Department of Electrical and Computer Engineering

North South University

Fall 2018

CSE499A.3 Senior Design Project

#Project Report

Project Name: Bicycle Sharing System

Submitted To: Dr. Shahnewaz Siddique (SNS1), Faculty, NSU

Submitted By: Group- 08

Section- 03

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Bicycle Sharing System

INTRODUCTION

Smart city demand for energy-efficient transport system also an emphasis on sharing system for utilization of vehicle (example bicycle, motor bikes etc.). Sharing bicycle system has various benefits like appropriate resource management, reduce pollution, etc., lead to improved health. To motivate the bicycle user first we need to explore various parameters like a number of stations, the number of routes, and the number of available cycle per station by using the appropriate statistical approach. Once we obtain the correct status regarding the parameters, then the serving of bicycles to the growing population in the smart city become quite an easy job. The motivation of our work is to enhance the efficiency of Bicycle sharing system by making bicycle smart by deploying sensors on bicycles this will help in collecting real-time data and to forward them to nearby stations. In the recent years popularity of a bicycle sharing program has shown a vital growth. Another reason is easily accessible and economical in promoting short-term bicycle rental system. There would be less congestion for commuters in traffic of the car parking. Tourists can also enjoy hassle free travel without changing multiple busses and taxis. The environment also gets the benefit of no smog after a weekday commute. Cities are managing development and urban living culture is facing major challenges in our daily lives. Based on statistical data of 2007, half of the population of the world was living their lives in cities. UN population fund forecasts that by the end of 2030 nearly 60% of the world population would live their life in cities [1]. Out of all major issues, we can outline, air quality, environmental crisis, and transportation issues. Use of a bicycle is an important mode of transportation that could be helpful to many urban transportation issues. As the use of motor vehicles is increasing problems as cost, congestion, accidents, loss of amenity and space, noise, air pollution, energy consumption and have an adverse effect on the natural environment. Use of the bicycle as transport should be the transportation solution for cities as it has no adverse effects [2] [3].

One more critical issue in any modes of transportation is of pod cars to bike, the issue is about picking people from the transport hub as a railway station, bus depots and to their destination, this problem is called last mile problem [4]. Ever wondered if we could take our vehicle out and then forget it after reaching the destination or if you don't have to plea anyone to drop you down or pick you up. Bicycle sharing is required where a person can borrow a bicycle from one of our stations in the city and can return to another station. For the same smart bicycle sharing system develops the concept of riding a bicycle from one point and returning it back at another point can help to solve last mile problem. An efficient bicycle sharing system collects the real-time data using sensors deployed on them and send the data to the owner and the admin on the way. Smart bicycle sharing not only solves the issue of the last mile, but also a problem of area/acres requires for car parking and reduces the waiting time for a local bus. Our problem was to increase the efficiency of bicycle sharing systems and increase the participation of people in these sustainable systems, thus moving towards the concept of the smart city. Due to growing population and change in the transportation usage in urban cities, some people have demanded usage of bicycle sharing system in the last few years [5] [6], however, still there are some people who are the reluctance to a combination of the mode of transportation of traditional days [7]. Some explanation was given by people for choosing a traditional transportation, over bicycle sharing system is that the bike riding is not safe and one has to travel a longer distance also, the weather is another deciding factor. The transportation authorities and local council need to encourage the use of a bicycle and also need do develop separate infrastructure and alternative routes for bicycles to provide safety and provide shorter distance [8] [9].

ABSTRACT

These last years with the growing population in the smart city demands an efficient transportation sharing which is bicycle sharing system for developing the smart city. The Bicycle sharing as we know is affordable, easily accessible and reliable mode of transportation. But an efficient bicycle sharing capable of not only sharing bike also provides information regarding the availability of bicycle per station, route business, time/day-wise bicycle schedule. The embedded sensors are able to opportunistically communicate through wireless communication with stations when available, providing real-time data about tours/minutes, speed, effort, rhythm, etc. We have been based on our study analysis data to predict regarding the bicycle's available at stations, bicycle schedule, a location of the nearest hub where a bike is available etc., reduce the user time and effort.

WHAT IS CYCLE SHARING?

Cycle sharing is a flexible form of personal public transport. Cycles are stored in a closely spaced network of stations. With a smart card or other form of identification, a user can check out a cycle from a station and return it to any other station.

Key features of cycle sharing systems:

- A dense network of stations across the coverage area, with a great spacing between stations
- Cycles with specially designed parts and sizes to discourage theft
- A fully automated locking system at stations that allows users to check cycles in or out without the need for staffing at the station
- Radio frequency identification devices (RFIDs) to track where a cycle is picked up, where it is returned, and the identity of the user
- Real-time monitoring of station occupancy rates through General Packet Radio
- Service (GPRS), used to guide the redistribution of cycles
- Real-time user information provided through various platforms, including the web, mobile phones, and/or on-site terminals
- Pricing structures that incentivize short trips, helping to maximize the number of trips per cycle per day

PROJECT MOTIVATION

This is basically ride sharing system in Bangladesh. Here we have some similar application like uder and pathao. But our proposal is different, which is a bi-cycle sharing website. First we decided to design the website as the owner and the rider will directly talk to rent a bicycle. This deal will be occur by the both owner and rider mutual understanding with a fix amount of time.

But now we changed our plan and updated our design. The website has now turned into the location fixation system. Notification is sending to the owner when the bicycle is picked and the bicycle is dropped. The owners have to drop their cycle at any station and then the riders can pick the cycles for going any station and park to the selected locations as well as lock the cycles. By this time payment will be done as the previous procedure.

So we got those ideas from our honorable faculty Dr. Shahnewaz Siddique and by doing research on many existing papers and following different ride sharing system.

The aim of the project is to propose and implement the Public Bicycle Sharing System in Dhaka and government's vision to develop a sustainable and integrated transportation system for the city.

To provide economical mobility option to the citizens: To provide an economical and convenient mode of transport for short trips as an alternative to motorized forms of transit that cost more.

To serve last mile connectivity: To bridge the gap in public transportation for end to end journeys, this would attract high ridership.

To minimize adverse effect on environment: To reduce negative impact that motorized vehicles have on the environment by encouraging people to opt for cycling.

To reduce the congestion on roads: To reduce number of vehicles on road by catering to short Trips through PBS which will help in reducing the number of active vehicles on the roads and hence serve as long term strategy to improve transport scenario.

LITERATURE REVIEW / TECHNOLOGY REVIEW

A bicycle-sharing system, public bicycle system, or bike-share scheme, is a service in which bicycles are made available for shared use to individuals on a short term basis for a price or free. Many bike share systems allow people to borrow a bike from a "dock" and return it at another dock belonging to the same system. Docks are special bike racks that lock the bike, and only release it by computer control. The user enters payment information, and the computer unlocks a bike. The user returns the bike by placing it in the dock, which locks it in place. Other systems are dock less. For many systems, smartphone mapping apps show nearby available bikes and open docks.

The first bike sharing projects were initiated by local community organizations, or as charitable projects intended for the disadvantaged, or to promote bicycles as a non-polluting form of transport, or they were business enterprises to rent out bicycles.

Ernest Callen Bach's novel Ectopic (1975) illustrated the idea. In the utopian novel of a society that does not use fossil fuels, Callen Bach describes a bicycle sharing system which is available to inhabitants and is an integrated part of the public transportation system. [10]

The earliest well-known community bicycle program was started in the summer of 1965[11] by Luud Schimmel pennink in association with the group Provo in Amsterdam, the Netherlands. [12][13][11][14] the group Provo painted fifty bicycles white and placed them unlocked in Amsterdam for everyone to use freely.[15] This so-called White Bicycle Plan provided free bicycles that were supposed to be used for one trip and then left for someone else. Within a month, most of the bikes had been stolen and the rest were found in nearby canals. [16] The program is still active in some parts of the Netherlands (the Hoge Veluwe National Park; bikes have to stay inside the park). It originally existed as one in a series of White Plans proposed in the street magazine produced by the anarchist group PROVO. Years later, Schimmel pennink admitted that "the Sixties experiment never existed in the way people believe" and that "no more than about ten bikes" had been put out on the street "as a suggestion of the bigger idea". As the police had temporarily confiscated all of the White Bicycles within

a day of their release to the public, the White Bicycle experiment had actually lasted less than one month. [17]

