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Review Article

Survey of Station-less Bike-sharing System

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Abstract *- Nowadays, in the 21st century, Transportation has become a mandatory aspect of every individual's life. There is a constant requirement for easy, cheap and accessible modes of transportation everywhere, especially in metropolitan areas. Bikes are becoming the most affordable and efficient way of getting from point A to point B. Commuters who can't afford their own personal vehicles and in case their personal vehicle is not readily accessible to them struggle to get their commuting needs done. Tourists who need temporary transportation access can make use of bike-sharing systems for fulfilling their needs. The current system has fixed points or stations where the bikes need to be dropped off. We propose a system that does not involve any stations for the bikes and rather, the user can drop off the bike at any location of his choosing, and the payment process can be furnished on the mobile application.*

Keywords *- No stations, temporary transportation.*

I. INTRODUCTION

We are in the information age where there is provision for anything to be made possible with the right technologies and technical know-how. Currently, there is a high need for public transport in urban cities. As cities develop and populations rise increasingly, it is becoming harder and more difficult to find a means to active transportation which is feasible and affordable to the everyday commuter. As vehicles prices skyrocket and the cost of fuel and insurance is not getting lower anytime soon. It is becoming a huge necessity for commuters to find a new way for transportation in a cheap and effective manner with minimal hassle. So the commuters have turned to bikes and similar two-wheelers for hire for fulfilling their transportation needs. However, the current system involves the use of station enforced bikes, and the problem with this current scenario is the fact that the users need to drop off their vehicle at one particular location, which is becoming ever increasingly inconvenient and more time-consuming, which leads to an overall loss in productivity and profitability. The proposed system amends the current system by using a station-less bike-sharing approach which minimises the last mile problem for commuters using the present application of bike-sharing, as they can basically drop off their bike at their convenient locale and finish the payment process wirelessly on their mobile application. Therefore it provides the facility for the user to go directly from point A to point B while being high-time efficient.

The current necessity for this proposed project is that it is highly customizable according to user requirements and puts user comfort first. It also helps in reducing pollution and is more of an eco-friendly approach to the current system.

This is the technology we have chosen to propose our system where it is needed. To turn an ineffective system into a more efficient and effective method to accomplish the same. The system we have chosen is Station-less Bike-Sharing System.

II. LITERATURE SURVEY

A. Bike-sharing-A maximal covering location approach

Ines Frade, Anabela Ribeiro and Team proposed a system where the bikes are made available to the maximum locations with particular bike stations to improve the quality of city life and urban environment. This approach is useful for covering the maximum location.

The main defect of the system is that they have a certain capacity for storing bikes. For example, in a station, they have a maximum of 20 bike capacity. It is hard to acquire land for bike stations. There will be a huge amount of money spent on this system.

B. Uncertainty in urban mobility: Predicting waiting times for shared bicycles and parking lots

Bei Chen Fabio Pinelli expresses their approach towards the waiting time for the next available bike or parking stations nearby with a vacant place. By Spatio-temporal features of the bike, users provide the availability and additional information to the commuters.

The demand during the abnormal time such as festivals and other activities, it is basically hard to predict the parking lot availability, and the waiting time for the bike also differs. This involves high maintenance costs for the people using.

C. *Dynamic Spatial-Temporal Representation Learning for Crowd Flow Prediction*

Lingbo Liu, Jiajie Zhen, Guanbin Li and the team proposed a system that is designed to predict the crowd flow in a particular location. This will work based on the digital device they use to predict the crowd flow. Based on the proposed ACFM, they developed a unified framework to adapt merge the sequential and periodic representations with the aid of a fusion module

The main key challenge lies ow to integrate diverse factors such as temporal laws and spatial dependencies to infer evolution crowd flow. Huge population in the metropolitan cities brings a great challenge to the urban environment to manage

D. *Spatial-Temporal Graph to Sequence Model for Multi-step Passenger Demand Forecasting*

Lei Bai Lina Yao proposes the idea of Spatial-Temporal Graph to Sequence Model for Multi-step Passenger Demand Forecasting. In this system, the long-term encoder and short-term encoder are introduced to achieve multi-step prediction without relying on RNN. It provides citywide passenger demand on a graph and employs the graph convolution architecture to extract spatial and temporal correlations equally.

In this system, the chain-structured RNNs employed in the encoder iterate over one input time step at a time. Errors from the previous time step are carried forward and directly influence the prediction, which results in error accumulation in each future step.

E. *Functional Zone-Based Hierarchical Demand Prediction For Bike System Expansion*

JunmingLiuQiao Li and her team propose A hierarchical station bike demand predictor which analyses bike demands from all functional location levels to station levels. The hourly bike check-ins and check-outs of that particular zones are predicted by NewYorkCity Bike system. In this way, they can calculate every activity of bike and their locations.

