Planning of Bicycle Sharing System for Erode City

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Abstract: *Bicycle sharing systems are an increasingly popular means of advancing urban cycling. Public bicycle sharing programmes have become a prominent feature across city spaces world- wide. The benefits of bicycle sharing system include flexible mobility, physical activity, and reduced congestion; reduce the emission of harmful gases and financial saving for individual. There are currently over 700 such programs in operation globally. Bicycles are available for individuals on a short term basis for price in this system. In this project a bicycle sharing system for Erode city was planned. A stated questionnaire survey was conducted to know the public opinion on this system. Based on the survey and inventory study location for dock stations were chosen. Bicycle sharing systems are an increasingly popular means of advancing urban cycling. Public bicycle sharing programmes have become a prominent feature across city spaces worldwide. The benefits of bicycle sharing system include flexible mobility, physical activity, and reduced congestion; reduce the emission of harmful gases and financial saving for individual. There are currently over 700 such programs in operation globally. Bicycles are available for individuals on a short term basis for price in this system. In this project a bicycle sharing system for Erode city was planned. A stated questionnaire survey was conducted to know the public opinion on this system. Based on the survey and inventory study location for dock stations were chosen.*

Keywords - *Bicycle sharing system, financial saving, Questionnaire survey, Inventory study, Dock stations*

I. INTRODUCTION

The bike sharing system was initiated in Amsterdam, Netherlands in 1965. It is a service in which bicycles are made available for shared use to individuals on a very short term basis for price. Currently 813 bike sharing systems are in operation and 221 systems are under planning [1]. Velib, the most popular bike sharing program is in France which contains a network of 1800 stations and around 20000 bicycles. The largest bike sharing market is in China. Bike share scheme allows people to pick the bicycle at one station and drop off the bicycle at other station. Due to growing population and mass usage of fuels, there is a considerable demand for bike sharing system. The bikes can be available for free or by coin deposit or information technology based or multimodal system [2]. They can be subscribed on long term or shot term basis. The long term subscription involves monthly or annual renewal, where short term subscription involves weekly or daily renewal [3]. Public bicycle sharing system helps in improvement of health and also upgrades the quality of life. It also has various social, environmental and economic benefits by increasing job opportunities, decreasing harmful gases emission, reducing traffic congestion and noise pollution [4,5].

1.1 Literature Review

An earlier research effort provides useful information of bicycle sharing system. The bicycle sharing system reduces travel time and the efficiency of urban transport network is increased by multimodal accessibility pattern in urban cities [5, 6, 7and 8]. The journey time is influenced by the factors such as number of shops, restaurants, and public transport links [9]. The usage of bicycle sharing system has greatly reduced the energy usage, automobile emissions and health effects [4, 10]. The factors for low rate bicycling are found to distance, age, occupation and gender from analysis of [11]. The demand for bicycling is determined by the distance of trip, slope inclination, purpose of the trip and lack of bicycle paths [12]. The number of bicycle station, number of bicycles, fleet size, annual revenue and annual expenses are determined by the demand study, mobility pattern and traffic volume of the city [1, 13]. The potential demand for the sites is found to be apartments where many people use bicycle [14]. The impacts of bicycling are found to be bicycling infrastructure, temperature, rainfall, public holidays, high wind, proximity to off- road structure and free initial period [15, 16]. Bicycles are monitored through smart phones and Wi-Fi networks which help to trace the location of bicycles [17].

The choice of shared bicycle is based on the factors such as effective use of scenarios, demand

forecasting, environmental and metrological conditions on demand [18]. The lack of support of laws, regulations and awareness are the main difficulties in implementing bike sharing system [19]. The short car trips are reduced by locating bike sharing systems which are eco-friendly. The stations are scattered over the district, or they were more concentrated on the central area based on the two models [20]. After implementation of bicycle sharing system in Vancouver, the bicycle usage is increased where home or office of the public lies within bicycle share service area [16]. The funds for bicycle sharing system are obtained from government, public private partnership, advertising and sponsorship contracts [1]. The bicycle usage is in peak during morning and evening in week days, public holidays, weekends and warmer temperature [15]. The causes for failure of this system in Beijing was found to be infeasible fare, lack of safety of cyclist, randomly distributed bicycle service station, deteriorated conditions of bicycle equipment and in explicit policy orientation which should be avoided [21].

In London public bicycle sharing system not only encourages using bicycle and also increasing the number and diversity of bicycling [22]. The key to success are partnering with universities and private companies which helps in reducing barriers, focusing on dense and walkable areas with high concentration of demand and bicycling facilities [23]. Bicycle sharing is ineffective when there is not sufficient number of bikes and empty spaces in stations. The relocation of bicycles and routing are done to facilitate the service without interruption [24, 25]. The starving station is filled with bicycle from overfed station and the station is improved [26]. To increase bicycle sharing system, the appropriate government policies and budget allocations should be done [27]. The bicycling infrastructure, transportation network infrastructure, land use, urban form, metrological characteristics and temporal data are examined to find their influence on the system [28].

