Rent-A-Cycle (Smart Bicycle Sharing Service-IOT Based)

Sarmad Hameed, Faraz Junejo, Naqi Jafri, Dania Rashid and Fabiha Shoaib
Department Mechatronics Engineering, SZABIST, Pakistan

Received Date: 09-06-2021 Published Date: 13-09-2021

Abstract

Bicycle Renting Service or sharing service is about renting a cycle. Bicycle sharing schemes offer a minimal effort and ecologically helpful mean of transportation for short journeys. It can likewise be utilized as a shared mode to other open travel, for example, transports, neighborhood trains. Bicycle sharing systems unite the benefits of open and private transportation to all the more likely adventure the given transportation foundation. This paper high point smart bicycle sharing service which is totally accessed by android application. This research paper also states facts and figures that bicycle sharing services are environmentally friendly and also great for an individual health. The main scope of this bicycle renting schemes is to implement it to reduce environmental pollution and for health purposes. This scheme is smart bicycle renting scheme in which GPS tracking, QR scanning, online payment, automatic locking/unlocking through android application, and all features on just one android application. This scheme also has admin website where all the information of user and bikes are stored also history of bikes, payment and rides for security purpose. From a distinctive individual's perspective, bicycle share systems take out the burden of bicycle proprietorship, the need to look for parking places, and the dread of burglary. It helps in decreasing rush hour jam clog as number of vehicles on street can be fundamentally reduced.

Keywords: Bicycle Renting Service; Environmentally Friendly; GPS Tracking; QR Scanning; Website; Android Application; Automatic Locking/Unlocking.

Introduction

Bicycle sharing system or Bicycle renting system programs seems to be a very great initiative and these programs came into considerations in current years. People are encouraging this concept more and taking initiative to bring back the cycle culture again because modern transport is a very big achievement but they have ruined the atmosphere and environment, health issues are increasing day by day and this modernization is also a factor of these issues. This concept of bike sharing is of very old form early 1960’s but the growth of these programs had been slow because there were no innovations in the idea and problem solution, but now people came up with improved technology like tracking of bicycle, automatic lock, access through phones and many newer and improved features. This development in technology helps bike sharing system to rapid increase of these programs throughout Europe and now mostly other continents during this development era [1]. Bike sharing or renting programs have constantly progressed over numerous peers, becoming more evolved and refined. Previous generations in which first and second generation includes, faced problems with destructions or damages of cycle, theft which leads to the third generation where innovation is improved to solve these issues and also improved payment methods, bicycle distribution all over the city and user data. In fourth generation of Bicycle sharing service it leads to the electric bike with dock less feature, because parking of bicycle was also a problem in public space but dock less offers more flexible solutions in usage of parking and bicycle distribution issues. As day by day improvements and variations are increasing in Bicycle sharing services so cities will also be able to implement or adopt and control this system in its local environment. The diversity of alternatives now days involves more detailed analysis or exploration, steady-fast

Corresponding author: Dr. Sarmad Hameed, Department Mechatronics Engineering, SZABIST, Pakistan
E-mail: sarmad.hameed@szabist.edu.pk

development and principles for new generation rather than previous generations, specifically if someone is looking for new business models within the private zone [2].

Bicycle sharing services are beneficial in many ways than using other transportation modes like buses etc. This Bicycle-sharing or renting programs has facilitated to reduce the hurdles to use the bicycle as a genre of transport, as well as security and safety parameters, parking space, travel configuration, weather and environment, general fees and maintenance. Companies have tried to reduce the barriers and challenges so more people will likely to use the service because everyone needs easy access and comfort, thus automatically it will contribute in effort to upsurge the transport approachability. This BSS service helps to improve atmosphere of the environment by:

- Reducing the air pollution,
- No high greenhouse gas emission,
- Health of people,
- Improved quality of life,
- No carbon gas emission.

Sustainable improvement is a very important and crucial concept, nowadays in all areas of communities. In this modern era, individuals are using more size of the earth to offer the assets that the humans need to endure. Due to the massive consumption of energy, resources and capacity of earth this era is not sustainable [3]. Bicycles are good substitute to cars because it is:

- Eco-friendly,
- Energy effective,
- Reducing traffic,
- Cheap and effective rides,
- Certainly maintained,
- An egalitarian vehicle.

