Survey On Dock Less Cycle-share Reallocation Based On Data Analysis

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Abstract- *Dock less cycle sharing service is predominately used across the world over the traditional dock based cycle sharing system. But there arises a problem of unbalanced distribution of these cycles across the city which requires to be solved. Data analysis is used for examining large datasets and extracting useful information from it like hidden patterns, customer preferences and market trends. It can be used for finding a solution to the problem of reallocation. In this paper we have surveyed about the dock less cycle share service and different methods used for reallocation.*

I. INTRODUCTION

Bicycle sharing programs have sprouted up in many cities and communities across the World. It has given an effective, affordable and environment friendly alternative mobility service mainly for short distance travelling within the city. The cycles are GPS enabled and can be unlocked using smartphones while the payment is done online. [3]Unlike the traditional way where the user had to pick and return the cycle at fixed predetermined stations, in the dock less cycle-share we can grab a cycle from anywhere and park it anywhere inside the service area of the company(figure 1). This has relieved the user from riding the extra distance in search of docking stations. But it has been seen that the cycle-share is mainly used for medium-short distance rides and mostly for one-way trips hence it causes the cycles to be scattered across the city. This makes it hard to find a cycle at frequent places.

We can solve this problem by using the cycle use history data analysis techniques to reallocate the cycles. [4] There is abundance of data including the GPS tracking of the cycles, trip history and user type available. We can use this data and analyse it using various techniques of data analysis. Preferred routes of the users and other hidden patterns, unknown correlations can be found to provide useful business solutions.

The dock less cycle sharing service is a new innovation of the cycle sharing service and hence has very few papers related to the reallocation of the cycles. We have surveyed some of these available papers.

II.DOCKLESS CYCLE SHARE

Dock less cycle-sharing users can find cycles nearby via smartphone apps, then, scan a code to unlock the cycles via the apps, and park the cycles anywhere at any time.

We know from publicly available data that global cycle-sharing services received 4.267 billion U.S. Dollars in venture funding in 2017.[1]

In 2017, the number of global cycle share users reached 227 million. It has been predicted that in the next two years, the number of global cycle share users will continue to rise and is expected to reach 306 million in 2019.

Figure 1:Unlocking Spin cycle with a smartphone. [1]

Dock less cycle share is designed for short, spontaneous trips. While the cost of using traditional cycle share for a single trip (typically, $7/day) could be seen as a barrier to ridership, most dock less cycle share models offer single trips for $1. Although $1 per ride isn't great for multiple trips in one day, it is great for that one way trip for a tourist, to cruise around shortly, or the quick ride to meet friends or ride to a meeting. To address more frequent users, LimeCycle offers a monthly package of $30/100 rides.[2]

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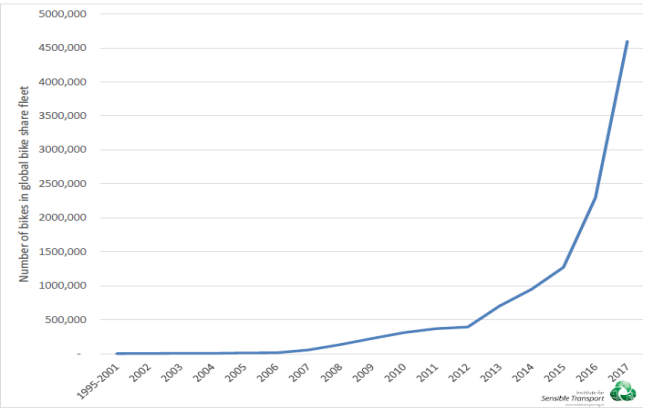

Figure 2:Cycle share users over the years.[2]

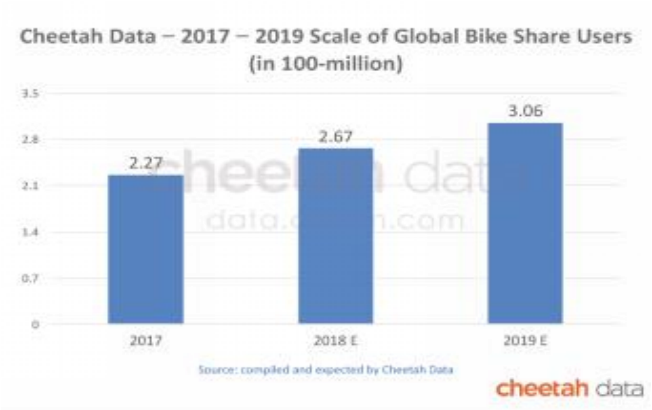

Figure 3:Global Cycles Share Users .[1]

III. PROBLEM OF UNBALANCED DISTRIBUTION

Dock less cycle share adds even more convenience for users who no longer need to worry about empty cycle share stations at the front end of the trip or full stations upon arrival. However, this convenience for users can be a problem for both system operators (who must rebalance cycles to meet demand) and cities (who must manage a clutter of bicycles on sidewalks already under pressure from competing uses). The wide, scattered nature of operations also poses drawbacks related to maintenance, bicycle durability, economic sustainability, and potential lack of visibility that established stations provide. Misplacement of dock less cycles can be a real issue. To manage parking issues, cities and operators can institute incentives and disincentives as part of a regulatory framework. Several operators like oCycle and LimeCycle give credit points for returning to cycles to a designated parking location.