II.   Methodology

The planning of bicycle sharing system for Erode involves data collection through questionnaire survey. The survey is conducted among various groups of people and their opinion and suggestions are used as a base for planning bicycle sharing system. The dock station location is selected based on the factors travel demand, people response, availability of the area, environmental and socioeconomic characteristics. The station location is identified and finally road map for bicycle sharing station is developed and given in Google Earth Pro software.

III.   Study area

The bike sharing system is to be planned for Erode city which is one of the fastest developing cities in Tamilnadu. The total area of the city is 109.52 km². It has also been selected for Smart City Development Programme by the ministry of urban development. Heavy traffic congestion is main problem in the city because of its poor infrastructure for non motorised transport. It has a population of 2,251,744 people where 1,195,773 people were working. The density of the city is 397/km². It also has 1621 schools and 52 colleges within the city. The total population of school and college students are 236,000. It is one of the prominent trade centres in the state which normally faces traffic congestion. It is landlocked and has a long undulating plain throughout the city. The average summer and winter temperature is 35°C and 18°C respectively. The annual precipitation is about 700 millimetres. It also has several interesting places which attracts tourists from various places. Erode has a dry climate which favours development of public bicycle sharing system.

IV.   Data Collection

Data collection is prime step in the planning. Questionnaire survey was conducted among the different group of people. The people of all age groups were considered and the data was collected to observe their opinion and ideas for public bicycle sharing system. A questionnaire survey form was prepared, and they were issued to the public of different age groups, occupations, literacy level etc. The survey was conducted on February 13, 2018. The data collected was then analyzed further to get idea of developing bike sharing system.

1.2 Inventory study

The condition of each places and their accessibility was checked through inventory study. It involved detailed analysis of places, ground condition, population and nearby places. From this detailed study, we could choose the areas where the dock stations were to be located. To identify appropriate places and details inventory study was carried out. As per the collected data, the ground condition was fairly level and firm. The climate of city also supports public bicycle sharing system which is normally dry climate.

1.3 Data Analysis

The questionnaire survey was analyzed based on the response of public which gives general opinion of public in this project. The data was collected among all groups of people. It helped to predict how many people may use this system if it was implemented. The people using their own vehicle and percentage of people using bicycle all over the year and willingness of people using bicycle are shown in figures.
The data analyzes shows that people using their own vehicle are maximum during week days and minimum on
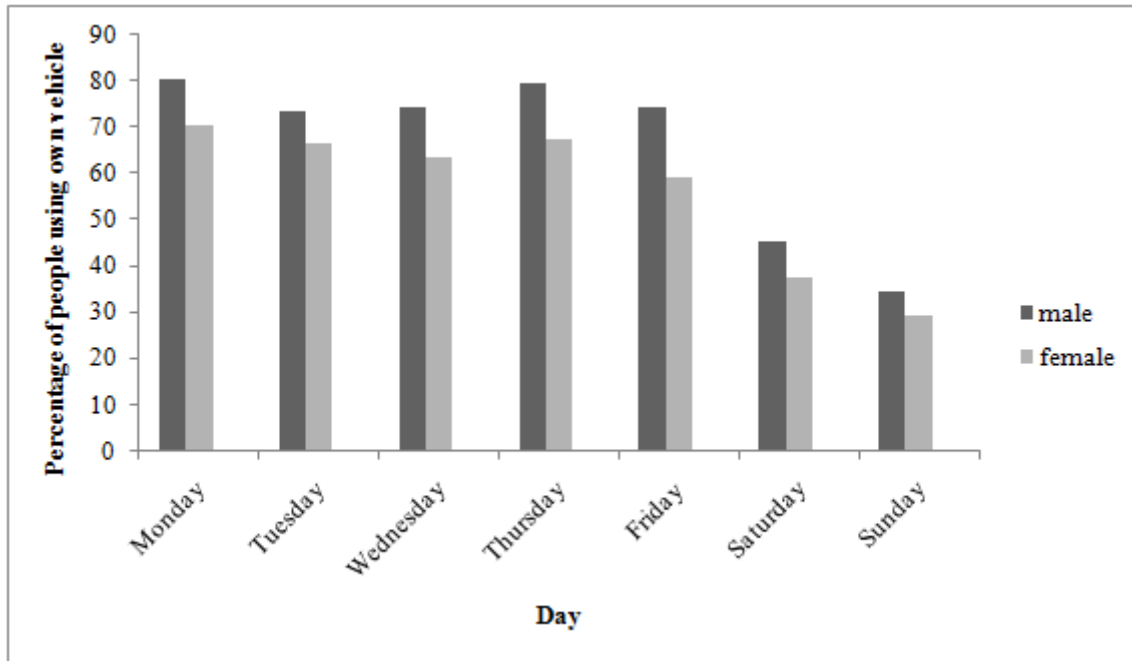
weekends.

