A Proposed Bike sharing Project using GIS-based method in Sheffield City UK

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کورتەی توێژینەوە

پێشنیارکراوی دیاریکردنی شوێنی پایسکیل وەک بەشێکی سەرەکی لە سیستەمی گواستنەوەدا بەتایبەتی لەناوشارەکاندا پرۆژەیەکی پێشنیارکراوی ئەم توێژینەوەیە ئەویش بە بەکارهێنانی بنەماکانی سیستەمی زانیاریە جوگرافیەکان وەک هۆکارێک بۆ هاتوچۆکردن وبڕینی ماوەکورتەکان، هەروەها وەک شێوازێکیش کە توانای گۆرانی هەیە بەئاسانی لەلایان بەکارهێنەرەکانی پاسکیلەوە.

ئامانج لەنوسینی ئەم بابەتە بریتیە لە پێشنیارکردنی پرۆژەیەک بۆ دەستنیشانکردنی شوێنی پایسکیل لە شاری شێفیڵد لە بەریتانیا چونکە هۆکاریکی ئاسانە بۆ هاتوچۆکردن لەناوشاردا، وە بەکارهێنەرەکانیشی دەتوانن زۆر بەئاسانی باکاریبهێنن بۆ گەیشتنیان بە شوێنی کارەکانیان. لەم توێژینەوەیەدا ئامازەکراوە بە چەندین لایەنی سودمەندی دەستنیشانیکردنی شوێنی پایسکیل کراوە وەک شێوازێک بۆ رێکخستنی چۆنیەتی بەرێوەبردنی هۆکارەکانی گواستنەوەی ئاسان،هەروەها لەشێکاریەکەدا کاریگەری وەبەرهێنان وباشترین رۆڵی پایسکیل وەک هۆکارێکی ئاسان بۆ گواستنەوەو وە تیشک خستنە سەر پێشنیارکردنی چۆنیەتی بەرێوەبردنی بۆ سەرلەنوێ دابەشکردنەوەی سیستەمی پایسکیل سواری لەچوارچێوەی سیستەمی گشتی گواستنەوەدا . هەروەها ئەم توێژینەوەیە جەختی کردۆتەوە سەر رێکخستنی کاروباری بەکاربەر بۆ پەلەکردن لەبەدەستهێنانی زانیاری دروستدا لەسەر شوێنی هۆکاری گواستنەوەکەی ئەمەش بەبەکارهێنانی سیستەمی زانیاریە جوگرافیەکان(GIS) کە زۆر وردبینانە کاردەکات بۆ جێبەجێکردنی تۆرو دامەزراندنی پرۆژە تازەکانی هاتوچۆ لەناو شارەکاندا.

وشەی سەرەکی: پرۆژەی پایسکیل. سیستەمی زانیاریە جوگرافیەکان، شیفێلد، سیستەمی گواستنەوە، شوێنی گشتی.

گۆڤاری زانکۆی هەڵەبجە: گۆڤارێکی زانستی ئەکادیمیە زانکۆی هەڵەبجە دەری دەکات	
بەرگ	٥ ژمارە ٣ ساڵی(٢٠٢٠)
رێکەوتەکان	رێکەوتی وەرگرتن: ٢٠٢٠/٧/٢٢ | رێکەوتی پەسەندکردن: ٢٠٢٠/٨/١٠ | رێکەوتی بڵاوکردنەوە: ٢٠٢٠/٩/٣٠
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خلاصه

يعد مخطط الدراجة جزءاً اساسياً من نظام النقل خاصةً في المناطق الحضرية، حيث نقوم بدراسة كوسيلة للسفر بين المسافات القصيرة وكذلك كونها وسيلة قابلة للتحويل من قبل المستخدمين.

الهدف من ذلك هو اقتراح مخطط للدراجات في شيفيلد كونه وسيلة نقل بسيطة لكنها ذات اداء جيد للتنقل داخل المدينة، كذلك يمكن للمستخدمين استخدام هذا النوع من وسائل النقل من اجل الوصول الى وجهتهم بسرعة كبيرة .

أشار هذا البحث الى ان هناك جوانب متعدد للاستفادة من مخطط الدراجة مثل المنهجية التي يركز عليها في ادارة وسائل النقل البسيطة، ثم ينظر في تحليل تأثير استثمار دورها الامثل كوسيلة نقل مع تسليط الضوء على الادارة المقترحة لأعاده توزيـع الدراجات داخل النظام وبيان< المستخدم للوصول الى المعلومات الصحية حول المخططات المقترحة ويعد استخدام نظم المعلومات الجغرافية (GIS) حاسما للغاية لتحسين اداء الشبكة ولِانشاء مشاريـع جديدة لمخططات الدراجات في المناطق الحضرية.

تضع هذه الدراسة المقترح كأساس لمخطط الدراجة في شيفيلد.

الكلمات الرئيسية: مخطط الدراجة ، نظم المعلومات الجغرافية، مدينة شيفيلد، نظام النقل، المواقع العامة.

Abstract

Bike scheme is a crucial part of transportation system especially in urban area, which is study convertible travel for users. The aim is to propose a bike scheme in Sheffield as an extension for transportation; as well as, Users can use this type of transportation in order to reach their destination quickly. This research indicated that the several aspect of the bike scheme such as and focuses on methodology then it considers an analysis of the optimal cycle hire scheme while highlighting the proposed management for redistributing bikes within the system and explained history of bike sharing. Designing public websites is another section which this study focuses on and user interface for accessing information on the proposed schemes. Utilizing GIS is very, decisive to improving the network and to making new bike scheme projects in the areas. This proposed study lays the foundation for the bike scheme in Sheffield.

Keyword: Bike scheme, GIS, Sheffield City, transportation system, public websites.

Introduction:

Recently, the bike scheme is part of a transportation system in urban areas as it provides a flexible travel for users. Public bike schemes are found in different forms worldwide. According to DeMaio (2009), the first bike sharing started in 1965 in Amsterdam, the second generation of this program began in 1991 in Denmark and the third generation started in 2005 in Lyon; it was the largest program. It also expanded to Paris in 2007 and to London in 2010. The "4th generation system like Capital bike share is characterized by GPS tracking technology, improved distribution, and mobile, solar powered stations" (Daddio, 2012 p 2).

