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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.

1. 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.

2. 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 forinvestors in (1) defining a set of criteria for selecting a provider that takes into account all of the threedomains of sustainability (economic, social, and environmental) and (2) developing a tool that bestmeets 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 analytichierarchyprocess/data envelopment analysis (AHP-DEA) super-efficiency approach was proposed and appliedto 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 directlybased on the responses of the selected group.

(II) Shinya Mizuno, Shogo Iwamoto , Mutsumi Seki3 and Naokazu Yamakiproposed 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 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

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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.

3. RESEARCH GAP

- The analysis of the bicycle station recommendation system reveals several gaps in its functionality, including limitations in extracting hidden insights, scalability, interactivity, adaptability, and real-time analysis. In order to overcome these challenges, our proposed system will employ advanced machine learning libraries, such as Pandas, NumPy, and Matplotlib, to perform in-depth data analysis. By doing so, we aim to uncover hidden patterns and trends that can significantly enhance business profitability.
- Moreover, the current system lacks interactivity and visualization capabilities, which we plan to address by leveraging modern web technologies like React and Flask. Through the implementation of an interactive interface, users will be able to access real-time charts and insights derived from the analyzed data. This will empower them to make quick and informed decisions, further enhancing the system's value.
- Furthermore, our proposed system will prioritize adaptability by integrating user feedback and interaction. This will allow us to continually refine the recommendation engine, ensuring its accuracy and responsiveness to evolving user needs over time.
- Lastly, to address the gap in real-time analysis and changes, our system will employ a scalable architecture capable of handling large amounts of data. This will enable businesses to make immediate decisions based on up-to-date information, thereby improving overall profitability.
- By harnessing modern technologies and advanced algorithms, our proposed bicycle station recommendation system aims to deliver valuable insights and maintain relevance in a rapidly evolving market landscape.

4. EXISTING SYSTEM

In today's time, the technology revolving the E-Bicycle sharing systems is not evolved at a goodstrength that it may be used in our day-to-day life likewe use some cab booking technologieslike Ola and Uber. These cab sharing Applications work on modernalgorithms and they havebeen integrated into one app which makes this application to work flawlessly. But in the caseof E-Bicycle sharing systems (EBSS), there is no such system that works on this level. Previous efforts have been taken by researchers to create algorithms to smartly recommend users withnearest stations

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but none of those efforts have been successfully taken off like Cab sharingApplications. The gap between researchers and investors to make these applications workingis very huge and thus it has not yet grown at pace it should have been grown today. Sometimesit is the algorithm that's not working properly or the scope of the researchers that does not

expand into the business sector of this problem. This creates a huge opportunity among theexisting systems to be modified. Some EBSS have been developed in the countries like NewYork, USA and Berlin, Germany but they have not yet taken off like apps like Ola or Uber dueto poor managements of stations by the owners. This creates a huge flaw in the potential of thissystem.

5. PROPOSED SYSTEM

Our proposed idea as the solution for this problem would be a Mobile application that wouldpick up user's location as the start point and let user add their destination and accordingly theapplication will show them the list of nearest station from which they could lend a bicycle toreach their destination. This application will let them select their desired stations and book theirdesired bicycle from within the app. The payment would be done at the station once the userreaches to pick-up the bicycle. Likewise, during the drop-off at the destination, the user willprompt with the ride complete popup and would be able to rate the ride. Using this application,the real-time data of the users will be readily available to be analyzed and thus finding the userneeds becomes a easy task in this situation. The back-end algorithm would take this data alongwith previous data of the station and analyze the behavior of the users that use that particularstation. This behavioral pattern can be used to predict the trends in current usage and somewhatpredict the future usage statistics of that particular station. This would be very helpful since thebusinesses will readily know how their stations have been doing so far and what would be theprediction that it would be doing in future. This will increase profitability of the businesses thatcontrol the stations since the stations that are frequently used can be provided with additionalbicycles and the ones that are not used so much, their strength of the bicycles can reduceaccording to the needs.

6. RESULTS

So, we have developed a frontend web application that will show the recommendation and statsof the dataset at the frontend using machine learning.
These stats can be used by companies to look at the hidden insights and work accordingly toincrease their business profitability.
Data that we are collecting should be readily available and fit for use by other parties.
We would just have to rename the fields in the data set for our model to access and recommendcorrectly.