The background of bicycle-sharing system is discussed in this section. The advancement and progress of Bike-sharing programs have four generations up till now.

- First generation,
- Second generation,
- Third generation,
- Fourth generation.

Each generation is different from each other in aspects of technology. Now this generation is about smart bicycle renting services. All four generations have different way of payment method and tracking way of bicycle. This Bicycle sharing service was first introduced in early 1960’s, formal bike sharing but at that time this concept didn’t expand rapidly until modern years.

**First Generation**

First generation of Bicycle-Sharing service first started in Amsterdam in 1965 in which they started a scheme of unlocked and free use of bicycles in many open and free areas of the city.

**Second Generation**

Second generation of bicycle-sharing service launched in Denmark in 1995, the scheme that they launched was that use of bicycles were continue to be free, while the individuals who use the cycles or riders required to insert a coin to unlock the cycle. They just have to put a coin to use cycle freely in the city.

**Third Generation**

Third generation of Bicycle-sharing service was launched in 1998 in France. In this generation technology was improves and advanced and contains automated options for example:

- Credit card,
- Smart card.

These were the payment methods that were implemented to deduct the cost of ride. And to track the cycle they plant embedded GPS systems to track bicycle data.

**Fourth Generation**

In fourth generation of Bicycle-sharing service have been changed and improved in such a way that bicycle is now:

- Have automated locking system,
- No need of a dock,
- Electric bike,
- Solar panels used for bike powers.

In fourth generation there is also a docking Bicycle sharing service ‘DBS’ in which there is ‘lock-to’ technology, this technology consists of a U-shaped lock that is locked to the frame [Figure 1].

**Literature Review**

There are various natural issues that naturalist have been managing in the course of recent decades; one of which is contamination. For example, in China, the measure of carbon outflows, brought out via vehicles and manufacturing plants, have been great to the point that the administration is experiencing serious difficulties controlling air quality. Moreover, reducing oil assets, and rising gas costs are a couple of different components that may convince the overall population like never before to look for different methods for transportation [4]. Bike sharing can contribute towards improving air quality and lessening clog in urban areas as a piece of a manageable travel [5]. Evaluating the vitality ramifications of supplanting car trips with bicycle trips. Its ubiquity has expanded over the most recent couple of years.
internationally fundamentally due its preferences in expense and accommodation over owning a bike and different types of transport. With the improvement of “Internet of Things”, dock less bike sharing plans originally developed around 2015. In [6] the genuine spatial area information of the open bicycle-sharing frameworks of Hangzhou and Ningbo in Chinas utilized which proved that BSSs are useful for equalizing traffic flow.

Bicycle-sharing frameworks (BSSs) are generally utilized in two unique ways: as a separated administration or as a multi-purpose administration giving the missing connection between existing purposes of other transport and wanted goals. Such frameworks are perceived to have natural, traffic, and medical advantages since they are without emonation, can expand open transport, and give a motivating force to athletic action. Moreover, they offer accommodation for individuals who can utilize the administration without the expenses and duties related with owning a bicycle. DeMaio et al. showed that there were three ages of BSSs, with the soonest going back to the 1960s in Netherlands [7]. The “Witte Fietsen” (White Bikes) program was presented on July 28, 1965, in Amsterdam, denoting the commencement of the original framework. These white bikes were shared casually and not followed, prompting various bike-robbers. In 1991, a coin-deposit framework was presented in Denmark, denoting the commencement of the second-age framework. The third-age framework, which uses data innovation to track bicycles and clients, first rose in the late 1990s in Europe and afterward stretched out to numerous urban areas everywhere throughout the world. Before the finish of 2016, around 1,175 urban communities or areas in 63 nations have executed BSSs, incorporating 430 urban communities in China [8].