In an attempt to overcome losses from theft, the next innovation adopted by bike sharing programs was the use of so-called 'smart technology'. One of the first 'smart bike' programs was the Grappa bike storage rack system used in Portsmouth's Bike about scheme.[18][19][20] The Bike about scheme was launched in October 1995 by the University of Portsmouth, UK as part of its Green Transport Plan in an effort to cut car travel by staff and students between campus sites.[19] Funded in part by the EU's ENTRANCE[21] program, the Bike about scheme was a "smart card" fully automated system.[19][20]22] For a small fee, users were issued 'smart cards' with magnetic stripes to be swiped through an electronic card reader at a covered 'bike store' kiosk, unlocking the bike from its storage rack.[19] CCTV camera surveillance was installed at all bike stations in an effort to limit vandalism.[19] Upon arriving at the destination station, the smart card was used to open a cycle rack and record the bike's safe return.[19] A charge was automatically registered on the user's card if the bike was returned with damage or if the time exceeded the three hour maximum.[19] Implemented with an original budget of approximately £200,000, the Portsmouth Bike about scheme was never very successful in terms of rider usage,[23] in part due to the limited number of bike kiosks and hours of operation.[19][22] Seasonal weather restrictions and concerns over unjustified charges for bike damage also imposed barriers to usage.[19] The Bike about program was discontinued by the University in 1998 in favor of expanded minibus service; the total costs of the Bike about program were never disclosed.[24][25]

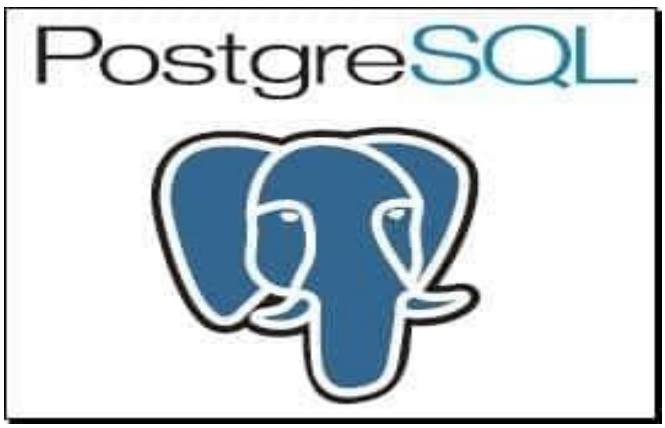
METHODOLOGY

We need to use different tools to create our website. We are using API to use different features like Google map API, payment system API etc. The system gets all the location related information using MAP API. The system is connected with real-time database which can store information in real-time. And we are using framework and database management tools.

USING TOOLS:

- We use Python Django as the framework for our website. Django is a Python-based free and open-source web framework, which follows the model-view-template architectural pattern. It is maintained by the Django Software Foundation, an independent organization established as a 501 non-profit. Django's primary goal is to ease the creation of complex, database-driven websites.

- We use PostgreSQL for our database which will handle the data for our website. PostgreSQL, often simply Postgres, is an object-relational database management system with an emphasis on extensibility and standards compliance.

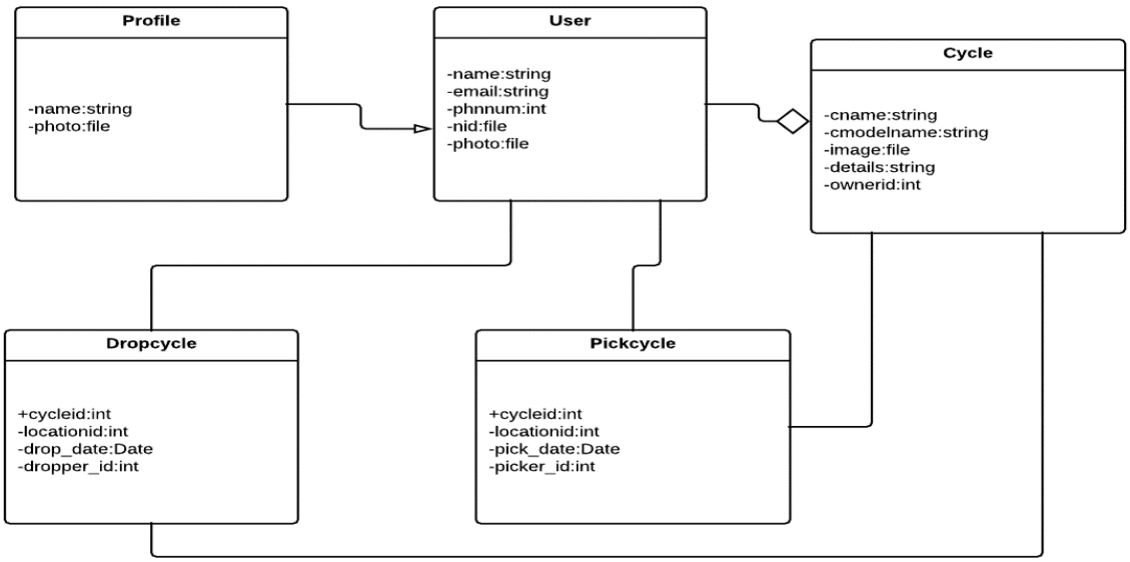


- For basic design we use programing language HTML, CSS. Hypertext Markup Language (HTML) is the standard markup language for creating web pages and web applications. With Cascading Style Sheets (CSS) and JavaScript, it forms a triad of cornerstone technologies for the World Wide Web. Web browsers receive HTML documents from a web server or from local storage and render the documents into multimedia web pages. HTML describes the structure of a web page semantically and originally included cues for the appearance of the document. HTML elements are the building blocks of HTML pages. With HTML constructs, images and other objects such as interactive forms may be embedded into the rendered page.

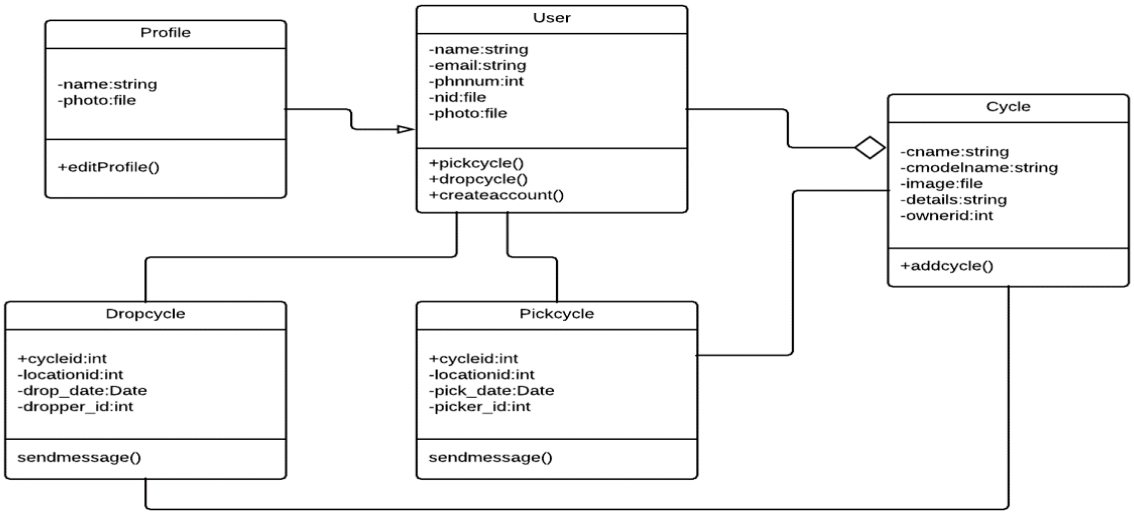
- We are using XAMPP for create a virtual server. XSMPP is a free and open-source cross-platform web server solution stack package developed by Apache Friends, consisting mainly of the Apache HTTP Server, MariaDB database, and interpreters for scripts written in the PHP and Perl programming languages.

