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Recommendation System For E-bicycle Usage and Maintaining Stations

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Abstract: *E-Bicycle sharing stations are suffering huge losses due to improper positioning of the stations and hence the potential of these stations could not be fully unlocked to its fullest due to lack of proper knowledge and insights about the user needs. This leads to a factor of loss among the businesses and thus creates negative environment for this sector. This project represents how the proper use of data about any particular aspect would lead to a great insight into that particular area which would not have been possible normally. This shows how the use of Various Machine Learning Algorithms would benefit a particular industry like E-Bike rental stations and help them to properly locate their stations for maximum profitability. By using the data we can optimize Business needs which helps the Owners of that Business tremendously.*

Keywords: Insights, Algorithms

I. INTRODUCTION

This project is developed in such a way that it tries to help the E-Bicycle sharing stations to gain maximum profitability and for the end user to optimally do the commute using these E-Bicycles. The Feasible way in which a user can easily book his E-Bicycle from one station to go till another stations. The real time or semi real time data will be collected via multiple sources such as web applications , APIs and then these data/datasets will be pre-processed after which machine learning will be applied to the data to gain hidden insights and the recommendation of stations will be done. This shows how the use of Various Machine Learning Algorithms would benefit a particular industry like E-Bike rental stations and help them to properly locate their stations for maximum profitability. By using the data, we can optimize Business needs which helps the Owners of that Business tremendously.
And this is how we tried to maximize the profitability of the E-Bicycle sharing station using the hidden insights that are obtained from huge amount of data.

II. LITERATURE SURVEY

(I) Patricija Bajec, Danijela Tuljak-Suban and Eva Zalokar proposed a paper which took into account the shortcomings of previously published papers. There is no previous paper that provides support for investors in (1) defining a set of criteria for selecting a provider that takes into account all of the three domains of sustainability (economic, social, and environmental) and (2) developing a tool that best meets sustainability standards on the one hand and the needs and requirements of all stakeholders(including e-bike users and investors) on the other hand. A distance-based analytic hierarchy process/data envelopment analysis (AHP-DEA) super-efficiency approach was proposed and applied to adapt DEA to the needs of predefined groups by using slack variables. The approach takes intoaccount the fact that not all outputs have a positive impact on the final outcome; the approach alsoallows decision-makers to define the hierarchical structure of the importance of the criteria directly based on the responses of the selected group.
(II) Shinya Mizuno, Shogo Iwamoto, Mutsumi Seki3 and Naokazu Yamaki proposed node system to bicycle renting system in which bike stations were treated as nodes and after a user is done with a ride he/she can return the rented bicycle at the nearest respective node to conclude their journey. However, from these experiments, the effectiveness of distributingbikes was unclear, and many models were discontinued midway. Thus, they needed to consider whether these models are effectively designed to represent the distribution system. Therefore, they constructed a model to

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arrange the nodes for distributing bikes using a queueing network. To adopt realistic values for our model, they used the Google Maps application program interface. Thus, they can easily obtain values of distance and transit time between nodes in various places in the world. Moreover, they applied the distribution of a population to a gravity model and we compute the effective transition probability for this queueing network. If the arrangement of the nodes and number of bikes at each node is known, they could precisely design the system. They illustrate their system using convenience stores as nodes and optimize the node configuration. As a result, they could optimize simultaneously the number of nodes, node places, and number of bikes for each node, andcan construct a base for a rental cycle business to use our system.

(III) Siying Zhu's research paperaimed to study the effect of shared e-bikes on the traditional bike-sharing system and determine the optimal fleet deployment strategy under a bimodal transportation system. A stochastic multiperiod optimization model is formulated to capture the demand uncertainty of travelers. The branch-and-bound algorithm is applied to solve problem. A 15-station numerical example is applied to examine the validity of the model and the effectiveness of the solution algorithm. The performance of integrated e-bike and bike-sharing system has been compared with the traditional bike-sharing system. The impacts of the charging efficiency, fleet size, and pricing strategy of e-bike-sharing system on the traditional bike-sharing system have been examined.

(IV) Danijela Tuljak-Subanand Patricija Bajec's problem statement was that an An e-bike sharing system (e-BSS) solves many of the shortcomings of BSS but requireshigh financial investments compared to BSS. So they proposed an article which proposes an sustainable and targeted extension of the existing BSS with e-bikes and charging piles. The existing BSS in the selected city area is divided into sub-areas using the Voronoi diagram and reference points (landmarks). Then, the integrated approach of the Analytic Hierarchy Process (AHP) and Data Envelopment Analysis (DEA) is used to assess the adequacy of the existing bike-sharing stations for updating with e-bikes and charging piles. The joint approach allows decision-makers to look at the whole process and highlight the link between the criteria assessment and user preferences in the context of the chosen reference point. This can encourage future users to use e-BSSs.