Dissimilar to conventional bike sharing schemes where bikes must be acquired and returned at docking stations, the dock less schemes enable clients to utilize smartphone apps to find and get bicycles and leave them at countless open areas in a predefined geographic region. The smart lock framework and GPS unit on the bikes makes an enormous amount of spatiotemporal information at the individual dimension to help the administration of the plan, which likewise gives new chances to uncover urban elements and individual non-mechanized portability designs [9]. In comparison with continual bicycle sharing, dock less bicycle sharing is progressively adaptable and increasingly helpful for the clients. Bicycles of bicycle sharing frameworks are broadly dispersed; along these lines decreasing travel remove from explorer to bicycle dropping stands [10]. At that point, the smart bicycle sharing application will demonstrate a guide of the considerable number of bicycles around clients and find the nearest bike. From that point onward, clients scan the QR code with the application and in a few seconds, they can hear the snap and hit out and about. Notwithstanding, with every one of the advantages of this inventive bicycle sharing framework, here come operational difficulties. It is important that there are countless individuals cycling daily. As indicated by certain measurements, there are in excess of 10,000,000 bicycles in bicycle sharing framework. In the interim, heaps of bicycles will be rejected as a rule in three years in China. These variables could cause the accompanying:

1. The nearness of the faulty cycles sharing seriously undermines clients’ security,
2. The administration nature of bicycle sharing framework will influence the notoriety of the organizations,
3. Faulty cycles in the city have an awful impact on the city appearance [11].

At present in excess of 700 bike sharing frameworks have been propelled in excess of 50 nations on the planet, working around 806,200 bicycles at 37,500 stations [12]. These bike sharing frameworks have scored an extraordinary achievement in upgrading the proficiency of individuals’ every day drives. For instance, the Capital Bike share individuals in Washington D.C. decrease their driving by 4.4 million miles for each year [13]. Then again, the current bike sharing frameworks face a few viable operational issues. An enormous assortment of work to date has focused on individual cycling conduct and versatility designs so as to improve the administration and administration of schemes. For instance, [14] and [15] analyzed the geological bunching of docking stations dependent on transient bike utilization designs. By investigating the examples in utilization, bike armada regularity procedures were created and execute for various kinds of stations [16]. Displayed a relapse approach that related encompassing area use qualities with station request, appearing business zones positively affect the use of station-based bike sharing. Such investigations have for the most part centered on interest and regularity bike arrangement, while the relationship and the effect of occasions that occurs between bike sharing and other transportation is less evaluated and talked about [17]. Thought about different spatio-fleeting insights and system (chart) properties of docking stations to uncover the effect of Cylinder strikes in London on bike sharing. Existing investigations of dock less bike sharing are constrained and have concentrated on the administration of bike armadas [18] or the arranging of cycling frameworks [19]. There is considerably more novel research that should be possible focusing on versatility example of dock less bike sharing. A significant part of this is the connection between docks less bike sharing joined with the utilization of other open travel frameworks. This paper disected the effect of new worked metro stations/lines on dock less bike sharing framework. Significant changes in excursion sum, trip remove, just as the diagram structure of cycling streams were found. The new metro administration has had noteworthy positive effect on dockless bike sharing portability designs in various ways [12].

The present synthesis on bicycle sharing frameworks is essentially rotated around the conventional bicycle sharing structure with dropping stands close by movement blueprints and security issues [20], task scales and the operator [21], and ideal position on the earth [22,23], were the first to demonstrate regularity assignments for bicycle sharing framework and projected look calculations for unraveling it [24]. Indicated joined twofold limited association level necessities that fuse stock adaptability for constant regularity in BS frameworks [25]. projected a heuristic calculation for managing the dynamic regularity issue with different vehicles and showed a dynamic evaluating structure that requested that clients return bikes to discharge stations. Regardless, the bicycle sharing
framework in a city does not have the confinement of fixed stations. So the present examinations can't comprehend the Faulty Bike-Sharing Recycling in China. Beginning late, the new bicycle sharing framework without docking station has pulled in idea from a few researchers [26]. Made an exceptional model to verify an ideal progression of bikes inside the working region, in context on a point by point GPS-information examination for the bicycle sharing framework [27]. Projected a technique to utilize the compensation amassed by a blockage regard blueprint to execute a bicycle sharing framework [28]. Projected a compound entrenched gigantic search with variable neighborhood drop figuring, which can manage static regularity issues for bicycle sharing structure [29]. Projected an official based bike redistribution framework that began from the measure of the number and placement of cycles in a working territory and finished with a choice truly solid framework for the improvement technique [30]. Considered the pay changes of the stage after the bicycle sharing stage got a handle on the month to month strategy and got the best month to month enlistment evaluating to expand the stage pay. Regardless, separated and bicycle sharing scale in China, these examinations depended upon intelligent examinations that are of fundamentally increasingly modest scale. Accordingly, Faulty Bike-Sharing Recycling issue legitimizes more idea. Furthermore, [31] found that without a doubt the most grounded marker for bicycle use is the accessibility of a bicycle. Regardless, up to now, there is no examination on faulty bicycle sharing reusing in the structure. In like way, this examination relates this hole by revealing an answer tally that watches out for this issue and causes bicycle sharing relationship to lessen working expenses especially in Chinese urban zones [14].