PROPOSED SOLUTION AND DESIGN

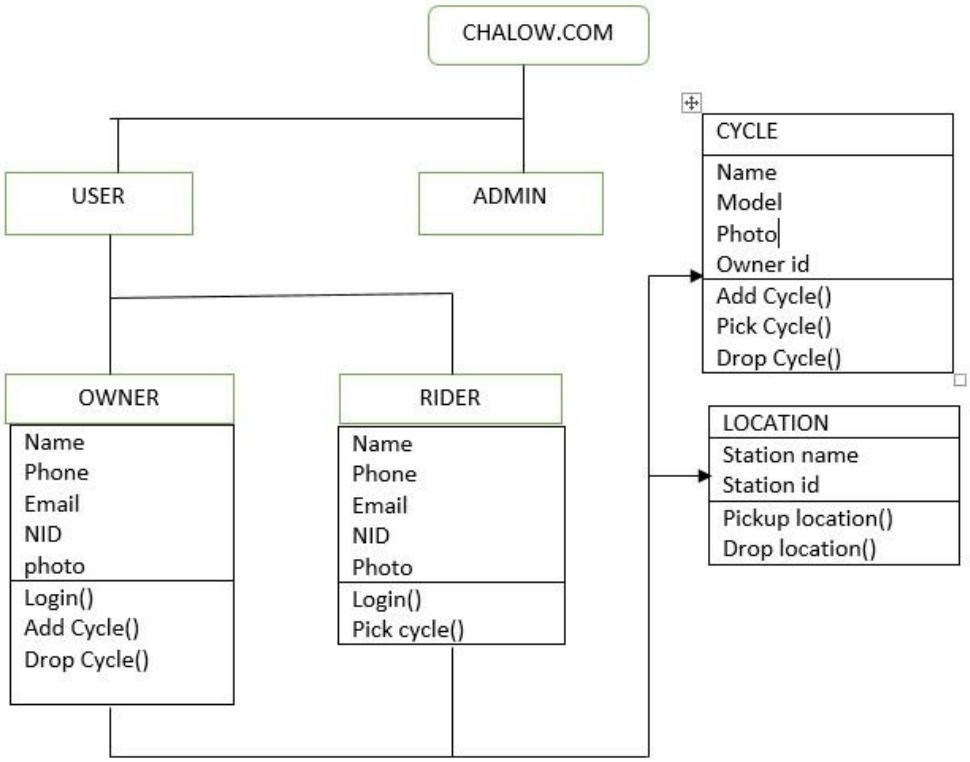
Domain model:



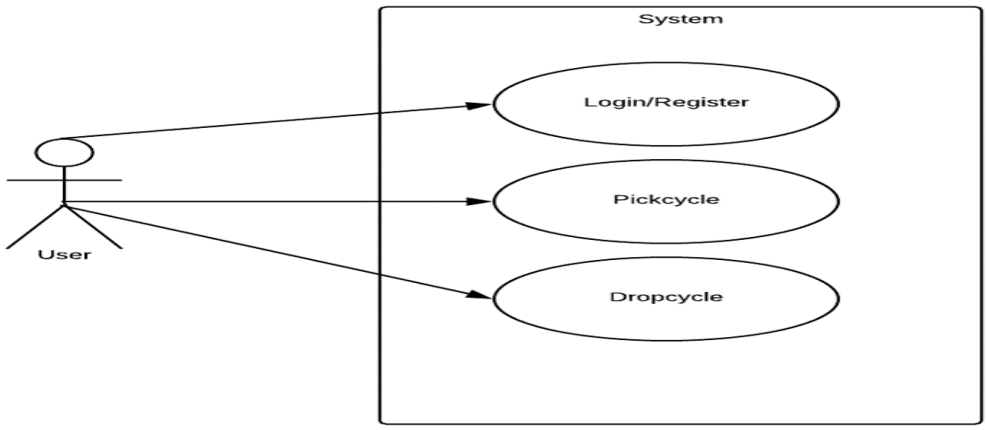
UML Class Diagram:



ER Diagram:



Use case diagram:



Use case-1:

Use Case Name	Login/Signup into BicycleSharing website
Scope	bicycleSharing
Level	User-goal
Primary Actor	End user
Stakeholders and Interests	End user wants to successfully login/signup into the website
Preconditions	Site must be loaded
Main Success Scenario	1. User enter bicycleSharing site. 2. System show home page. 3. User enters his login credentials. 4. System redirects user in bicycleSharing site.
Extensions	3a. User is using site for first time , he/she signup required. 3b. User enters invalid login credentials, system displays error message. 4a. Down site show error message

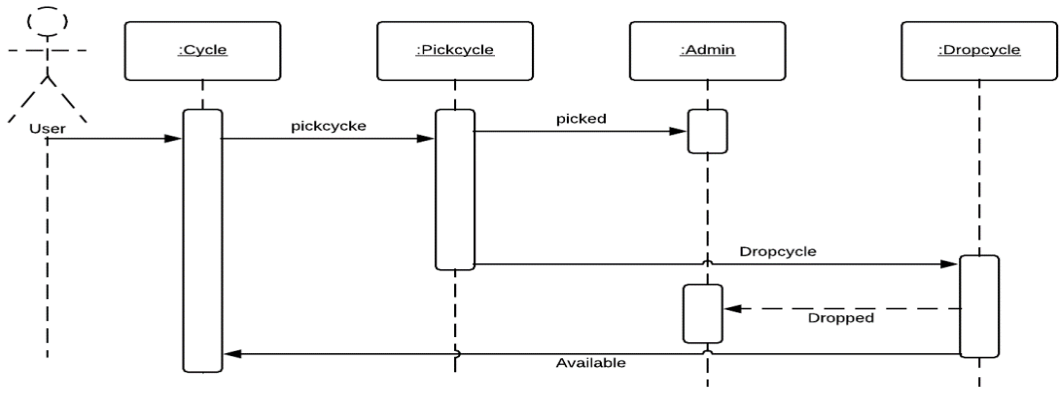
Use case-2:

Use case Name	Drop cycle in bicycle Sharing website
Scope	Bicycle Sharing
Level	User-Goal
Primary Actor	End User
Stakeholders and Interests	User drop cycle in fixed location.
Preconditions	User should be logged in
Main Success scenario	1. User select bicycle dropping option. 2. System serve bicycle dropping page. 3. User enter cycle id and location id. 4. System provide message to the admin site and bicycle owner cycle dropping information.
Extensions	3a.System provide error message for invalid cycle and location credential.

Use case-3:

Use case Name	Drop cycle in bicycle Sharing website
Scope	Bicycle Sharing
Level	User-Goal
Primary Actor	End User
Stakeholders and Interests	User drop cycle in fixed location.
Preconditions	User should be logged in
Main Success scenario	1. User select bicycle dropping option. 2. System serve bicycle dropping page. 3. User enter cycle id and location id. 4. System provide message to the admin site and bicycle owner cycle dropping information.
Extensions	3a.System provide error message for invalid cycle and location credential.

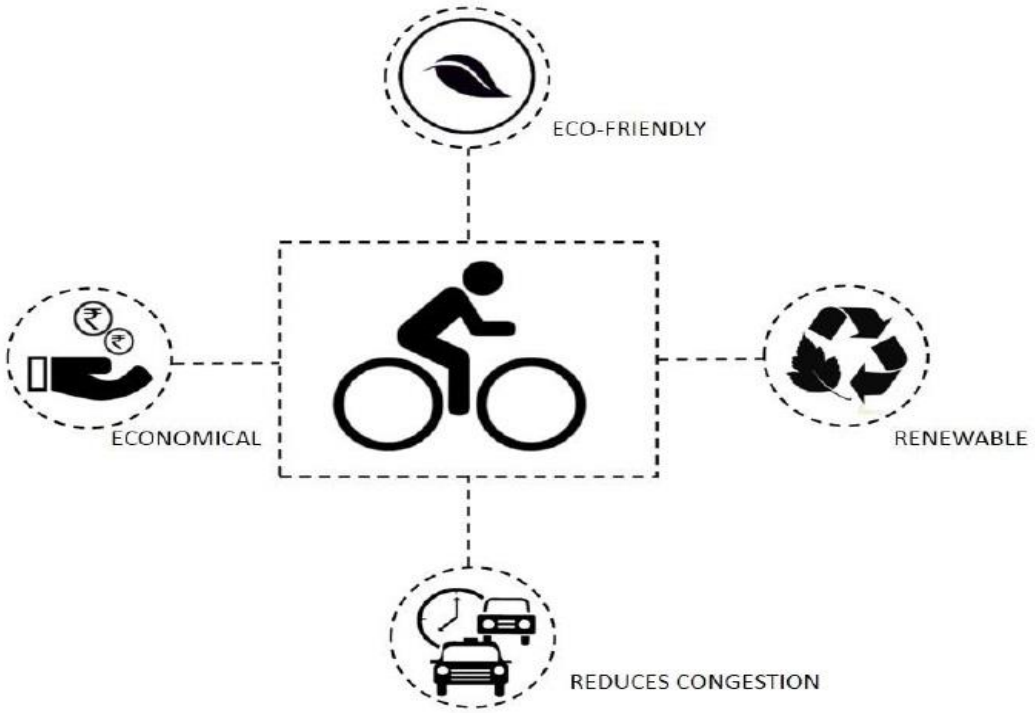
Sequence diagram:



COVERING AREA

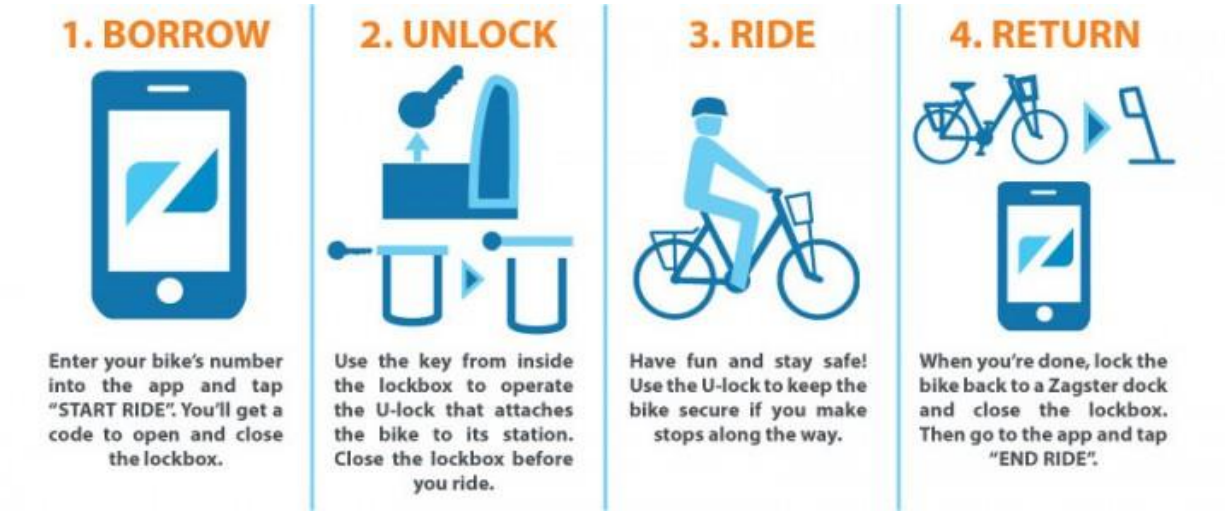
- At first we are covering the 7 locations of Basundhara Area.

- In Future we will expand our idea throughout the Dhaka city.



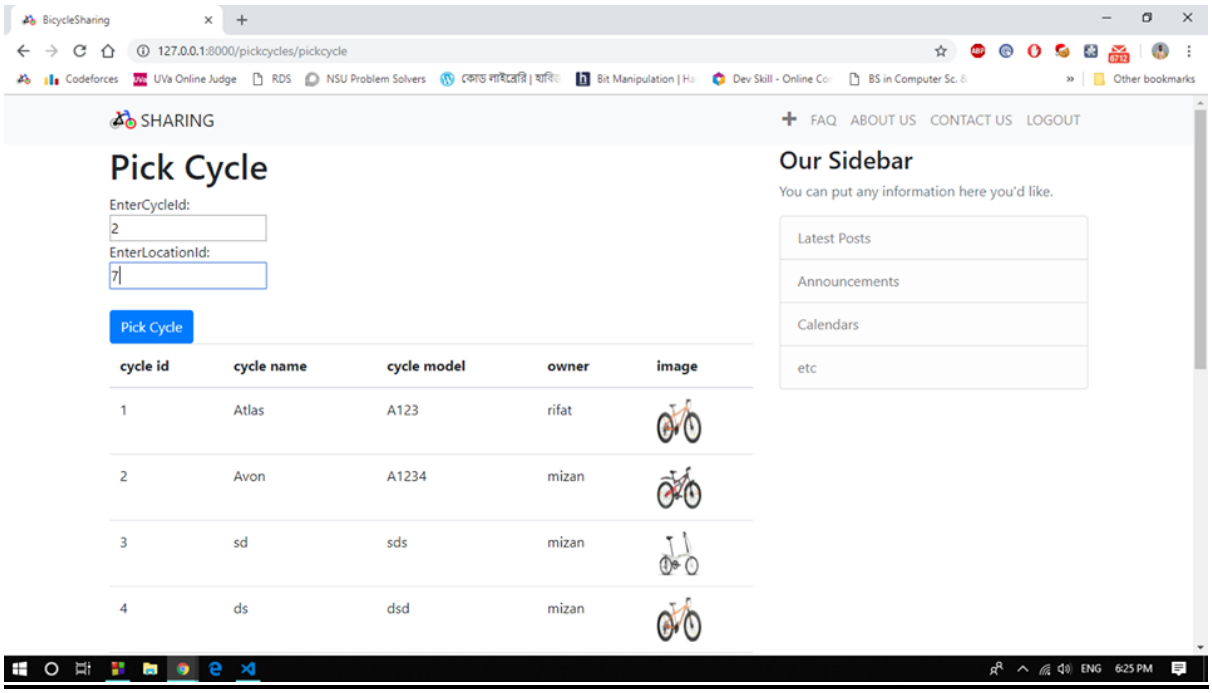
AIMS AND OBJECTIVES

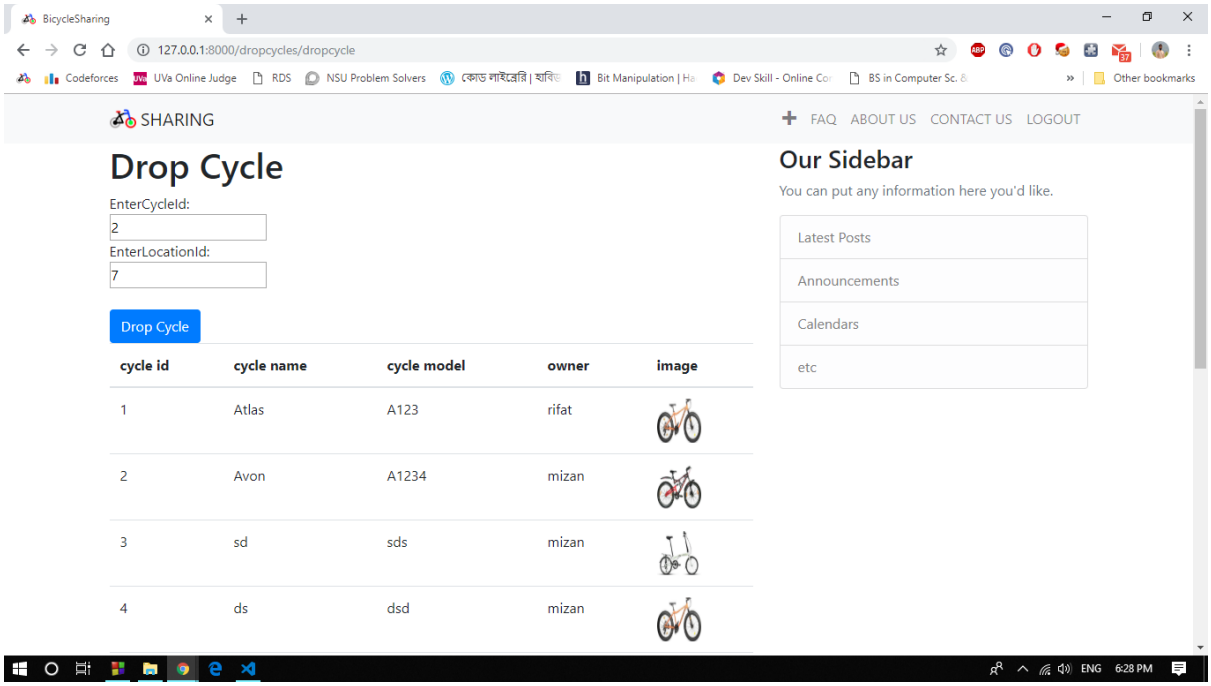
- People in Dhaka city feel board while sitting in bus or car or any other vehicle for the cause of traffic jam, In that case people who will use bicycle for going to their desired location by riding themselves, they can easily reach to the destination although traffic jam occurs. (At present we are developing the idea only for Bashundhara R/A. But In future we will expand the idea for all the location of Dhaka city.)
- Owner of the cycle will get the notification of which their cycle locates.
- There are some fixed locations near the center point of a crowdy place.
- People like to pay online, that's why people can easily pay their cost through online payment system like BKASH, Rocket etc.
- Instant messaging to the owner and the admin to know about the picking as well as the dropping point.
- People who loves to ride bicycle can easily get the cycle if there is no cycle for the newcomers.
- Cycling is a good exercise also……!!!