DeMaio (2009) stated that bikes have varied benefits in an environment and socioeconomic fields. They are environmentally friendly as they reduce pollution; they positively affect health and fitness and assist in decreasing the traffic conjunction and in improving the feasibility of public transport by creating an extension service. The purpose of this study is to propose a bike scheme in Sheffield as an extension for transportation; it also helps users reach their destination speedily. The study discusses the different aspects of the bike scheme including an illustrated history of bike sharing and focuses on methodology then it considers an analysis of the optimal cycle hire scheme while highlighting the proposed management for redistributing bikes within the system. Another section focuses on designing public websites and user interface for accessing information on the proposed schemes.

The Study area

Sheffield is located in Southern Yorkshire and it contains 29 wards. According to the census of 2001, it has 513, 234 inhabitants.

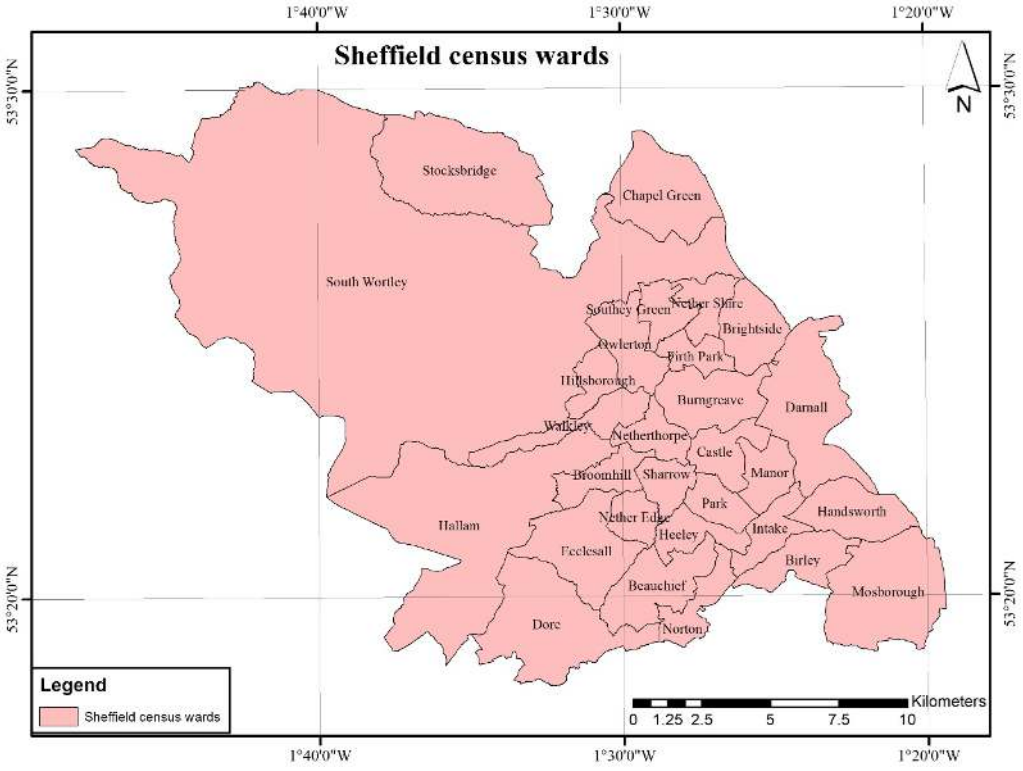


Figure 1 Sheffield: study area

Location of docks

To create a new bike scheme system in Sheffield, GIS can be used to identify the area proposed for the project; such identification is based on the population density which is determined in accordance with the travel distance; it is utilized for selecting suitable areas for dock locations and the number of bikes on each dock. Figure: 2 illustrates the area of the project and the location of the hubs. This project attempts to place (115) hubs including (878) bikes. The number of bikes is divided on the docks in the area according to the estimated demand.

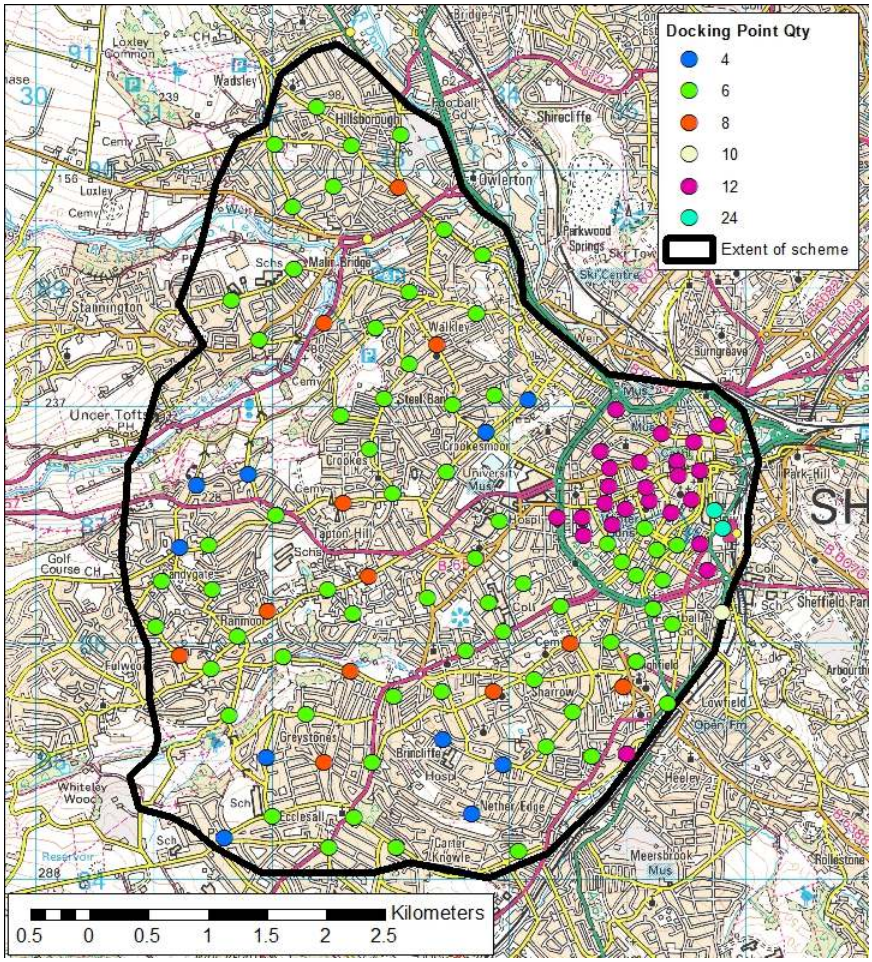


Figure 2: the location of the project and the hubs.