Fig 1: Percentage of people using own vehicle in a week

The data analyzes shows that people using their own vehicle are maximum during week days and minimum during weekends.
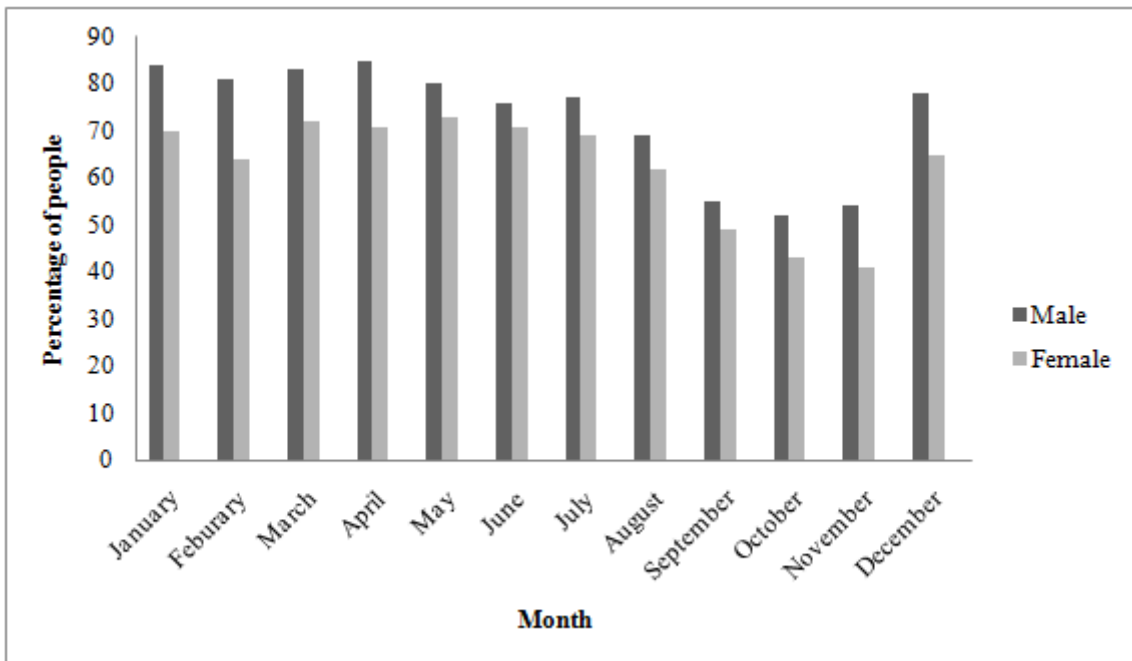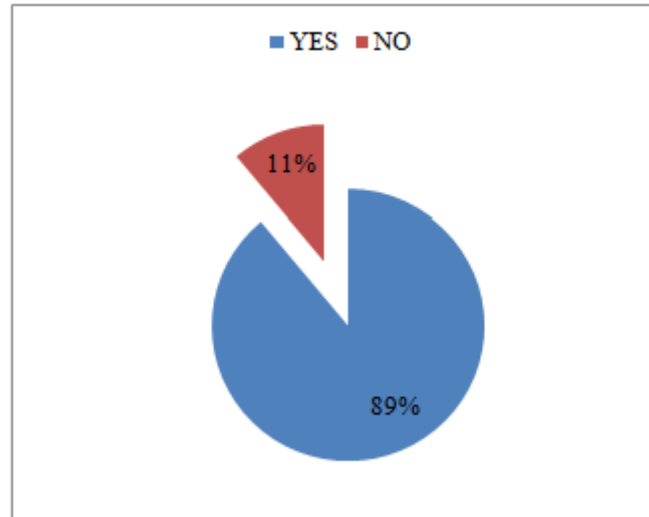

Fig 2: willingness of people use bicycle in all month

Figure 2 shows that people are willing to use bicycle when bicycle sharing system is implemented. They show less interest to use bicycle in months of September to November where the City experiences monsoon rainfall in those months.

