Dock Based Bicycle Rental System: Survey

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Abstract -- *Many college students living away from home do not own any transport vehicle which makes it difficult for them to commute between classes, cafeteria, ground, sports arena, etc. Although walking has been proven good for health, it's still time-consuming. An alternative for this is 'bicycles'. It is more time-efficient, burns more calories, and increases lower body strength. Other than the above mentioned, opting for bicycles over pollution causing automobiles also helps to reduce the harmful pollutant gases. It is possible to rent a bicycle through a bicycle rental service. For short distances, bicycle rental schemes provide a low-effort and environmentally friendly mode of transportation. This removes the need of buying a new bicycle and makes it affordable to a wider population. It reduces the maintenance time and cost, which would be required of a bicycle owner. This paper is research on why there is an increasing need for bicycle rental apps, how they are better than the air polluting automobiles, their health and environmental effects and how many bicycle rental apps are currently present in India.*

Index Terms: Bike rental system, Bicycle Management system, Cloud-based servers, Firebase by Google cloud, Android application, Google map API, Google direction API.

1. INTRODUCTION

Everything we want is now just a click away, thanks to technological advancements. We may book cabs online for travel, but we cannot rent bicycles and go wherever we want. This is why we built this website, which is aimed at college students who do not have access to a vehicle. Cycling is far healthier than walking because it burns far more calories. Because walking is also beneficial to one's health, it takes up additional time that could be spent on other productive activities. Cycling takes up less time. Aside from that, it helps to improve the environment by lowering air pollution and noise pollution.

Transportation is one of the major causes of increasing greenhouse emissions which can be reduced by replacing automobiles with bicycles.

One of the health benefits of bicycles over automobiles is it reduces the cost of injuries caused due to road crashes[2]. The bicycle is an excellent short-distance transportation option since it produces no pollution, needs no energy, is silent, takes up little room, and is quick and inexpensive (McLintock, 1992; Tolley, 1990). In Britain, 40% of all automobile trips are less than 1.6 km long, and most of these might be converted to bicycles with the right encouragement.

Bicycles take up so little room that 10-12 can be parked in the same space as one car. Their presence contributes to a meditative and peaceful environment, as well as a more modern and appealing image than a campus dominated by parked cars. Cycling should be promoted to improve the nation's health, according to the British Medical Association (British Medical Association, 1992).[1]

Using a bike to get to work is a great method to avoid going to the gym. If you're a cyclist, it's a great method to build up your base miles and fitness without setting aside time for specific training.

Cycling and cardiorespiratory fitness in youths were found to have a clear beneficial association in cross-sectional and longitudinal investigations. Prospective observational studies among middle-aged to older adults found a robust inverse connection between commuter cycling and all-cause mortality, cancer mortality, and cancer morbidity. Commuting cycling showed consistent gains in cardiovascular fitness and some changes in cardiovascular risk variables in working-age individuals in intervention studies[3]. Several agencies assist in the discovery of routes and offers for travel by public transportation such as aircraft, train, or bus, as well as private transportation by automobile. Carsharing has grown in popularity in recent years, and it is a business that heavily relies on the internet booking. A variety of free-floating automobile sharing services have lately emerged, allowing customers to go in one direction without having to return the car to the prior location. [4]

2. Related Work

Rapid urbanisation in India has resulted in a massive increase in the number of motor vehicles. Automobiles contribute significantly to urban air pollution and are becoming major sources of anthropogenic carbon dioxide and other greenhouse gases. The transportation

industry is a key contributor, accounting for 90% of total emissions[5]. Shifting 5% of car kilometres to cycling will cut annual vehicle travel by 223 million kilometres, save 22 million litres of gasoline, and reduce transportation-related greenhouse emissions by 0.4 per cent [2]. If all automobile drivers residing at a distance corresponding to a maximum of a 30-minute bicycle ride to work switched to bicycling, there would be a huge reduction in emissions and exposure[6].

The shift from air-polluting vehicles to bicycles would bring a drastic change not only to the environment but also to health. Increased physical activity would prevent roughly 116 deaths per year, six fewer deaths owing to local air pollution caused by automobile emissions, and an additional five cycling fatalities due to road crashes[2]. There is considerable evidence for enhanced cardiorespiratory endurance and muscular fitness in children and adolescents, as well as favourable body composition, improved bone health, and improved cardiovascular and metabolic health biomarkers. In adults, there is strong evidence for the prevention of early death, heart disease, stroke, type-2 diabetes, high blood pressure, adverse blood lipid profiles, metabolic syndrome, colon and breast cancers; weight loss when combined with diet; improved cardiorespiratory and muscular fitness; prevention of falls; reduced depression; and improved cognitive function[3].

Annual fuel price increases have made bicycling the cheapest mode of transportation. From children to working adults, more and more people are investing in cycling as a cheaper and healthier option. Shorter distances can be covered by walking or cycling. Not only would this save gasoline usage, but it will also help to protect the environment from pollution[7].