Mocycle, which operates more than five million cycles and has 100 million registered users (taking 25 million trips per day at peak times), encourages users to park at Mocycle Preferred Locations (MPL) and provides cycle parking best practices on their website. The company also offers incentives for reporting bad parking practices, stating in their company FAQ, "If you see any illegal or poorly parked Mocycle, please send us feedback and you will be rewarded with Mocycle Credits".[2]

Figure 4:Mobike Dockless Cycle Share Service.[1]

IV.VARIOUS METHODS USED FOR REALLOCATION

Essentially, there are two different relocation strategies: the user-based approach, where users are induced to leave their cycles at a certain station in order to balance the global distribution of cycles; and the operator-based one, where the relocation process is performed by the BSS service staff.

User Based Approach:

User-based relocation strategies make use of different incentives or bonus models for the customers. One way of compensating the imbalance of supply and demand is the adjustment of the prize model. Trips to specific under supplied areas could be offered at a lower rate or even for free when needed.

Letting customers relocate the vehicles is free of costs except for free rides. Furthermore, those methods are environmentally sustainable. Vehicles are only driven by customers and no additional vehicle trips without customers are conducted. Nevertheless, there are also some disadvantages. The customer can only be influenced by these incentives to a certain degree. The customer acceptance and decision is difficult to control and predict.[3]

Operator Based Approach:

Operator-based relocation strategies are based on interventions initiated by the system manager and executed by the Car Sharing provider itself. There are basically two different possibilities of relocation for the system provider.

Dynamic Reallocation:

In the dynamic reallocation the cycles are reallocated according the need of the users after a specific interval of time throughout the day.

A decision support system is developed for the purpose of reallocation with maximum user satisfaction by making cycles available. The correlation pattern is found out by analysing the historical data of the use of cycles. The system is trained for each cluster generated using Nonlinear Autoregressive Neural Network. [4]

Static Reallocation:

The operation of redistributing cycles across the network using a fleet of vehicle(s) is known as cycle rebalancing. Rebalancing at night, when user intervention is negligible, is called static rebalancing.

An integer programming model is generated by doing the data analysis on the data generated in a particular day. The data is pre-processed and then the cycles are grouped in various clusters using k-means clustering algorithm. It provides effective solutions for reallocating cycles to optimize the availability of the cycles which satisfies the user demands. [5]

V.USE OF DATA ANALYSIS FOR REALLOCATION

Data analysis is used to examine large datasets to discover knowledge from it to find business solutions. The datasets can be analysed to abstract useful information, hidden patterns and unknown correlations. The GPS-data of the cycles can be analysed to find the preferred routes of the users and reallocate the cycles based on it.

Data Gathering And Pre-processing:

In the pre-processing phase ride and customer data as well as location factors in terms of external geographical data are gathered. To make the data suitable for analysis it has to be properly cleaned and selected. Also aggregation and normalization of data assures a solid basis for data analysis algorithms.

Data Analysis :

Here, cluster analysis is used in order to group stations according to their normalized cycle pickup and return activity. The outcome in form of temporal patterns are spatially examined to discover location dependent reasons for activity patterns. First, the clustering tendency of the ride data is determined. Then, different cluster algorithms are applied and evaluated with validation measures.
[7]

Visualization and interpretation:

Visualization and interpretation of clusters complete this section. The results from the cluster analysis have to be validated in a post-processing step. Visualizing clusters with a geographical information system is needed for a spatial interpretation of clusters.

Other methods for improving the service of cycle-sharing :

Along with the reallocation we can also detect the unusable cycles to improve the service. Undetected unusable bicycles appear in the information systems as available ones. This inaccuracy may adversely affect user's route choices and result in an inferior service level. By using the proposed method [6] we can detect the unusable cycles which could be repaired and used again.

VI. CONCLUSION

This paper analysed the dock less cycle-sharing system and the reallocation problem associated with it. Here we learned that there are basically two approaches of reallocating the cycles i.e. User based and Operator Based. Operator based approach is usually preferred as the user based approach has certain limitations. In static method the reallocation is done overnight by analysing the data of that particular days trip history. This can be used to generate constructive suggestions for managing dock less cycles which include the effective setting of demand and supply. But in dynamic method the reallocation is done after a specific time interval throughout the day. The service providing company can use these techniques to improve the availability of the service to ensure maximum user satisfaction.

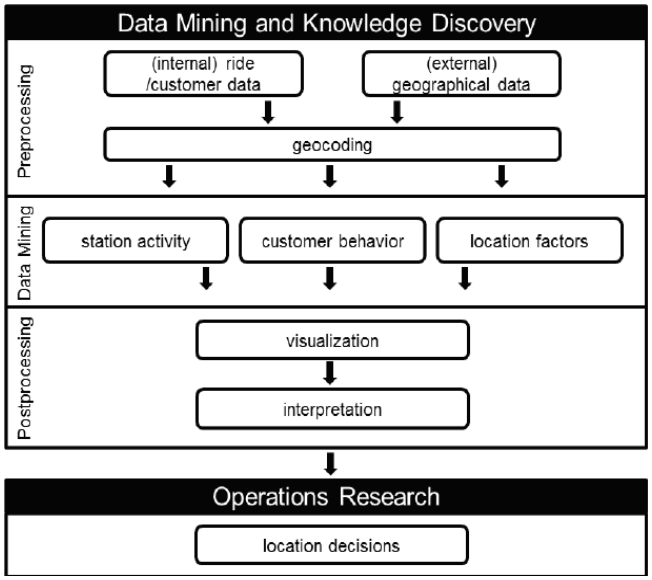

Figure 5:Data analysis for reallocation[7]

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