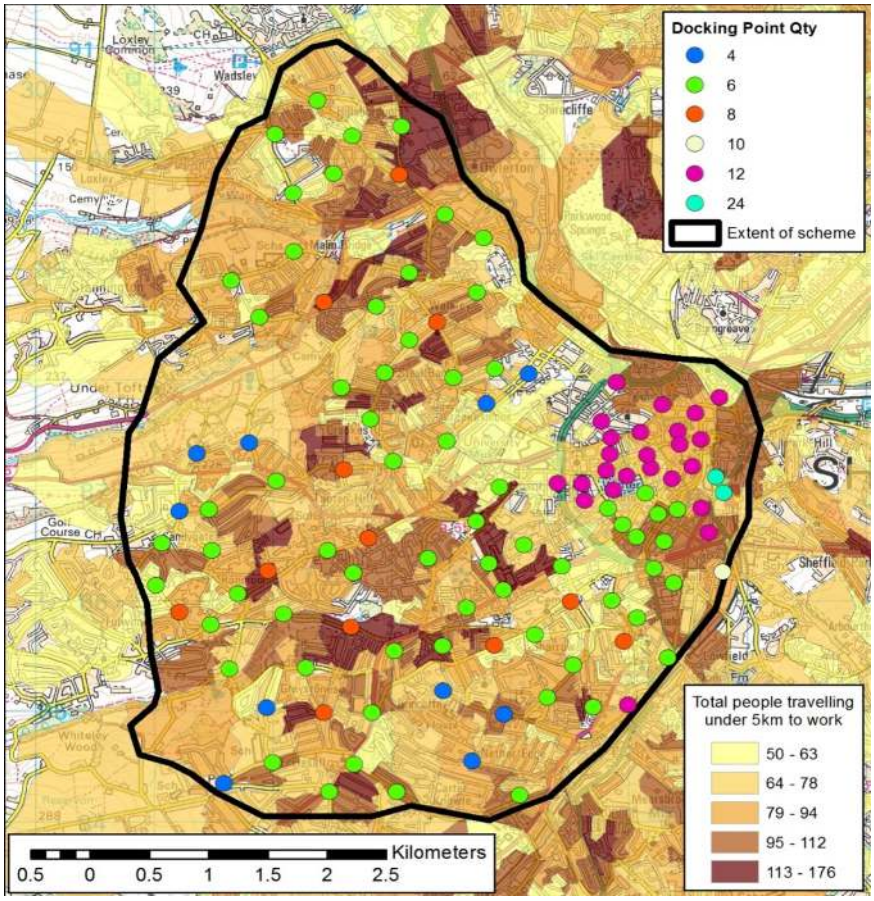


Figure 3: total people travelling to work less than 5Km

Two-thirds of all journeys are for less than 5 km. These trips might involve walking, riding a bike or taking public transport (Figure 3). These modes of transport are more attractive; they encourage people to reduce the carbon footprint by leaving their cars at home; they thus assist the UK to reach its climate change targets.

Methodology:

Using GIS is very crucial to developing the network and to creating new bike scheme projects in the cities. This proposed study lays the foundation for the bike scheme in Sheffield. Geo-Demographic data obtained from UK census 2001 to investigate the spatial distribution of population including student, people without cars and age between 15-45.

GIS displays the features as maps revealing the population density, network and topography by using ArcGIS. DTM created by ArcGIS to comprehend the topography of the site, and hillside in the area to finding a suitable location for the stations.

GPS plays a great role in this project as the user can find out the nearest dock station. On the other hand, GPS is useful for identifying the location of bikes around the area of the hub and for decreasing the level of theft and it is useful in the process of restocking (Alta Planning and Design, 2010).

Outline of the Tender

The tender aims to provide an efficient bike scheme for Sheffield as it succeeded in other cities like Paris and London. Younger travellers such as students and workers are classified as base users since they travel within a reasonable distance. For the success of the scheme, the researcher adopts the techniques applied in other schemes in the capital cities and takes advantage of their shortcoming. The scheme should also concentrate on specific times, for example, the early morning from 8:30 to 9:30 am, travelling for work, and the afternoon from 5:30 pm to 6:30 pm commuting back home; there is another time between 12:00 to 2:30 pm (Harper, 2010). Price is another issue, providing 30 minutes free and assigning suitable prices. One hopes that such prices encourage people to register for one year membership. This assists in controlling demand through statistics; for instance, in Paris and London, the fees are increased precipitously from short to long distance trips; this encourages shorter hops and thus, higher bikes will be made available.

Prkin et al, (2008) reported that the UK census offers data about the people who use bikes to work and the distance of travelling to work. Census data were used for mapping in order to decide the location of the hubs. In the first step 878 bikes divided into 115 docks in the study area, this might increase in the future.