With the burst of BSSs, many bicycle-share related issues use designs. This shows a test for individuals who will most likely be unable to discover a bicycle or an unfilled dock at specific stations, which will fundamentally decrease the administration dimension of the framework and the quantity of potential clients. To fulfill clients' needs, it is critical to direct regularity activities by expelling bicycles from stations that are full and refilling the docks of void stations. Nevertheless, redistributing bicycles straightforwardly as per the present condition of the rental station may not be fitting. The reason is that the pickup and return requests exceedingly vacillate for the duration of the day, which will make the redistributing procedure linger behind. Subsequently, request expectation, determining what number of bicycles will be grabbed or returned by clients at a station during a predefined time interim later on, is the way to regularity activities. As pickups and returns that happen at the same time at a similar station counteract one another, the net redistributing procedure linger behind. Subsequently, the absence of point by point rental information, numerous past investigations led research contemplates by utilizing surveys Bernatchez et al [33], enlisted an example of 7011 grown-ups to lead relative research considers on the BSS in Montreal Shaheen et al [34]. Issued two separate polls to bike sharing individuals and nonmembers to distinguish key contrasts and likenesses between the two gatherings [35]. A few examinations gathered the ongoing number of accessible bicycles at each station from the administration site that means to give rental data to clients to direct research Kaltenbrunner et al [36]. Recorded the quantity of accessible bicycles from the "Bicing" administration site to direct utilization design investigation and request forecast of the BSS in Barcelona Faghih-Imani et al [37]. Utilized the moment by-minute number of bicycles accessible at each station spared from the bicycle-sharing administration site in Montreal to ascertain the entry and flight rates [38]. As administrators as often as possible perform regularity tasks and the event of these isn't demonstrated inside the information on number of bicycles accessible, it is difficult to straightforwardly recognize whether the expansion/evacuation of bicycles is because of clients or administrators. As progressively rental information opens up to the world, there are more investigations in the writing that apply the rental information to increase a few bits of knowledge into the BSSs.

Disregarding eminent suitability and versatility, a noticeable issue in bicycle sharing structures is unequal bike usage, which means a little bit of bikes are used fundamentally more sometimes than others. Bikes that are used a ton of are powerless and consequently addition fix bills and lead to potential organization denied. The fix cost of Hangzhou bicycle sharing structure was right around 6,000,000 Yuan (2012) [39]. The yearly help cost was 200 dollars to 300 dollars per bike in the season of in Washington (2012) [40]. The bike stores in New York completed almost 5000 bike fixes in 2017 with a hard and fast number of approximately 9000 bikes in the structure [41]. Normally, chairmen can modify bike use by driving customers to use those unpalatable bikes subject to utilize counts of each bike. In any case, driving customers to rent a specific bike isn’t rational. Through coordinating the exercises of customers, it can enable evening out to bike use, reduce assignment cost and improve customer experience [42]. A couple of papers immediately analyzed customer individual lead gauges and after that projected perceptive models to guess bike use solicitation or stock component of stations later on period [43, 44]. Used four central conjecture prototypes to envision open bicycle in each stand: last regard, chronicled mean, genuine example and Bayesian framework.

SystemDesign

This section explaining the hardware components of ‘RENT-A-CYCLE’. In this chapter all the parts are briefly discussed with their specifications. The main hardware of this project is locking mechanism and dynamo to charge battery; other components are also discussed further in this chapter [Figure 2].
This system has two different parts; those parts are:

• Hardware,
• Software.