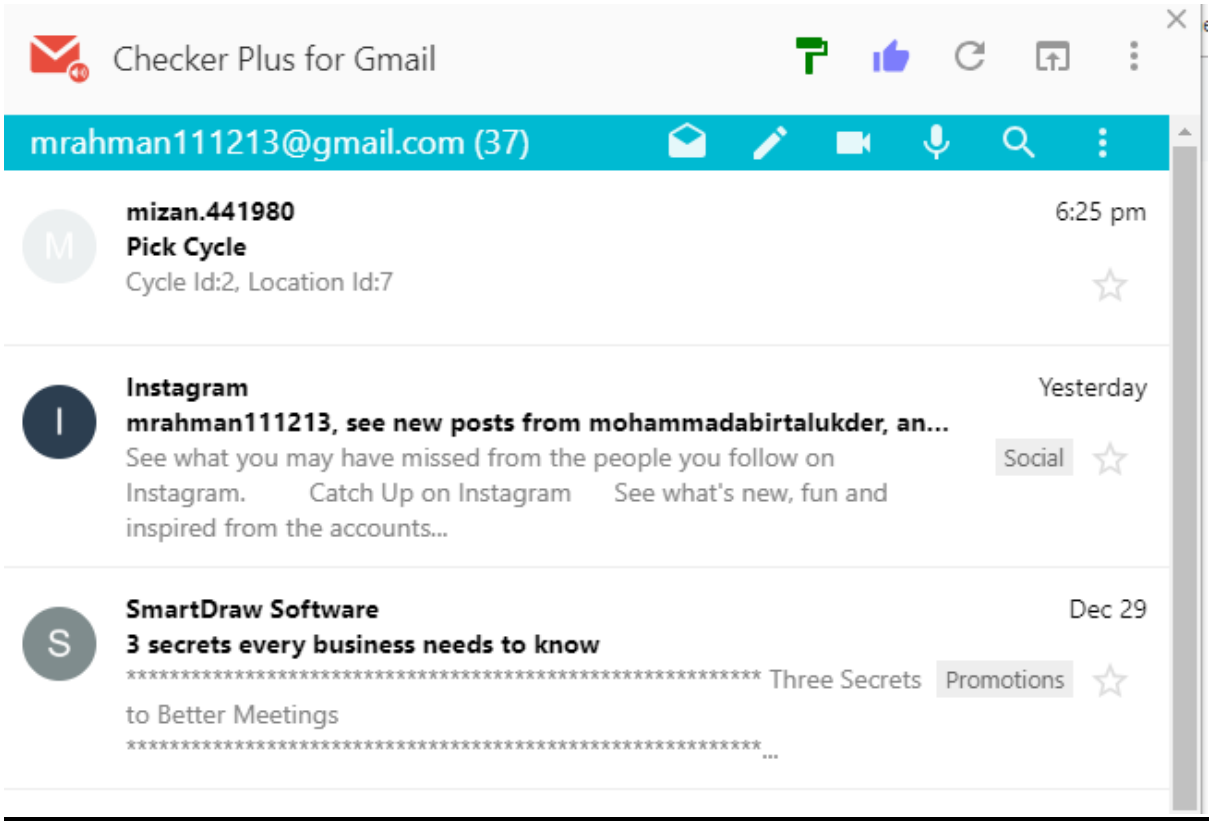
WEB-SITE DESIGN

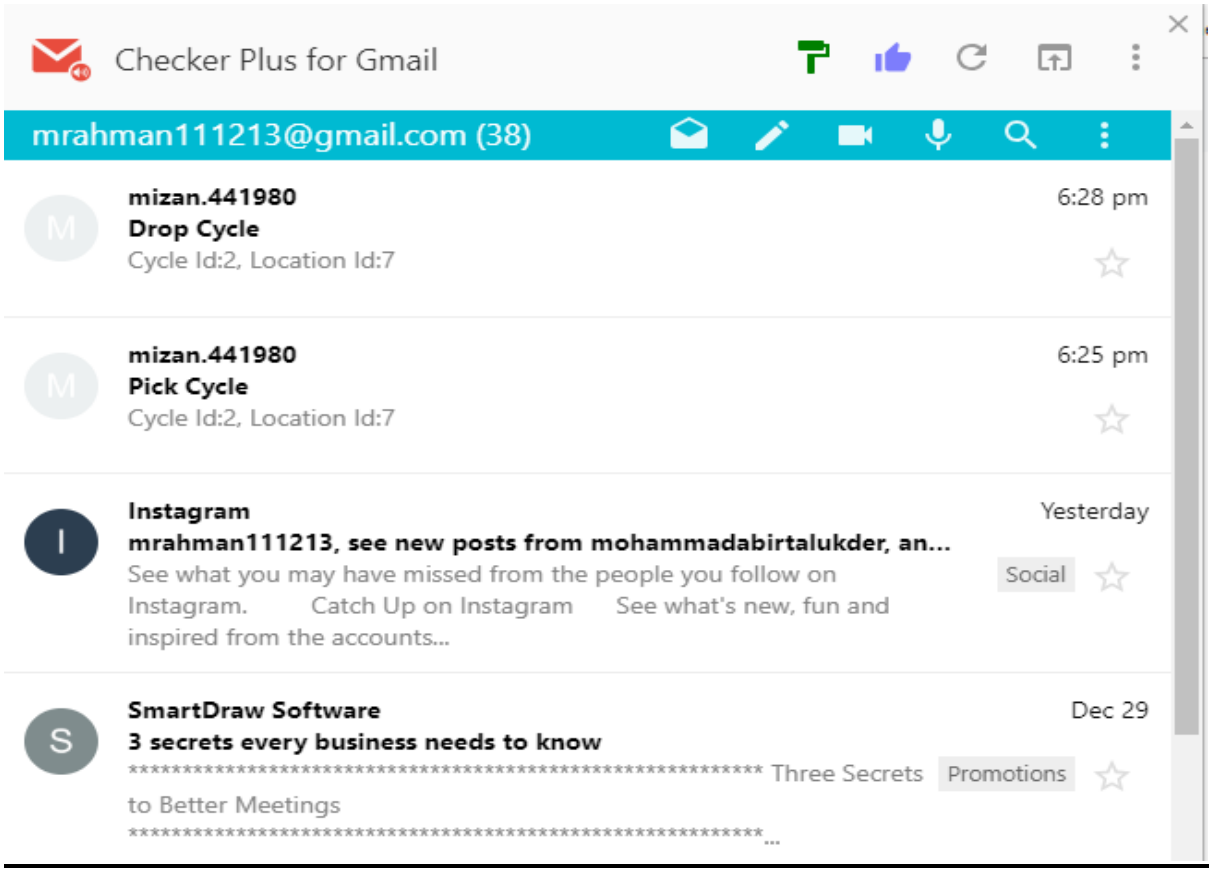
User view:



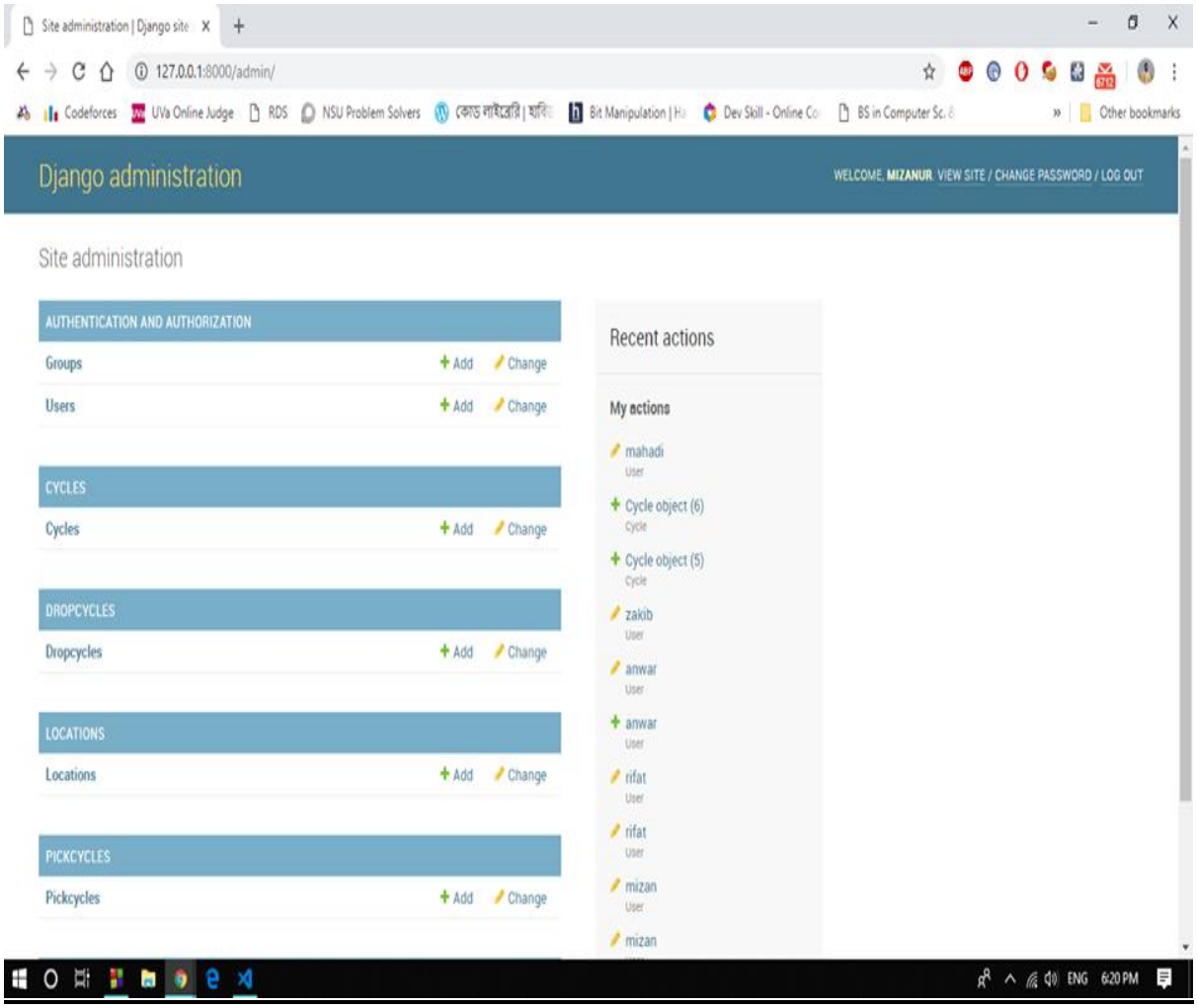


Getting message:





Admin view:


Site administration | Django site
127.0.0.1:8000/admin/
Codeforces
UVa Online Judge
RDS
NSU Problem Solvers
Bit Manipulation | Ha
Dev Skill - Online Co
BS in Computer Sc. &
Other bookmarks
Django administration
WELCOME, MIZANUR. VIEW SITE / CHANGE PASSWORD / LOG OUT
Site administration
AUTHENTICATION AND AUTHORIZATION
Groups + Add Change
Users + Add Change
CYCLES
Cycles + Add Change
DROPCYCLES
Dropcycles + Add Change
LOCATIONS
Locations + Add Change
PICKCYCLES
Pickcycles + Add Change
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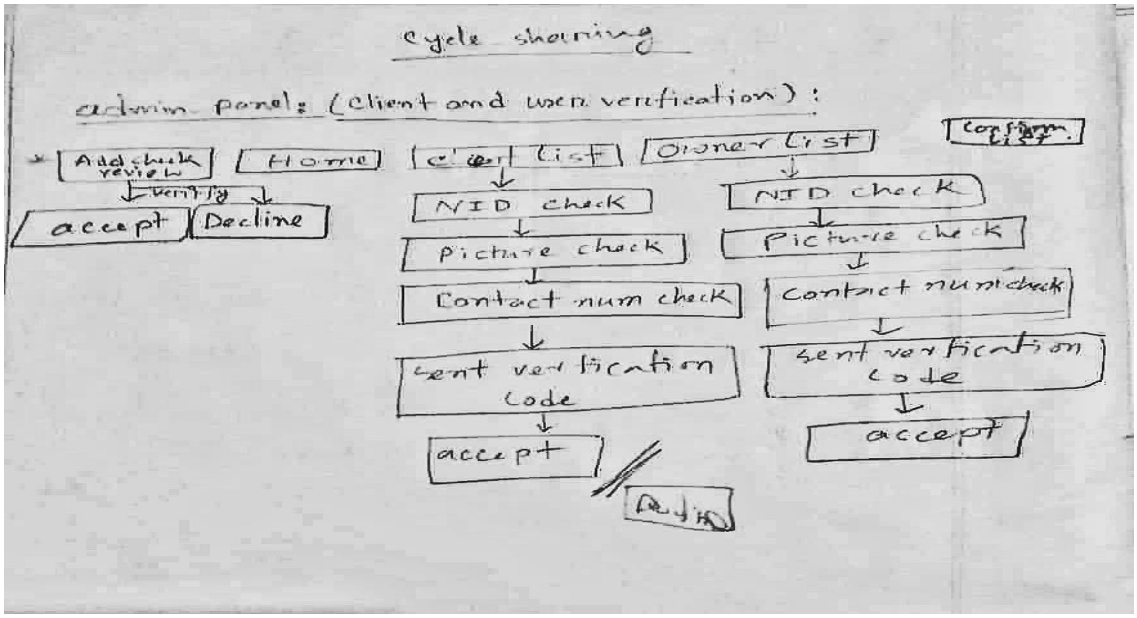
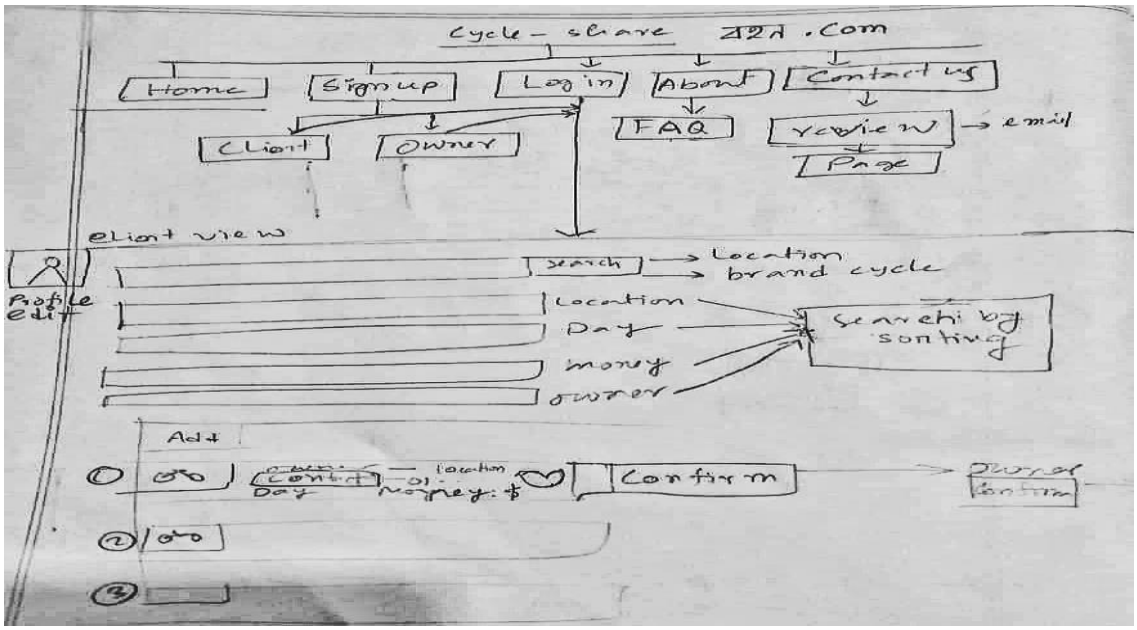
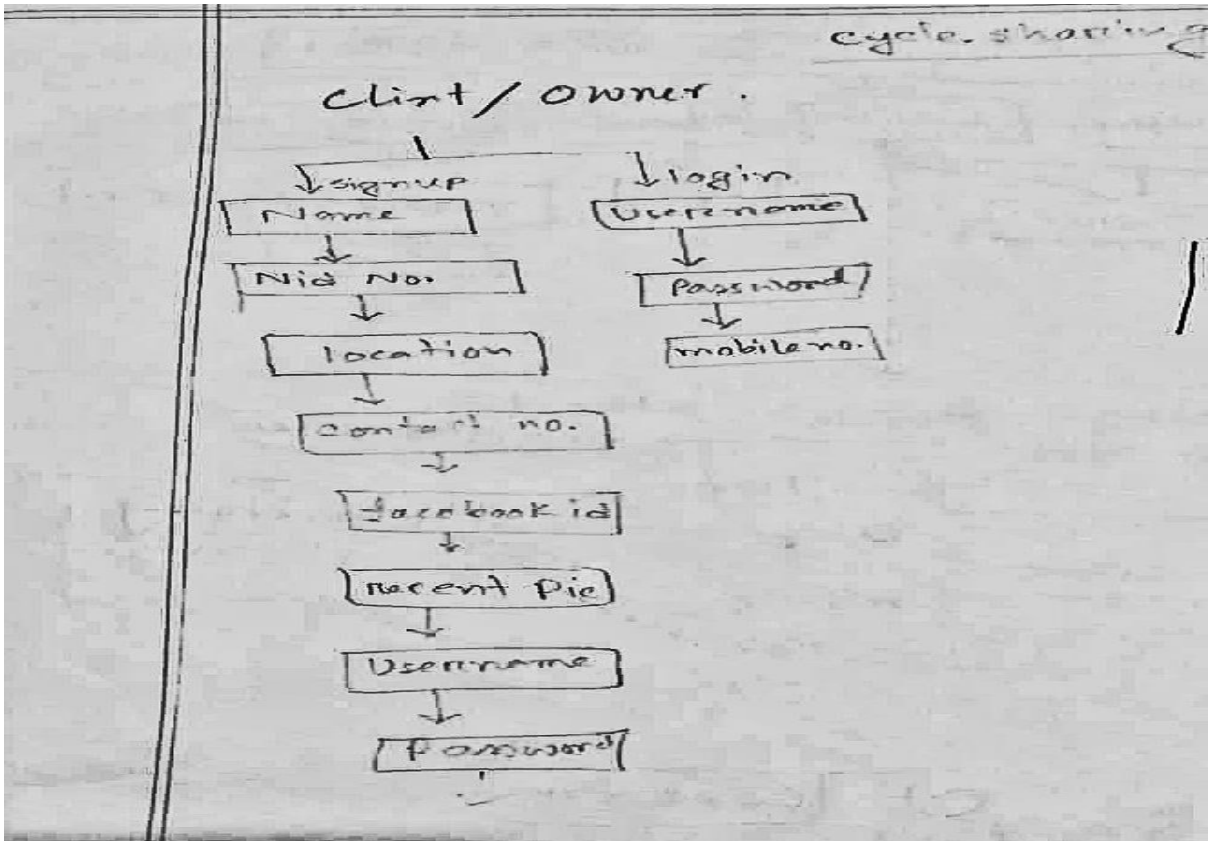
DESCRIPTION OF PREVIOUS SITUATION