The bike transition records are not available for the other area and second. Station bike demand has more variances across the metropolitan city. By identifying multiple features, assuming the station bike demands react the same to the world features, which brings large prediction error when the city area is large and highly diversified

F. *Incentivizing Users for Balancing Bike Sharing Systems*

Marco Santoni, AdishSingla, Proposes a system called incentivizing users for balancing bike-sharing system. The commuters in the bike repositioning process are provided with an alternative choice to pick the bike or else return the bike in exchange for some monetary incentives. This can be accessed by the user-friendly application at a low cost.

There comes a great imbalance problem such as the unavailability of the bikes on that current time or parking stations for the commuters who need to end the trip. The upcoming demands with such limited resources are the major challenge and recurrent problem for the operators.

G. *Urban cycles and mobility patterns: Exploring and predicting trends in a bicycle-based public transport system*

Andreas Kaltenbrunner, Rodrigo Meza and the team propose a system called urban cycles and mobility patterns. In which they can analyze the cyclic mobility patterns, which lead to a prediction of the number of available bikes in the station. Such prediction would allow the users to improve the current web service of a bike and increase the commuter's satisfaction with the system. It informs the user prior about the best place to pick up the bike or leave the bike and improves the distribution of bikes in all stations equally.

The biggest problem is that which makes the commuters get frustrated when impossibility to find a bike when a user wants to start a journey. The impossibility is to leave the bike at the commuter's destination due to empty or full stations.

H. *Multi-Graph Convolutional Network for Short-Term Passenger Flow Forecasting in Urban Rail Transit*

Jinlei Zhang 1, Feng Chen 1* Yinan Guo2and team proposed a system called multi graph network for short term passenger flow in Urban areas. Deep-learning-based models have been widely introduced to tackle the problems such as spatiotemporal dependencies. Topological information has been proved to have great advantages over previous models. The 3D CNN was used to innovatively integrate the inflow and outflow information as well as extract high-level correlations between three patterns of inflow and outflow.

Short-term passenger flow forecasting is a crucial task in the operation of urban rail transit.

The convolutional neural network (CNN)-based models, which can extract spatial dependencies even when stations are far away from each other.

we can understand this from **Table 1.**

PAPER NO.	TITLE	AUTHOR	TECHNIQUE	RESULT	ISSUE
1	Bike-sharing-A maximal covering location approach	Ines Frade, Anabela Ribeiro	Machine Learning	Presented an approach for bike-sharing with particular stations for the commuters.	Bike stations will have only a certain amount of storage capacity. A huge amount of money was spent on acquiring land.
2	Uncertainty in urban mobility: Predicting waiting times for shared bicycles and parking lots	Bei Chen, Fabio Pinelli	Deep Learning	They proposed an approach for the waiting time to get a bike and the availability of the parking stations nearby.	In the festival time, it is hard to find bikes or parking stations.
3	Dynamic Spatial-Temporal Representation Learning for Crowd Flow Prediction	Lingbo Liu, Jiajie Zhen, Guanbin Li	Data Mining	The crowd flow of the particular location can be monitored by the digital devices used by commuters.	It is hard to monitor and track a large number of devices at a time.
4	Spatial-Temporal Graph to Sequence Model for Multi-step Passenger Demand Forecasting	Lei Bai, Lina Yao1	Internet of Things	Presented a Spatial-Temporal Graph to Sequence Model for Multi-step Passenger Demand Forecasting	Error accumulation increases in each iteration step of the process
5	Functional Zone-Based Hierarchical Demand Prediction For Bike System Expansion	JunmingLiu, Qiao Li	Internet of Things	Presented a Functional Zone-Based Hierarchical Demand Prediction For Bike System Expansion	Demand will be higher in some arrears, which bring issues to commuters.
6	Incentivizing Users for Balancing Bike Sharing Systems	Marco Santoni, AdishSingla	Digital Image Processing.	PresentedIncentivizing Users for Balancing Bike Sharing Systems.	Unavailability of bike or parking stations will be a major issue
7	Urban cycles and mobility patterns: Exploring and predicting trends in a bicycle-based public transport system	Andreas Kaltenbrunner, Rodrigo Meza	Image Processing	Presented Urban cycles and mobility patterns: Exploring and predicting trends in a bicycle-based public transport system	Commuters get frustrated when impossibility to find a bike when a user wants to start a journey.
8	Multi-Graph Convolutional Network for Short-Term Passenger Flow Forecasting in Urban Rail Transit	Jinlei Zhang 1, Feng Chen 1* Yinan Guo2	Internet of Things	Presented an approach Multi-Graph Convolutional Network for Short-Term Passenger Flow Forecasting in Urban Rail Transit	Not feasible correctly due to cost.

III. CONCLUSION AND FUTURE WORK

A Station-less Bike-Sharing system is an effective and efficient approach to traditional ride-sharing applications. It would eliminate the liabilities of the current systems, which would help lessen the burden of the customers in terms of their transportation needs by making point-to-point travel possible.

Further modules can be added based on additional requirements that may be necessary later. Further security improvements are also welcome. The system is highly adaptable based on end-user requirements and gives the customer the first priority.

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