**Hardware**

The locking mechanism of our service is designed ourselves. We used helical worm gear mechanism. Helical gear smoothly mashes with the teeth of worm gear, and helical gear also covers the type smoothly for locking purpose. To give power to the cycle we have used Dynamo. Overall components that we have used in hardware are:

<table>
<thead>
<tr>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Dc motor,</td>
</tr>
<tr>
<td>• Helical and worm gear,</td>
</tr>
<tr>
<td>• Dynamo,</td>
</tr>
<tr>
<td>• Micro-controllers.</td>
</tr>
</tbody>
</table>

**Software**

The software part of the RENT-A-CYCLE system is android phone application of this system like Careem and Uber app. To use this service first user, have to unlock the cycle. The unlocking of cycle happens in such a way that user have to scan the barcode which is attached on the cycle, then barcode will check the code if it is correct code ride will automatically start, if it is not correct code then it will generate a message that ‘Wrong QR code’ and goes back to the previous page. User will use the cycle and when the user ends the ride according to his time his fees or cost will be deducted. User has to first popup his or her account before using a cycle through easy paisa or simsim. If the particular individual didn’t popup the money in his account, his amount will show in negative.

There is also a feature in which user can locate the bicycle to ride on it. Application contain following features:

**Android Application feature:**

• Login and signup,
• GPS tracking of bicycles,
• Locking and unlocking of bicycle,
• Payment deduction,
• Security feature and maintenance feature.

**Methodology**

Bicycle renting service was introduced in NUST Islamabad by students in 2017, but this service was deployed inside the university premises and was only accessible by the students and faculty. Therefore, we decided to launch a renting service which would not only be used as a mean of transport but will also be a way to develop cycling culture, as we already know about the environmental conditions of our country, 70% of our air pollution is due to emissions of transportation. Hence, RENT-A-CYCLE is a best fit for the solution of environmental problems.

After doing the literature review and survey about the existing bicycle renting services all around the world, we came across following features of those services:

• Few services have docking station with payments done through cards with pop-up machines available at the station.
• Few are dock less bicycle sharing services, which work through mobile apps having tracking system and online payment, but there is no automatic locking mechanism in the bicycle.
• These bicycle services do not have maintenance feedback option
• They have separate lanes for bicycle riders so they do not encounter any accident but there are places where these services are closed due to security issues in few cities.

**Comparison between RENT-A-CYCLE and CYKIQ:**

Figure 3 is a Table 1 containing the differences between RENT A CYCLE and the existing bicycle renting service in Pakistan i.e. CYKIQ.

| Components                                                                 |
|----------------------------------------------------------------------------|---|
| 1. Dock less Bicycle renting service                                     | 1. Docked Bicycle renting service |
| 2. Automatic locking mechanism on cycle                                  | 2. Automatic lock on the station |
| 3. Transportation mean plus for health purpose                            | 3. Purely transportation mean    |
| 5. Simsam or easy pass wallet                                             | 5. Built-in wallet at the app    |

**Comparison of Rent A Cycle with CYKIQ.**

**Trials and Failures**

We had to design a locking mechanism, which can be placed on the cycle and works through Arduino and operated through android app. Therefore, after surveying the market we conclude to design a lock that was:

1. Teflon pulley and curved iron rod but it did not work because of the friction factor. Surface was friction less so slipping occurred.

2. Then, we tried designing the lock through spur gear [Figure 2] but it also did not suit our requirements, because it needed a lot of modifications and the dimensions were not suitable for our lock.

---

After two failures we came up with helical worm gear mechanism [Figure 3]. With few modifications [Figure 4]

**Figure 4: Helical worm gear mechanism (mashed).**

**Working of locking mechanism**
- This lock consists of helical worm gear mechanism and a DC motor. The shaft of the worm gear is attached to the DC motor. When the DC motor is powered worm gear starts to rotate.
- It is mashed with the helical gear. The helical gear was circular in shape, which was later modified in a way that it surrounds the tyre when it is locked.
- Both the gears move in similar directions, it is locked when the motor moves anticlockwise and unlocks when it moves clockwise.
- There are two rollers placed with helical gear so the gear can move smoothly.
- The whole locking mechanism [Figure 3] is protected inside a metal case which will be attached on the cycle above the type. The lock is designed according to the dimensions of the cycle and it fits perfectly.