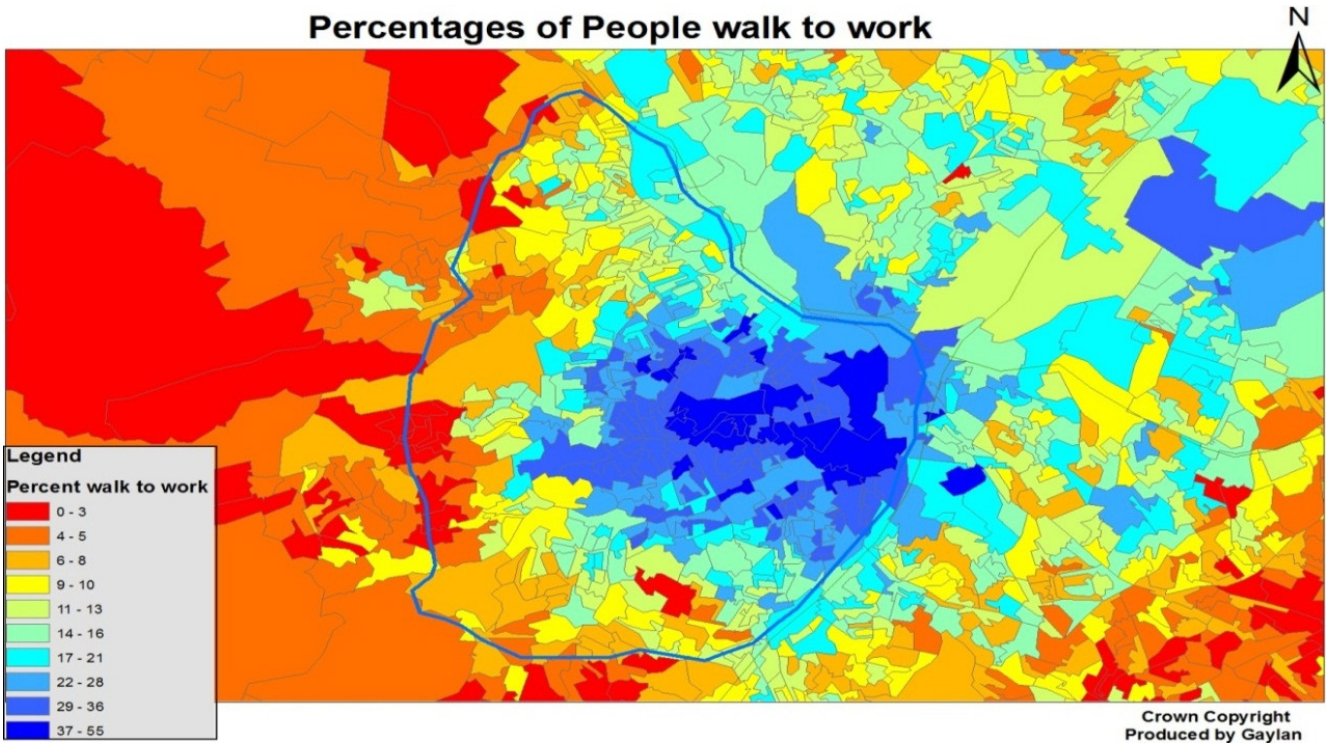
Market demand analysis:

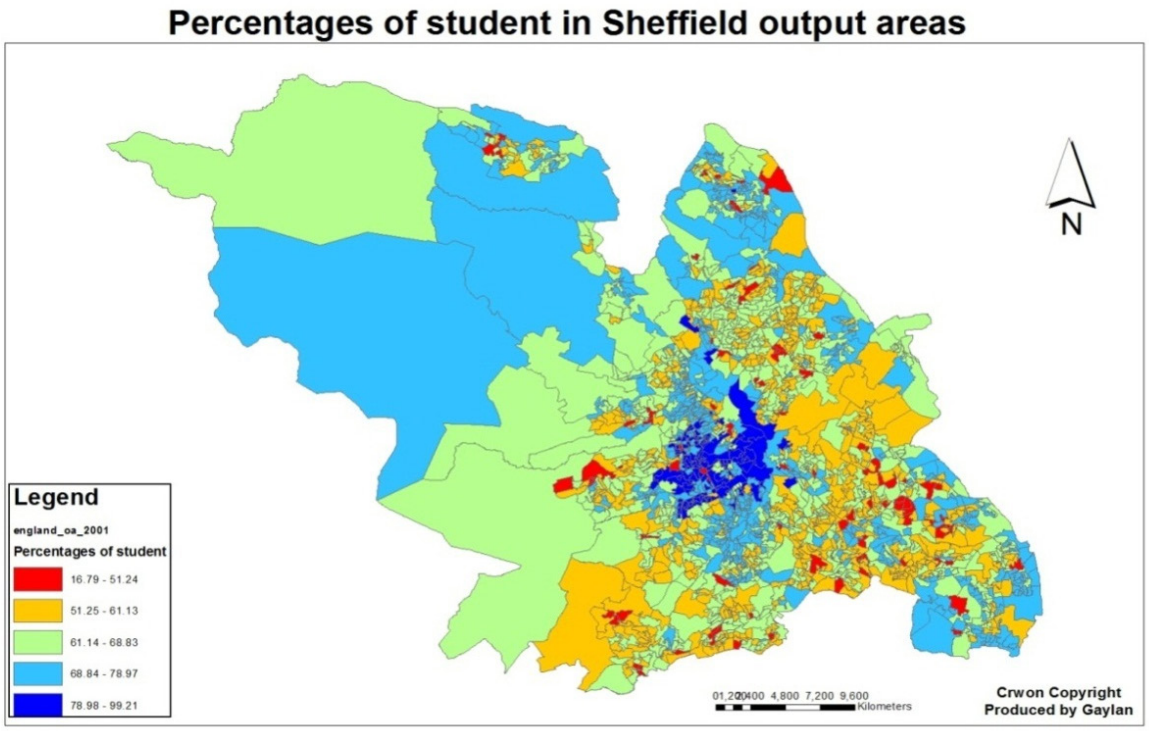
According to Longley and Clarke (1995), the markets should emphasize the sub-groups not the whole population for success is related to Mass-to-niche marketing. This project aims to target the sub-groups of the popula-

tion such as the students, the people with no car and the specific age groups and to investigate their demand patterns.

Students are significant targets for marketing the bike scheme as they need to travel daily between the university and their houses. People with no cars are a good variable in the bike scheme marketing, because they need to use public transport for their movement or walking to work figure (4) show that higher rate of population walking to work concentrating around the city centre. Similarly, people whose ages are between (15 to 45) are more likely to use bikes; people under 15 are not allowed to ride bikes from stations like the London bike scheme. For finding spatial distribution, the Choropleth maps were used.

Organizations such as the schools and the workplaces should be considered as a target market. They should design a program to encourage people in these organizations to use more bikes as they need to have a better travel plan





gure 5: Percentages of student in Sheffield Output areas. The figure demonstrates that the City Center contains a higher percentage of students.