First we decided to design the website as the owner and the rider will directly talk to rent a bicycle. This deal will be occur by the both owner and rider mutual understanding. But now we changed our plan and updated our design. The website has now fixed location and the owners have to drop their cycle at any station and then the riders have to pick the cycle & go any station and then park and lock. By this time payment will be done as procedure. Below we show our previous hand draw design and the new updated hand draw design.

PREVIOUS DESIGN:






cycle sharing
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signup
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location
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facebook id
recent pic
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login
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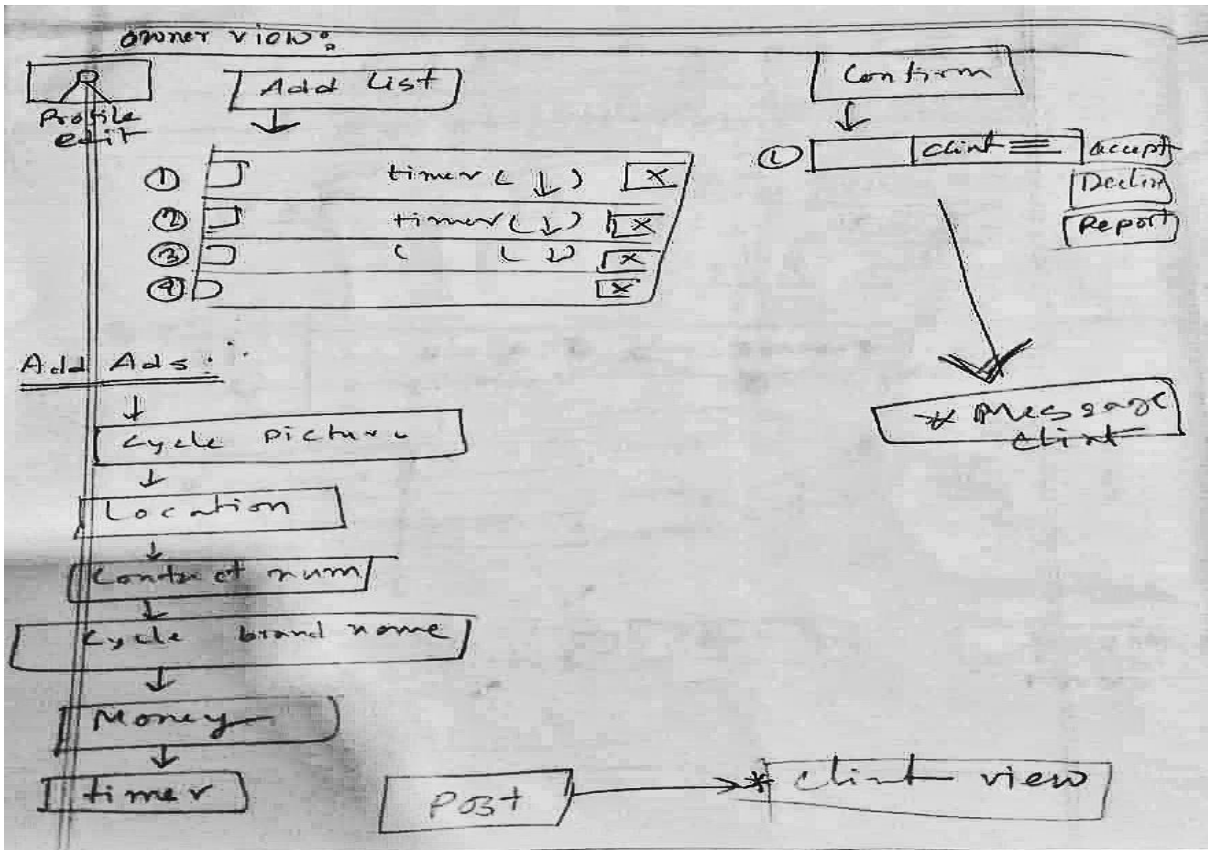
mobile no.