**Working of the Android Application**
- Figure 5 shows the working of the android application with the data flow between the hardware and the software.
  - QR Scanning.
  - Tracking through GPS.
  - Server.
  - Arduino Wi-Fi module.
  - Automatic lock.
  - Online payment deduction.
  - Security feature.

**System Algorithm**

**System Overview**
- Figure 6 is the overview of the system. As shown above, server being the heart of the system controls the app, the website and Arduino simultaneously. Arduino controls all the hardware of the cycle. All these sections are processed through the server which connects them together.

**Figure 6: System Overview.**

**Flow Chart of Software**
- Figure 7 is the system flowchart. This shows the working off the android application systematically. It explains:
  1. The app when opened, the GPS in that phone tracks the GPS of the cycle and locates it on the map.
  2. The user discovers the location of the idle cycle and walks to it to scan the QR code placed on the cycle.
  3. If the code is scanned correctly, the lock gets unlocked automatically and the ride starts. While, if the code is incorrect it has to be scanned again.
  4. When the ride has been started, the system starts charging.
  5. When the user ends the ride, lock closes automatically.

The app shows the cost of that ride and consumed time. Also, it displays the available balance.

**System Block Diagram**

**Methodology**
- Figure 8 represents the methodology that has been followed to create RENT-A-CYCLE bicycle renting service. Further the methodology is divided into two sections i.e. the hardware and the software.
- The hardware consisted of:
  - Designing of a lock, which will be ideal for a cycle to get locked and unlocked automatically.
After the market survey and facing few failures, the correct material and gears were selected for the locking mechanism.

Next, the gears were modified to match the cycle's requirement.

The parts of the lock were assembled and fixed on the cycle.

The hardware was synced with the controller and the software.

Last was the testing phase where the system was checked, both hardware and software were working simultaneously. In addition, the website and server were processing the data well.

Figure 9 is the systematic block diagram mentioning the electronics present in the hardware. The input given by the app will give a signal to the Arduino. Next, the relay connected to the lock will get a signal to open or close. The Arduino also gives signal to the GPS for location.

**Sustainable Development Goals**

After the text edit has been completed, the paper is ready for the template. Duplicate the template file by using the Save command, and use the naming convention prescribed by your conference for the name of your paper. In this newly created file, highlight all of the contents and import your prepared text file. You are now ready to style your paper; use the scroll down window on the left of the MS Word Formatting toolbar.

There are seventeen United Nations sustainable development goals. All the goals are interrelated with each other; every goal is basically a solution of a problem. These goals are very important to follow to reduce the hazards and problems. These goals cover every aspect of the society like gender equality, sustainable consumption, reduced inequalities, affordable and clean energy and many others [5].

Following are all the seventeen goals:

- No poverty, Zero hunger, Good health and wellbeing,
- Quality education, Gender equality, Clean water and sanitation, Affordable and clean energy, Decent work and economic growth, Industry, innovation and infrastructure, Reduced inequality, Sustainable cities and communities, Responsible consumption and production, Climate action, Life below water, Life on land, Peace, justice and strong institutions, Partnerships for the goals.

These goals of UNDP are to help and the support the developing countries like Pakistan and other countries. UNDP Pakistan organization wants to reduce major issues that as a Pakistani we are facing in this country. This organization wants to help and support by strengthen public deployment, helping in early recovery from tragedies and hazards, internal transpositions and by establishing institutions [50].

After studying and understanding the goals, few goals are interlinked with the bicycle-sharing service RENT-A-CYCLE. It was concluded that following goals which are:

- Decent work and economic growth.
- Sustainable cities and communities.
- Climate action.

Can be achieved or fulfilled by RENT-A-CYLE, bicycle renting service.

Dock-less bicycles and additionally e-bicycles are the most noteworthy innovative headways to date as far as the BSS’s and can give a scope of advantages to urban areas. In request to catch these advantages, nonetheless, urban areas must most likely set up the kind of administrative norms that will deal with the difficulties of, for instance, the utilization of open space, sharing of information, street well-being, and financing. The principle issue with dock-less bike share plans is that clients can stop the bike in any area as opposed to at assigned stations. This has brought about bikes deterring pathways causing wellbeing issues for different clients, dumped into streams, disposed of in trees, over transport shields and aggregating in specific regions. There are additionally no components set up to anticipate burglary of the bikes and maltreatment of benefits incorporating securing bikes out of reach areas for individual use (for example carports).