(V) Esther Salmeron-Manzanoand Francisco Manzano-Agugliaro's research paper told us about the importance of ebikes and to detect how worldwide research on the electric bicycle is being developed, and, especially, around which scientific domains is it clustered, to finally identify the main trends in the field. They analyzed all the publications related to ebikes till the year 2017. It showed that since 2008 the growth of publications is much higher than in the previous period.The main countries were China and the USA, and it can be inferred that there were two major trend countries with high environmental awareness, which also have a large population and that the electric bicycle is a suitable and sustainable form of transport.

III. OBJECTIVES OF SYSTEM

- To collect the data which is suitable for our problem statement through APIs.
- To pre-process the data collected.
- To select appropriate machine learning and deep learning algorithms.
- To gain hidden insights about the bicycle usage data in real time.
- By using these insights, to suggest where to increase the number of stations or bicycle and where to decrease the them.

IV. IMPLEMENTATION DETAILS OF MODULE

The proposed system undergoes some modules such as :-

- **Web based application: -**It is the web based application or API interface (semi real time) for the extraction of the data. This is basically the interactive source for our e-bike datasets.
- **Dataset:** - This is the set of data which is helpful to us and will be used for prediction purposes in our project.
- This dataset is obtained from the web-based application or the APIs. This dataset will have multiple fields such as "station id", "No. of bikes available", "Total no. of bikes", "duration of trip", "start point", "end point" etc. There can be multiple different sources of datasets that can be selected based on different use cases and scenarios.

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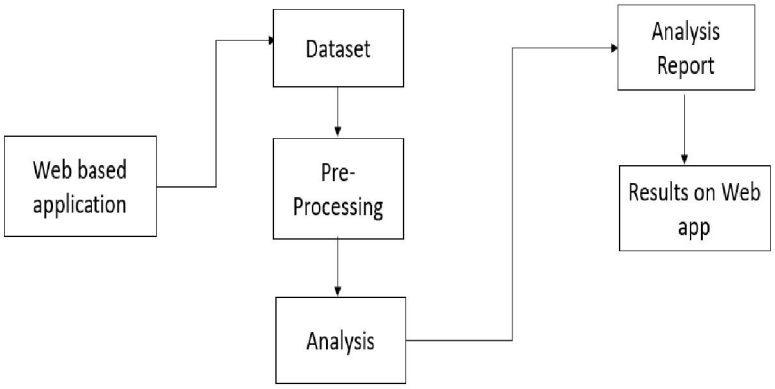

Figure a: Block Diagram

- **Preprocessing:-** First we import dataset into our file so that we can work with that data. Then we find information about that data, such as how many columns are there, which columns contains what type of data, which columns contains null values, which columns are useful for our analysis and which columns will not be useful. Then we change structure of the csv file by using the library pandas and we create dataframes according to our needs. We select particular data columns from our CSV file and mix and merge them with other tables so that we get desired output. We apply functions such as groupby, sort_values, sort_index, reset_index, set_index, count, rename, sum, etc. These all processes needs to be applied before the data can be used to make our analysis for this project.

4.1 Analysis and Analysis Report

We figured out 6 key points that make an impact on the overall usage and profitability of the stations, these include

a. Age distribution
b. Customer type
c. Date-Time analysis
d. Gender distribution
e. Usage analysis
f. Weather Impact analysis

We make analysis off of the preprocessed data and visualize the results for maximum understandability by the business owners.

Human mind don't generally understand the numbers quickly, but when those same numbers are represented in the form of graphs and charts, the information can be easily processed.

Thus we make use of charts in all of our key points of analysis that we mentioned above

We made a dashboard like website for the business owners who can see the analysis when they visit the website

When they request particular analysis point, the website makes request to the backend and the backend then processes the algorithmic steps to provide with the analysis charts and graphs

Those analysis charts are then use by the website to show the results related to that analysis point and then an analysis report is published to the website for understanding the results of the analysis

This all is done in a easy to use manner for the business owners that they don't even need to follow any steps to run a particular software that needs to be installed on their machine, they just need to visit the dashboard site on the internet using there browser and they get a easy to use and understand user interface that displays everything that they need to know about there station.

V. CONCLUSION

- Due to the increasing pollution and petrol, diesel rates people are slowly switching to public transport and e-bikes. But sometimes e-bike companies face losses due to miscellaneous problems.

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- One of those problems is the wrong placement of e-bike stations, which we have tried to overcome in our project.
- Using datasets our app shows the most used e-bike stops and the least used ones.
- By using machine learning on these results we can suggest where to increase the bike stations and where to decrease or completely remove bike stations.
- By adjusting the number of bike stations at different places we can increase the profit and influence of e-bikes over that area.
- Our Project helps in increasing the profitability of the E-Bicycle sharing stations owners and promoting it to the masses by making it easily available.

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