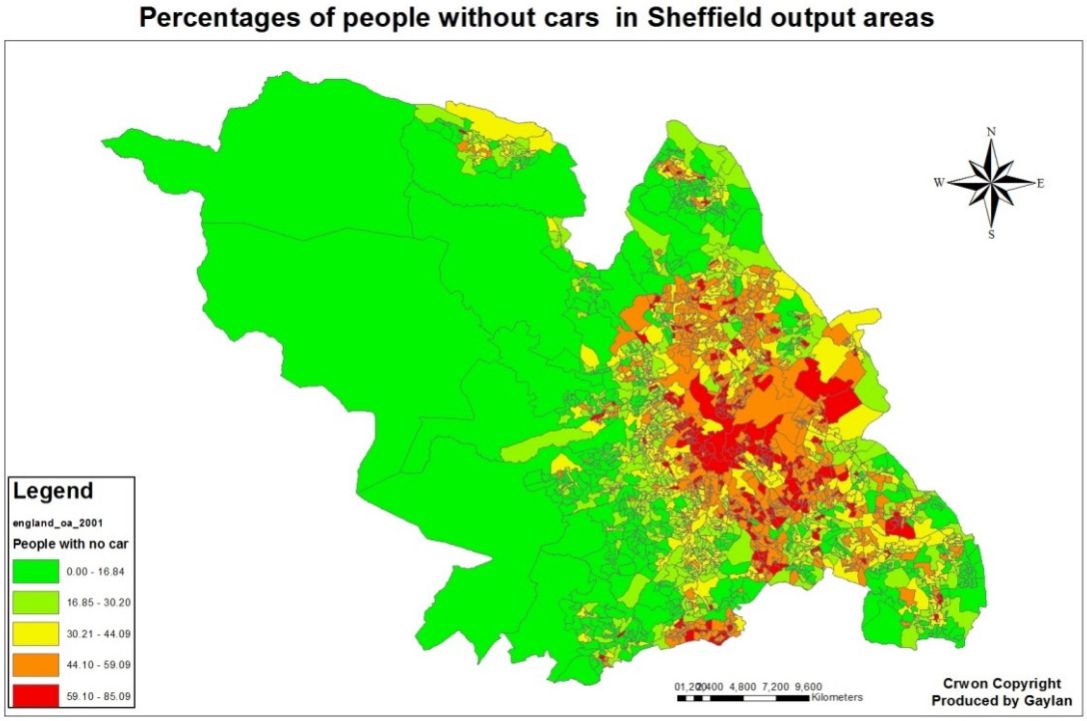


Figure 6: Percentages of people without cars in Sheffield output areas.

The figure reveals that the percentage of people without car is higher in the city center and in the eastern part of the city.

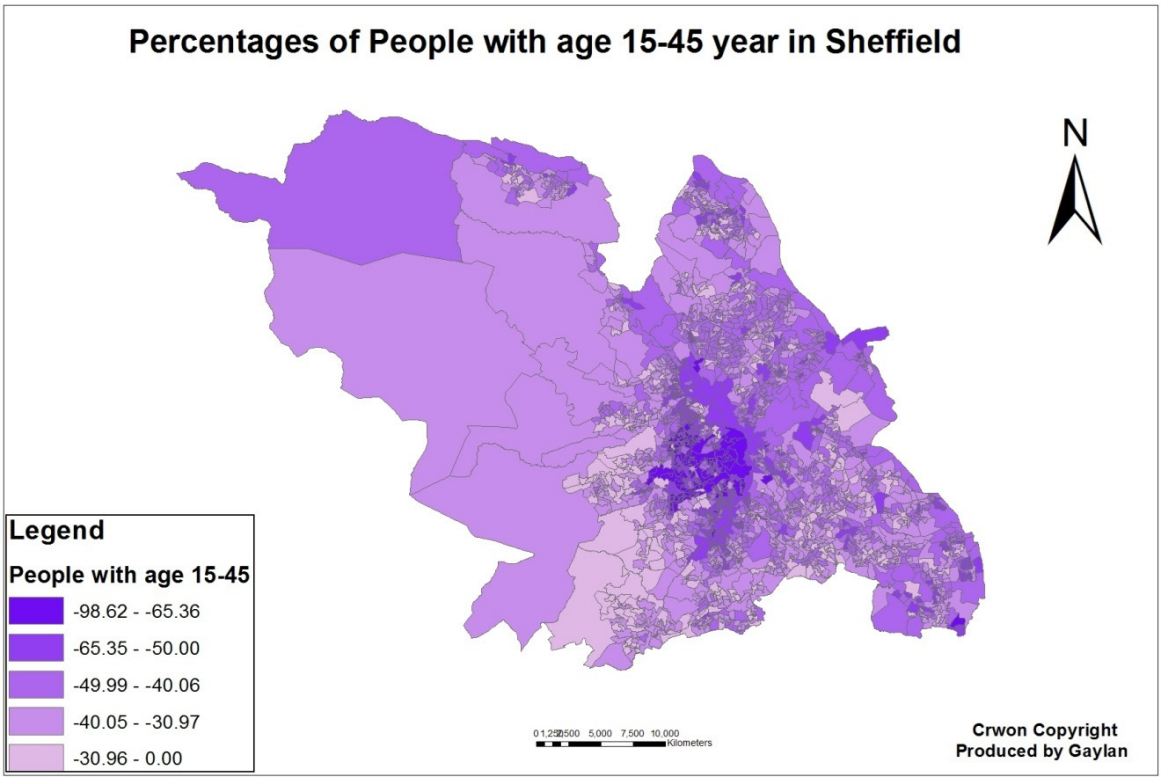


Figure 7: percentages of people aged 15-45 years in Sheffield Output areas. The figure illustrates that the high percentages are located in the city center.

Topography of study area:

Topography has a major effect on the bike scheme because people like to ride bikes downhill rather than uphill. In order to find out a suitable location for the stations, this study analyses the slope of the areas using GIS to create DTM; this analysis is essential for understanding the area and for finding the hub locations; it thus assists the redistribution processes. Figure (8) shows that the areas around city centre generally have less slopes and are mainly flat, which makes them better areas for locating the schemes.

