abstract.**

The project "Rental Bike Share Prediction" focuses on developing a machine learning solution to predict bike rental demand within bike-sharing systems. These systems automate the rental process, allowing users to rent and return bikes at different locations. With the rise of bike-sharing programs globally, the data generated by these systems offers valuable insights for traffic management, environmental planning, and public health.

This project will involve building an end-to-end regression model to predict bike rental counts. The solution will be evaluated based on code quality, including modularity, safety, testability, maintainability, and portability. The project will use a Cassandra database for data storage, and the solution will be hosted on a cloud platform like AWS, Azure, or GCP. The project will also require detailed documentation of system architecture, high-level and low-level design, and response time analysis.

The final deliverable will include a fully optimized solution with deployment options, either as an API or a user interface, and will be maintained on a public GitHub repository. The project will adhere to industry best practices, including logging, coding standards, and possibly integrating an AI ops pipeline for continuous integration and deployment.

1. **Introduction.**

# Why this High level Design Documentation ?

The purpose of High Level Documentation is to (HLD) is to add the necessary detail to the current project description to represent a suitable model for coding. This document is also intended to help detect contradictions prior to coding, and can be used as a reference manual for how the modules interact at the high level.

The HLD will:

* Present all of the design aspects and define them in detail.
* Describe the user interface being implemented.
* Describe the hardware and software interfaces.
* Describe the performance requirements.
* Include design features and the architecture of the project.
* List and Describe the non-functional attributes like:
  + Security
  + Reliability
  + Maintainability
  + Portability
  + Reusability
  + Application compatibility
  + Resource utilization
  + Serviceability

# Scope.

The HLD Documentation presents the structure of the system, such as the database, architecture, layers, application flow (Navigation), and the technology architecture. The HLD uses non-technical and mildly technical terms which should be understandable to the administrators of the system.

1. **Description.**

# Problem Perspective and 3.2. Problem Statement

The most important problem from a business point of view for bike-sharing system like Capital Bikeshare is to predict the bike demand on any particular day. While having excess bikes results in wastage of resources (bike maintenance and land/bike stand required for parking and security), having fewer bikes leads to revenue loss (ranging from a short term loss due to missing out on immediate customers to potential longer term loss due to loss in future customer base). Thus having an estimate on the demands would enable efficient functioning of this company Capital Bikeshare.

# Proposed Solution.

The solution proposed to take the required inputs from the user through the web interface created by us, pass this requirement to our machine learning model, and based on these inputs we have to print that ‘’XYZ” is the total number of bike counts getting rented around them based on different conditions.

# Solution Improvements.

The bike share prediction can help the company and users to determine which conditions are favorable to rent a bike.

The companies can understand how they can improve the end to end user experience. Bike share system can help the users to see if it's favorable to rent a bike based on Temperature, Humidity level, Season, Weekend etc thus fulfilling Bike rental demands, avoid wastage of resources by only deploying required number of bikes thus saving cost for bikes and even efficiently manage space for parking.

1. **Requirements**

# Hardware Requirements:-

A working computer to code with active internet connection.

# Tools / Software Requirements:-

* + - Python version used for this project 3.10.6( This may get updated and some features might not be available in new version. )
    - Python libraries such as NumPy, pandas, matplotlib, seaborn and scikit-learn ( Used for implementation of machine learning algorithms. )
    - Jupyter for Exploratory Data Analysis and testing code, Visual studio code is used as an IDE for writing the code.
    - HTML, CSS & Java Scripts are used for developing the front end of our web application.
    - Flask is used for backend development.
    - Github is used as the version control system.

1. **Data Requirements.**

Whenever we are working on any project the data is completely dependent on the requirement of the problem statement. For this project the problem statement was to create a Hyper tuned Regression machine learning model which can predict the total count of bikes rented at a particular day based on various parameters.

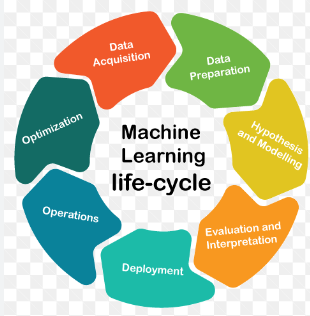
1. **Constraints.**

The web application should be user friendly so that without knowing any technical information user should be able to use our predictive system.

1. **Assumptions.**

The main objective of the project is to utilize the data which is provided by the user and to predict the count of rental bikes that would be required. The web application should be accessible from every system which is connected to the internet.

1. **Design Flow.**



**9.Logging & Error Handling.**

Every important step is logged within the system that runs internally, it basically shows us the data time of each process which is done with our system. It provides us with logging information for end to end web applications.

The logging which we have done in the above process helps us to handle the error because the error is being logged in log files (every time we run code) so that the developer can rectify it.

1. **. Performance Evaluation.**

## **Reusability**

The elements of the code is written in such a way that it can be changed and easily written again without changing or creating an entirely different web application from scratch. Just the HTML requirements and the app.py file constraints need to be adjusted and changed .

## Application Compatibility.

The elements of the project are written in python, it acts as the interface between the machine learning model and the user. The application can run on any system with a network connection.

## Resource Utilization.

Once the task is assigned to the model doubtlessly it will use all the resources which are allocated until the task is finished.

1. **. Conclusion :**

**The "Rental Bike Share Prediction" project successfully addresses the growing need for predictive analytics in bike-sharing systems. By leveraging machine learning, the project aims to accurately forecast bike rental demand, providing valuable insights for optimizing bike distribution and improving user experience. The project’s comprehensive approach, which includes modular and maintainable code, cloud deployment, and detailed system architecture, ensures a robust and scalable solution. Through careful optimization and adherence to best practices, this project not only enhances the efficiency of bike-sharing programs but also contributes to sustainable urban transportation planning.**