In RENT-A-CYCLE project major challenges which came in a way, which are:

- Theft.
- Maintenance.
- No awareness of cycling culture.

To overcome these issues following strategies are planned

1. The application will have an option for feedback. The rider can complain if there is any malfunctioning in the cycle for example if the lock is not working or if the tire puncture, etc.

2. The service will be provided in gated societies so that no one will be able to take the bicycle out of the area.

3. All the information of user is taken while logging in the application for example user’s NIC and email id.

4. If the cycle crosses a specified range, a buzzer will be turn on and lock will be automatically closed.

5. This service is an initiative to introduce the cycling culture in Pakistan. Smart Bicycle-renting services are already deployed all around the world and is the major factor for urbanization and growth of those countries. Therefore, Pakistan should also this step towards clean and green environment.

**Cost Estimation**

Mentioned below is the detailed cost calculation per ride. This amount is estimated in a way that the total money spent on one bicycle will be recovered in 4 months approximately.

- Cost of one cycle: Rs. 2100
- Cost of one lock (including gears, modifications and assembling): Rs. 2500
- Cost of one complete Arduino setup (Wi-Fi and GPS): Rs. 2000
- Cost of one dynamo: Rs. 2500
- Cost of battery: Rs. 300

Total cost spent on one cycle: Rs. 9400

Each ride charges Rs. 0.8/minute. According to this, if a cycle is used for 100 minutes/day, the amount obtained at the end of the day will be Rs. 80. Hence, in 4 (approximately) months if the cycle is used each day for 100 minutes i.e. 117.5 days, cost of 1 cycle will be recovered.

Cost per minute: Rs. 0.8

Time consumed/day: 100 minutes

Cost collected/day: 100 × 0.8 = Rs. 80

Total cost of cycle = Rs. 9400

Days required for recovering cost of 1 cycle: 9400 ÷ 80 = 117.8 days (120 days approx.) = 4 months

**Discussion and Conclusion**

Bicycle sharing innovation has constantly advanced over numerous ages, winding up increasingly refined. Prior ages (original and second era) battled with burglary and vandalism, prompting developments (third era) that improved client data, installment choices, and conveyance stations over the city. A fourth BSS age has now developed, with dock-less and electric bicycles coming into the overlay. Dock-less gives an increasingly adaptable arrangement as far as the utilization of open space for the stopping and circulation of bicycles. Bicycle sharing has extended quickly all through the world as of late. Bicycle sharing projects are intended to fulfill the expanding head out need and to decrease the comparing pessimistic externalities of individual vehicles. As expanding varieties and advancements in BSSs develop, urban communities progressively will almost certainly embrace and work the model inside a neighborhood setting. These new sort of dock-less imparted bicycles to extraordinary favorable circumstances as far as adaptability amid short treks are only...
the ones that could comprehend the suburbanites’ ‘last mile’ issue. Making an advantageous resource for the city and its inhabitants, just as to the achievement of the administrator.

To accomplish the vital ridership rate for long haul achievement, the plan must be grown with the end goal that it is broadly open. This will depend, somewhat, on an arranging procedure that is adequately vigorous as to incorporate a pre-feasibility concentrate to evaluate BSS potential; a practicality concentrates to characterize the specialized parts of the venture; a point by point venture configuration process; and an aggressive delicate or license for usage. Experience demonstrates that by coordinating BSS stations with open transport and giving adequate quantities of these over the city will expand openness and along these lines’ ridership. Additionally, obvious is the significance of situating stations (or administration regions for dock-less bicycles) in blended land-use zones to guarantee short-trip inclusion benefits in different ways in order to expand use from just pinnacle hours to expanded use for the duration of the day.

References


37. Online Z. Hangzhou will add Three Public Bicycle Maintenance Bases.

38. MSA. Bike Share Program.

39. Citi Bike Monthly Operating Reports. CitiBike.


42. Froehlich J, Neumann J, Oliver N. Sensing and Predicting the Pulse of the City Through Shared Bicycling. In IJCAI 2009.