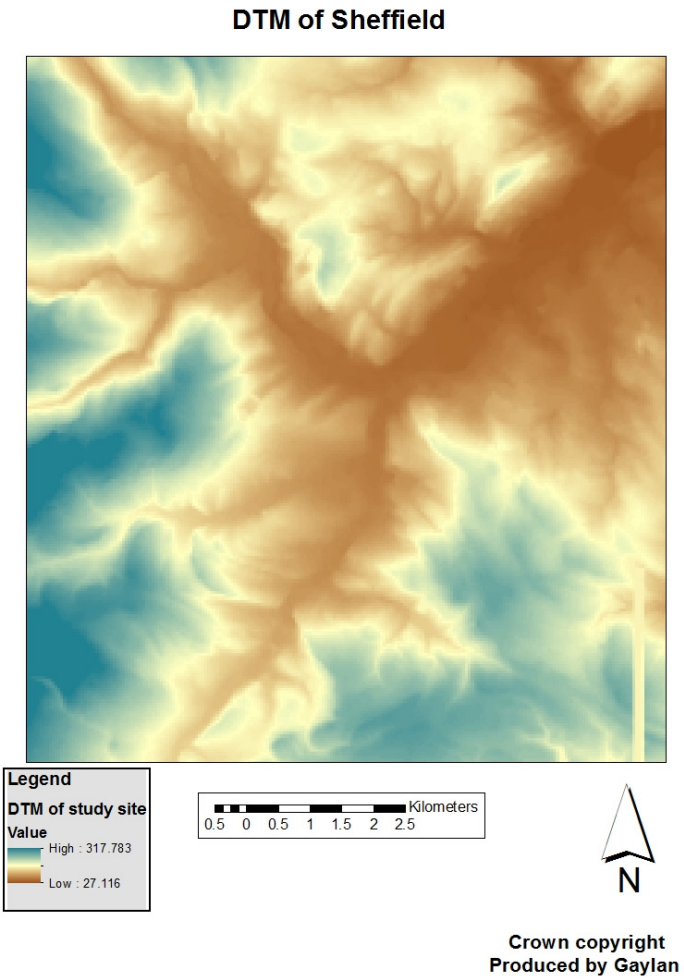
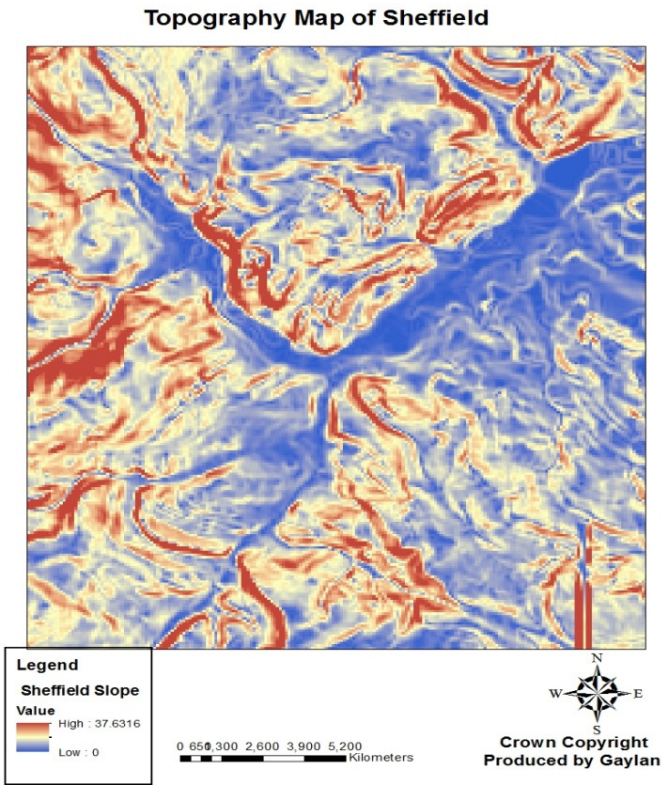


Figure 8: DTM of the study site



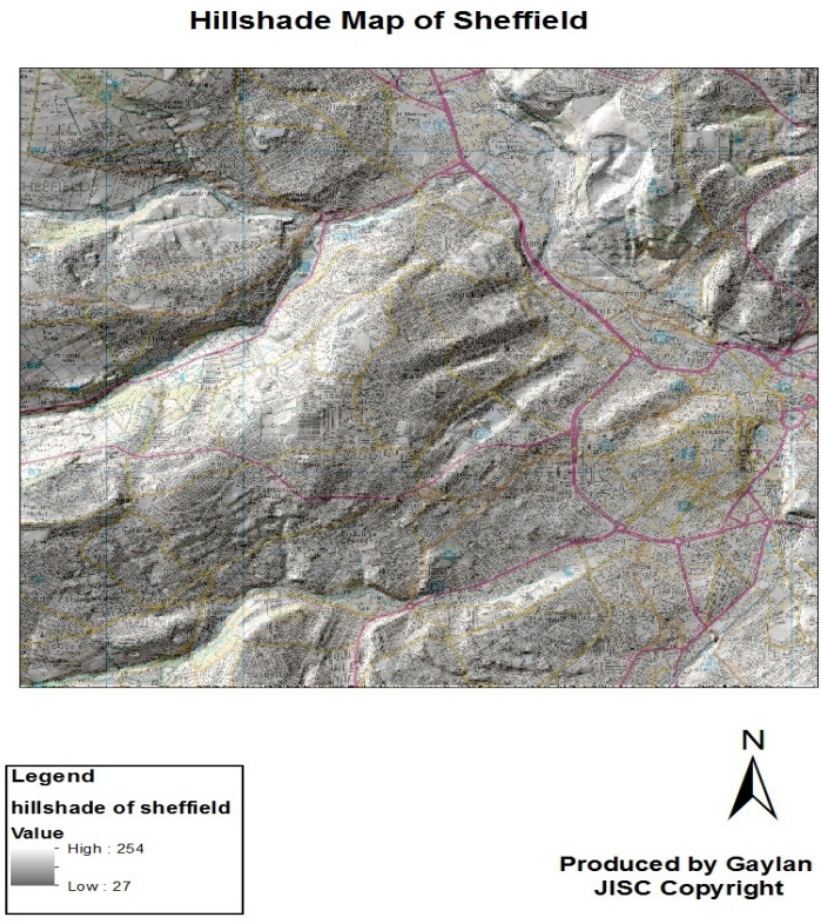


Figure 10: Hillshade of the study site. This figure shows clear view of land in the study area