The mobile application EZGO has demonstrated that it will significantly improve the current vehicle rental system. This application is used to share vehicles between one another which benefits both the owner who earns some money and the lessee who can use the vehicle as per his/her needs. This is primarily to provide a platform where people who visit the country can rent a range of automobiles at different costs and with ease and cost-effectiveness to rent a car anywhere in the country.[9]

OpenStack is a cloud computing software platform that is free and open-source. The software platform is made up of interconnected components that operate a data centre's diversified, multi-vendor hardware pools of computing, storage, and networking resources. Users can use a web-based dashboard, command-line tools, or an API to control it.[8] On the other hand, Google Cloud has various cloud management features such as Access Control, Billing & Provisioning, Capacity Analytics, Cost Management, Demand Monitoring, Multi-Cloud Management, Performance Analytics, SLA Management, Supply Monitoring, and Workflow Approval. Whereas OpenStack consists only of some of those, it is not a very hard choice to make between these two to choose a platform that can provide a server.

The Bike Sharing Bike Rental application might be implemented using this application, people can visit destinations by renting bikes fast and conveniently. This application can handle rental payment processes that are simple, quick, and secure. This software can display data from bicycle rental reports as well as a quick and accurate financial record[10]. Currently, more than 700 bike-sharing systems have been launched in more than 50 countries, with 806,200 bicycles available at 37,500 stations.[14]. These bike-sharing systems have made a significant contribution to improving people's driving skills daily.

However, contemporary bike-sharing systems have several operational difficulties. To present, a large amount of research has concentrated on individual cycling behaviour and flexibility designs to enhance scheme management and administration. For example, [15] and [16] investigated the geological clustering of docking stations based on transitory bike usage patterns. Bike armada regularity methods were devised and implemented for various types of stations after studying the examples in use [17]. Using a relapse technique that linked encompassing area usage attributes with station requests, it was discovered that appearing business zones have a beneficial impact on the use of station-based bike-sharing. Such studies have mostly focused on bike sharing's appeal and consistency, whereas the relationship and impact of events that occur between bike-sharing and other modes of transportation have received less attention[18]. To investigate the impact of Cylinder strikes in London on bike-sharing, considered various spatial-fleeting insights and system (chart) features of docking stations. Existing dockless bike-sharing research is limited and has focused on the management of bike fleets [19] or the planning of cycling frameworks [21]. There is a lot more innovative research that should be possible concentrating on versatility, such as dockless bike-sharing.

The customer gets the option of hiring any car of his choice based on the occasion using this app. They also included a payment gateway via which users can make payments using debit or credit cards. Additionally, the user has the option of selecting a driver or not selecting one. Their system is mostly made up of three viewing models. The user receives one, the administrator receives another, and the driver receives a third. The

user app allows them to choose from a variety of cars, as well as the pickup reason and destination. The administrator has complete authority over the admin app. They are in charge of adding or removing automobiles, accepting or rejecting bookings, and so on. The drivers are in charge of the driver app.[11]

A car-based rental service research paper uses AHP to determine the relative importance of all the aspects that consumers evaluate when renting a car. In this study, eight criteria were discovered, with buyers favouring the Vehicle model first, followed by price consciousness and the condition of the cars[12].

The use of QR codes in apps for locking and unlocking is used to ensure it cannot be unlocked other than the user. The paper on QR code security gives a thorough description of the most important use cases and the attack vectors that go along with them. - It organises the scientific community's state of the art. – It identifies the most significant research problems for improving QR code security, with a focus on usability and security[13]

3. Bike Rental Design

3A. Cloud computing

The new Firebase Storage is powered by Google Cloud Storage. By using firebase SDK we can upload and download data using our mobile phones. This acts as admin access which allows us to update all the details of users, and bikes and add and delete data which should not be provided to the users of this application.

3B. Architecture design

We have divided the whole project into multiple pages:

(1) Welcome page- On this page, you have two options either you can log in or signup if you are a first time user.

(2) Registration/Signup page- On this page, you will be asked to enter an email and password or you can go back to the login page if you came to the registration page by mistake.

(3) Dashboard- On this page, you have four options - Profile, Book your ride, Map and Helpdesk/Support.

(4) Profile- Here you can add your details like phone number, Enrollment number and college. This helps us to recognize you by your unique enrollment number and college. You can also edit these details if you have entered them incorrectly.

(5) Book your ride- Here you can scan for a QR code on the bicycle to unlock your ride this starts a timer to calculate your total ride time.

(6) Map- Here you will be able to see the nearest available bicycle stop where you can find bicycles to ride.

(7) Helpdesk/Support- Here a chatbot helps you with your problems like being unable to book a ride or maintenance issues or some issues while using our application.

4. Conclusion

Over the centuries, bicycle sharing and rental technologies have evolved, becoming increasingly polished. Bicycle sharing has recently spread rapidly throughout the world. Our approach was to use the concept of bike-sharing. Adopting the older dock-based system allows us to keep all bicycles centralized which makes maintenance of the equipment easier and finding the ride in specific locations easier for users. While the newer version called dockless is where the users can end the rides where they please but this has some disadvantages when used for smaller areas as the number of bicycles decrease[20].

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