Fig 3: Public willingness to use cycle

Nearly 89% of people had said that they will use this system if it was implemented in the Erode city. Figure 4 shows the response of the public on the rent they are willing to pay for using the public bicycle sharing system per hour.
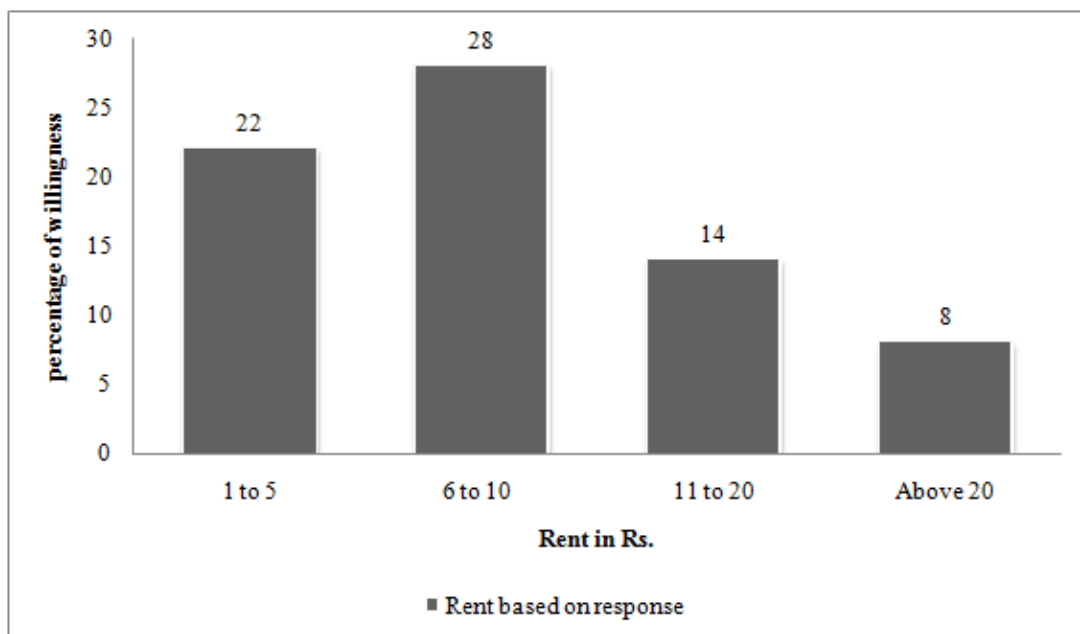
Fig 4: Rent based on willingness

Nearly 28% of the respondents had willingness to pay Rs.1-5 per hour and 22% of the respondents had willingness to pay Rs.6-10 per hour and 14% of the respondents had willingness to pay Rs.11-20 per hour and 8% of the respondents had willingness to pay above Rs.20.
After analyzing the data location of dock stations should be planned. In Erode city we planned to develop public bicycle sharing system with dock stations.

1.4 Location of Dock Station
Dock stations are located near the important places like colleges, markets, bus stand, railway station and shopping malls. The factors influencing the location of station includes on street parking spaces, vacant space in the road side landscaping strips, areas beneath flyovers and foot over bridges, private property near large commercial and housing department.

From the questionnaire survey and inventory analysis 46 places were identified for locating dock stations. The average spacing between the stations is 1 Km. The dock stations are located close to the road, so the public will have good accessibility to dock stations.

Table 1: Location of dock station

Road	Location of dock station
Sathy road	Veerappan chathram CNC college Periyavalsu Soolai bus stop Soolai Kaniravuthur kulam CS nagar Mamarathupalayam
Bhavani road	VOC road Bhavani road bus stop Lakshmi Theatre Madha church BP Agraharam Barrage
Pallipalayam road	Thirunagar colony KRV nagar Karungal palayam Housing board KAS nagar Check post
Marappalam road	Market Marappalam Manikoondu
Chennimalai road	Government hospital Soorampatti naal road Railway station Jaganathapuram colony Maharaja multiplex Soorampatti
Perundurai road	Sathyamoorthy hospital Edayankattu valasu Sampath nagar New teachers colony Collector office Kumalankuttai Palayapalayam Sengodampalayam Thindal Vettukattuvalasu PS park
Palani road	Fire service Kalaimattusilai Lotus hospital Kollamapalayam Byepass Annamar petrol bunk Telephone Nagar stop Jaycess school

V. Mapping of Dock Station

The locations of identified dock stations are shown in map. GPS survey was conducted and latitude and longitude coordinates of each location were taken. The recorded coordinates were given in Google Earth Pro software and places are located. Figure 5 shows the map of dock stations and Figure 6 shows the map with location of dock stations and tentative route that connect all the dock stations.

Fig 5: Map of dock stations

Fig 6: Map of dock station with route

VI.   Conclusion

This study shows that implementation of bicycle sharing system in Erode city will in- crease the bicycle usage by decreasing short car trips. It helps to promote sustainable mobility in the city. The planning of bicycle sharing system includes analysis of impact factors, public response and government regulations. Based on the above, 46 locations are identified for placing the dock stations across the city. The location is selected based on the people response, demand, travel time, geographic and metrological conditions. The places selected for dock station location includes commercial areas, educational institutions and also holistic places. A map showing the locations of dock stations are prepared using Google Earth Pro software.

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