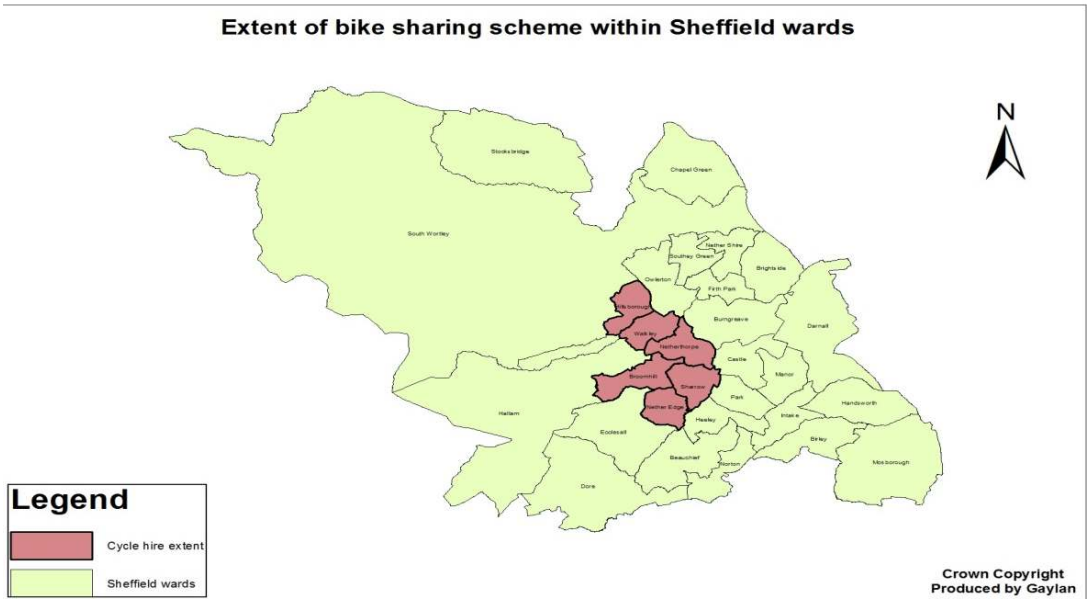


Figure 11: Illustrate a suitable location of the project.

From the figure above it is clear the wards around the city center are high in population density; they include students, people with no cars and age groups between 15 and 45. These areas are more likely to be the de-

mand areas for the bike scheme. Moreover these wards around the city center have a gentle topography as it is clear in the figure (8 and 9).

Monitoring:

Monitoring aims at observing the bike schemes in Sheffield; it estimates the traffic and maintains the running flexibility of the system. The following need to be monitored: firstly, the hub performance; each bike in the dock should be recorded whether it is rented out or docked by calculating the average of the visits (daily, weekly and monthly). According to the results, the board will decide which hub will be closed, remain as it is or relocated. Secondly, recording the incidence including the theft; from this record, the location of theft will be made clear and the dissension of increasing security in these areas should be considered; In London during the first year only 12 bikes have been stolen because the all-day travel cost £50 and the punishment of non-return bikes was £300 (Lewis, 2011). Thirdly, recording the life period of bikes and replacing them with new ones when they are expired. Bike damage is another issue and it assists in understanding the areas and the user with more bike damages. Besides, the quality of the bikes should be recorded by asking questions in order to improve the services. Lastly, the process of recording the accidents and analyzing their causes is important for drawing a suitable safety plan.

Redistribution

Redistribution is very important because one of the key points is the lack of bikes as it documented in London; the system should select the highest demand areas assuming that people have immediate and easy access. This will be more crucial in Sheffield because of its topography.

According to Jzti and Consulting (2010), the geographical features and the general characteristics of the city have an impact on the city; it limiting certain trips including those in the hill areas. At Montmarte which is a steep hill in Paris, the rider always takes the Vélib to cycle down the incline instead of going up, leading to a marked shortage of bicycles at the peak of the hill (Hickman, 2010). It is expected that Sheffield would face similar problems so the system needs to ascertain that it is fully ready for actual distribution. This is especially important in the beginning of the scheme as it needs to show easy access and better services. The topography map of the city clarifies the exact areas that might need redistribution during 24 hours; the system should also provide easy and quick access focusing on restocking the tops of the hills.

Bike share schemes redistribution is essential from full hubs to empty hubs by the particular design because of the unbalanced travel design and topographic conditions. Solutions can be applied to distribute bike professionally as the redistribution of a bicycle is a part of the (VRP) problems. Although, VRP solutions mainly use the Euclidean length which is a irrespective road situation including traffic rules and geographical reasons, may lead to needless waste of time deliverance and human assets.

The redistribution of the cycle is a fraction of dispersal logistics which is a type of spatial information actions

that requires GIS for its support. The majority of public services of bicycle affords exact information in time for renters as well as managers on GIS' Web, which shows the station locations of bicycle employ dockage and letting conditions. This service permits smart phones used by renters to get the closest station, and presents both numbers of accessible bikes and closest docking locations in actual period

In addition, thiessen polygon around the hub to determine the closest points to them. GPS will then be used to detect bikes in the area around the hub (Figure12).