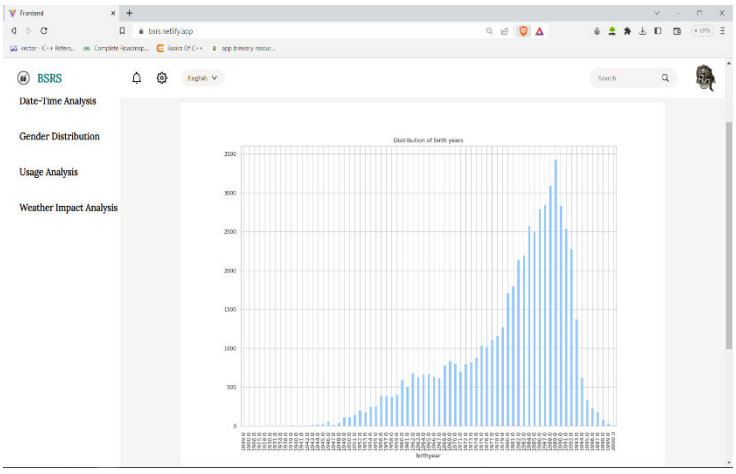

Fig 6.1 - Age Distribution of Userbase

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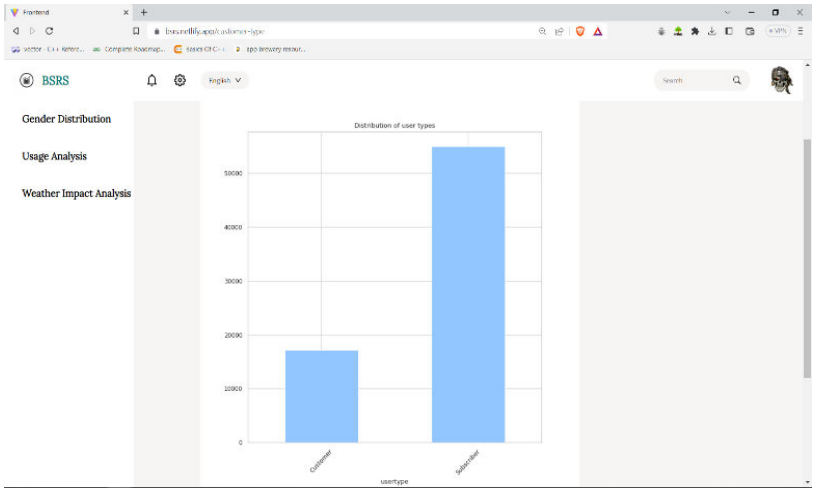

Fig 6.2 - Customer Type

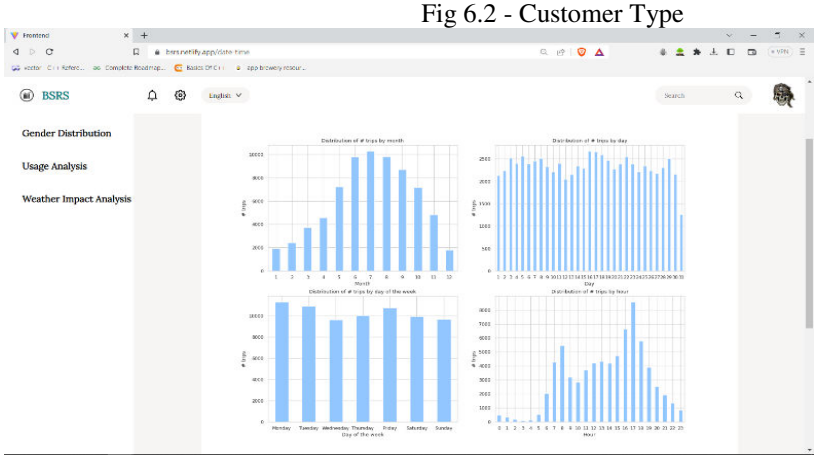

Fig 6.3 – Date time analysis

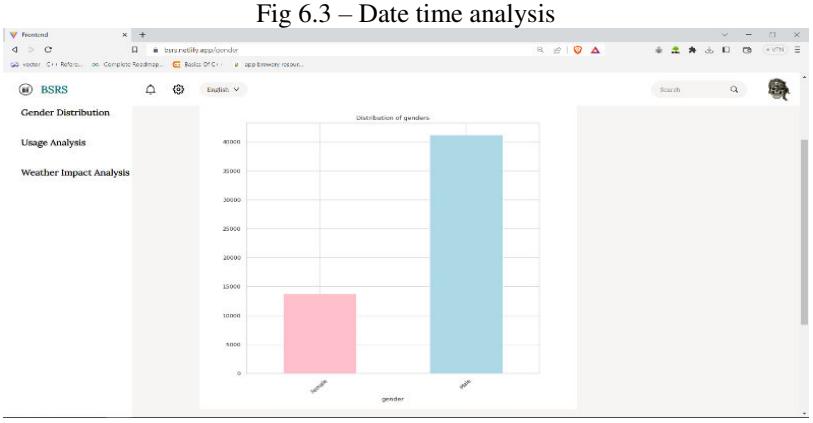

Fig 6.4 – Gender Distribution

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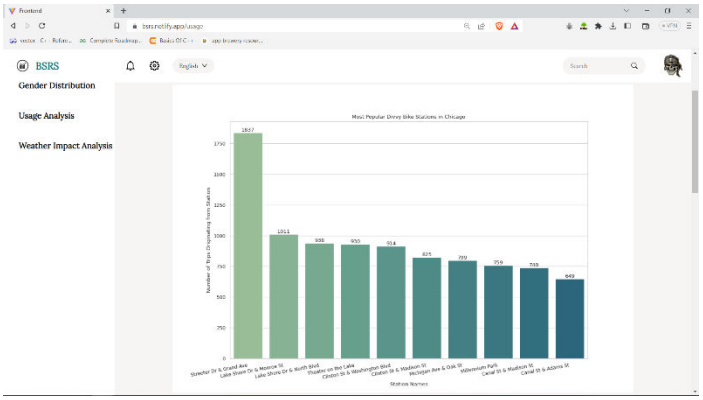

Fig 6.5 – Usage analysis

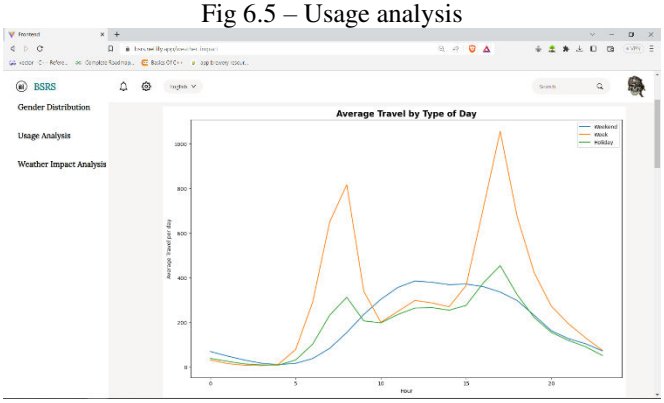

Fig 6.6 – Weather impact analysis

7. 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.
- 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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