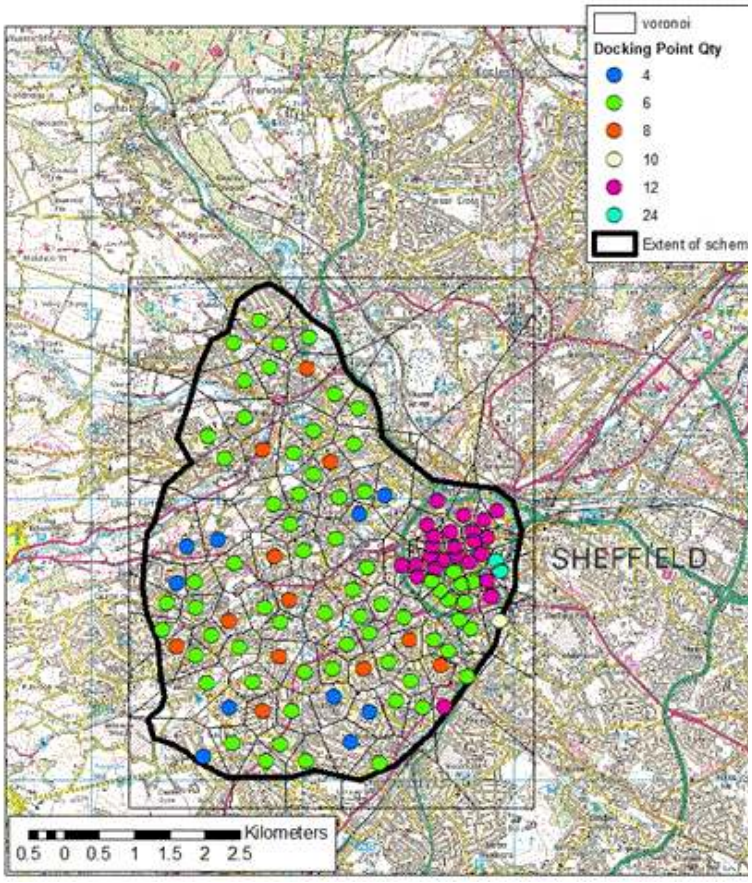


Figure12: Thiessen polygon around the Hubs

The Website:

The Website services should be made available approximately 99.9% per month; they should also ensure that 99.9% of the requests per day are processed in less than two seconds. They can contact the service center successfully by receiving customer calls quickly. From the website, everyone is able to get membership easily using the mobile. Moreover, it contains details of the manner the bike share system works. After the customer logs in, s/he selects the start point and the end point of the journey; all the details will be displayed on the website including shorter distance, the average of calories burnt and the tress that is saved per year by using bikes for transportation (Figure13) .

GIS plays a basic role in the website in that it can display the current network by mapping and selecting the shorter distance for travelling; GPS also helps users discover the nearest docking stations (Lin and Chou, 2012).

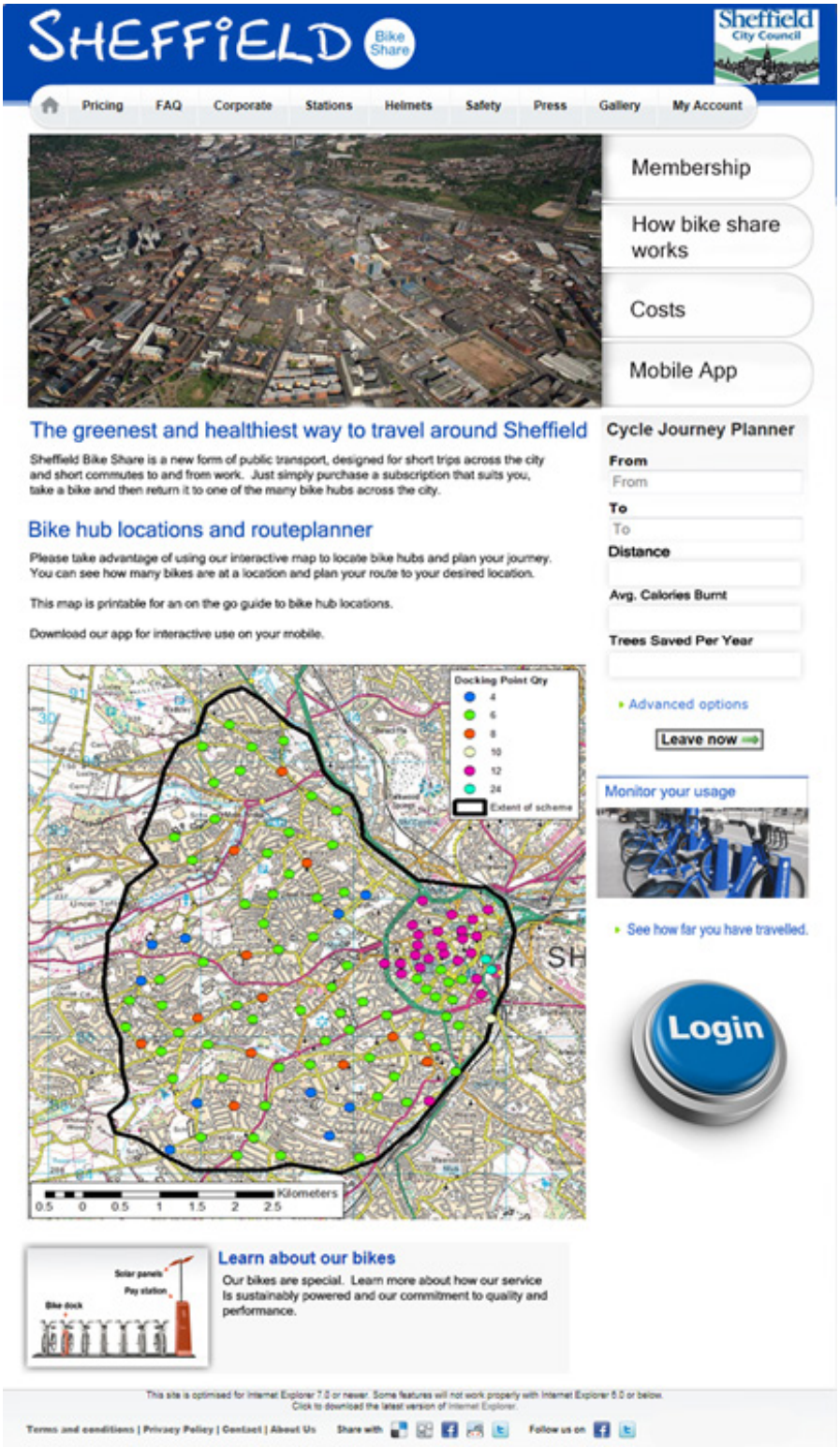


Figure13: the design of the Website as it appears to the users

Conclusion:

Using a bike for short distance travel can fill the gap between walking and using other types of transportation. This tender attempts to discuss the project of opening bike schemes in the Sheffield. GIS assists in improving on the system by selecting the current roads and identifying the suitable locations of hubs according to the population density and travel distance. Furthermore, the proposal benefits from GPS in that it selects the nearest location of the bikes in the process of redistribution and restocking.

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