owner view:
Profile edit
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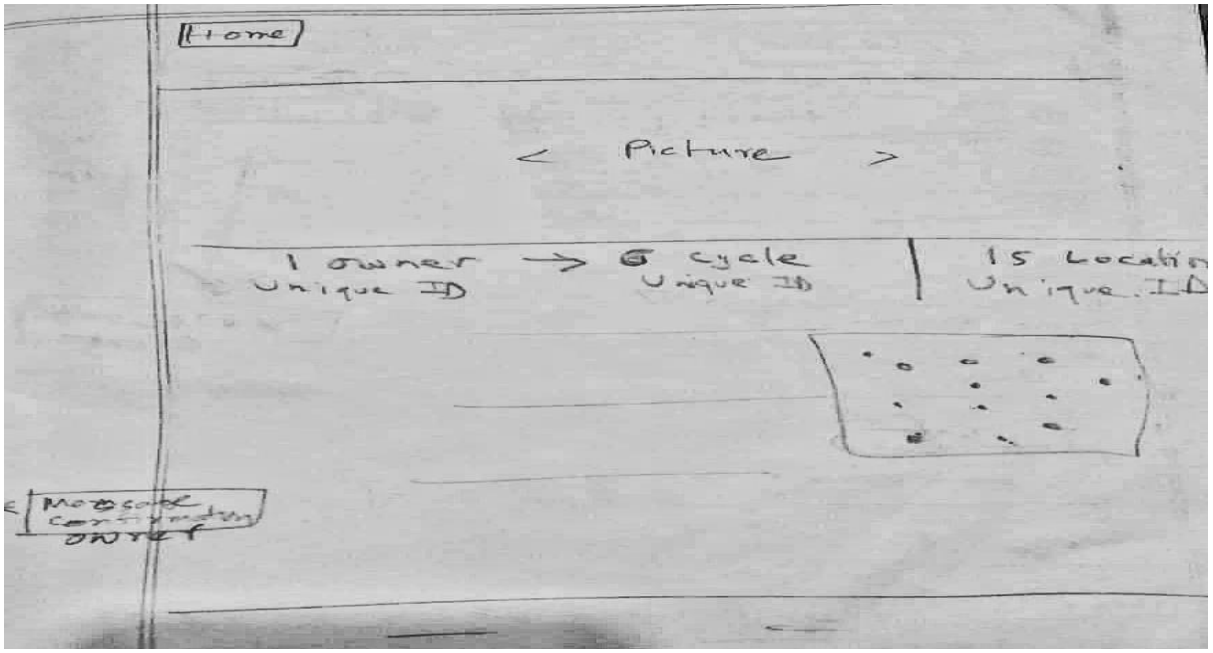
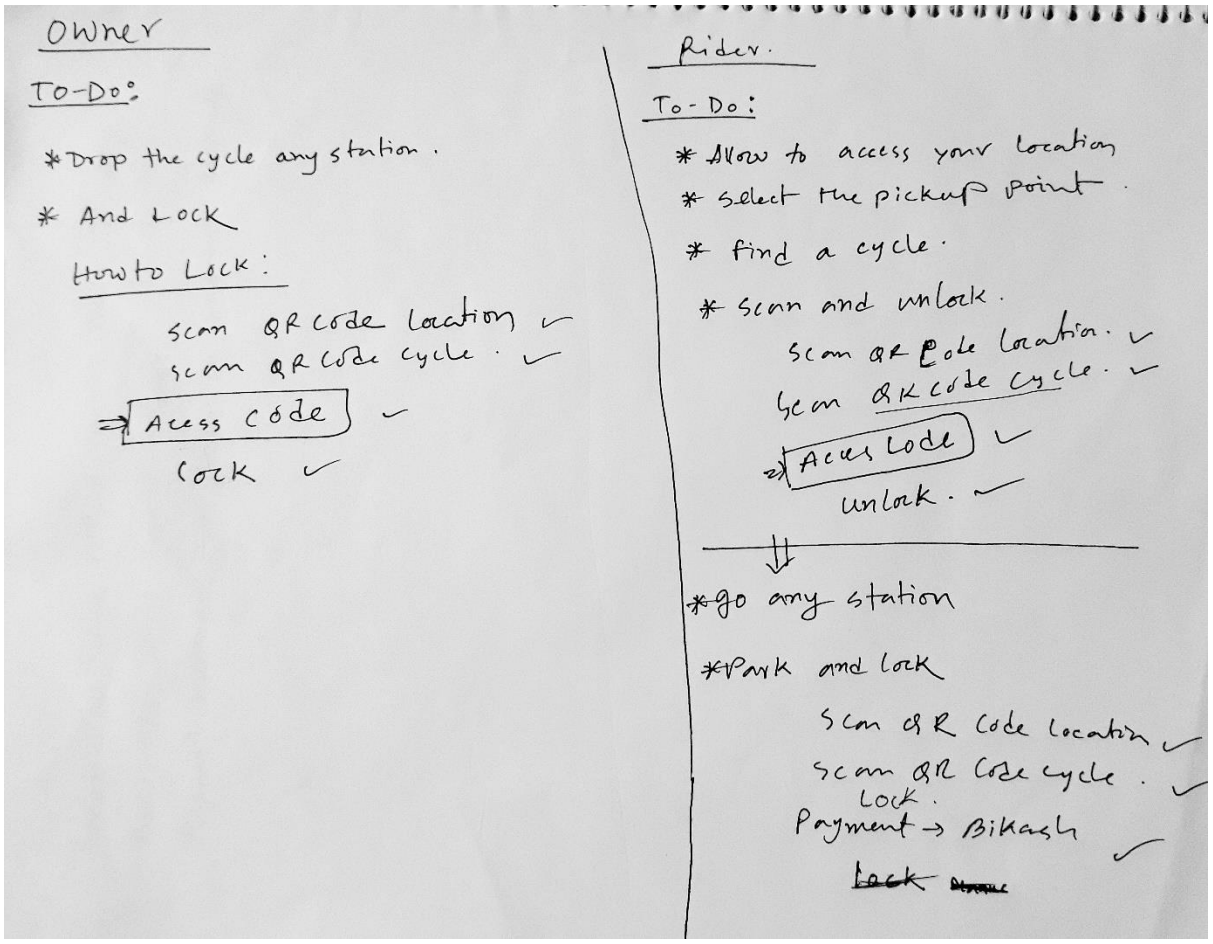


UPDATED DESIGN:



Owner

Register:
→ user picture
→ Name → Cycle picture
→ Mobile → etc
→ Details.
→ NID.

⇒ Access Code

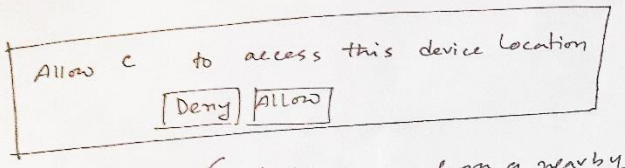
→ visit office
→ get cycle machine/
Lock-Unlock machine

→ Send ID
→ Registered ✓

Rider

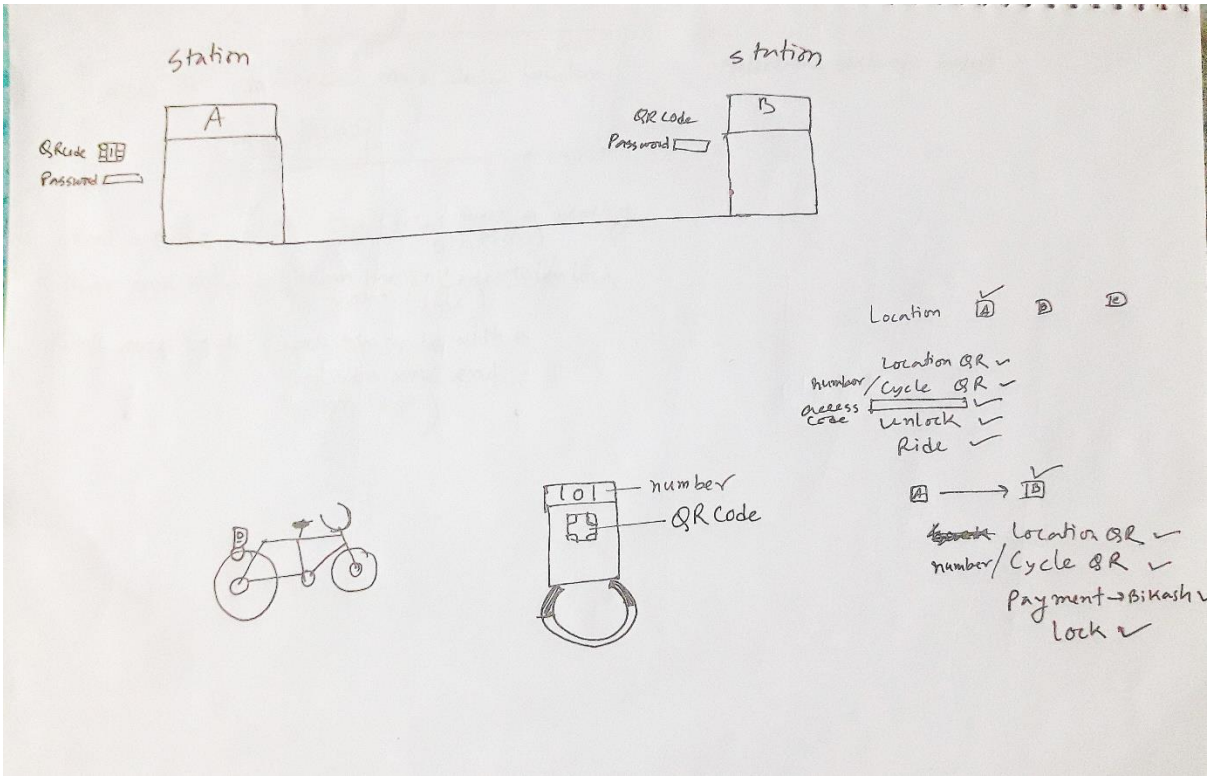
Register:
→ name → User Picture
→ Mobile.
→ NID
→ Details.

⇒ Access code



Find a Bike (Spot the cycles from a nearby station)
Scan and unlock (Scan the qr code to unlock your cycle)
Park and lock (Lock the cycle with a station and end your trip)

Select the pick up point


station
station
A
B
QR code
Password
QR code
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number / Cycle QR
access code
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number / Cycle QR
Payment → Bikash
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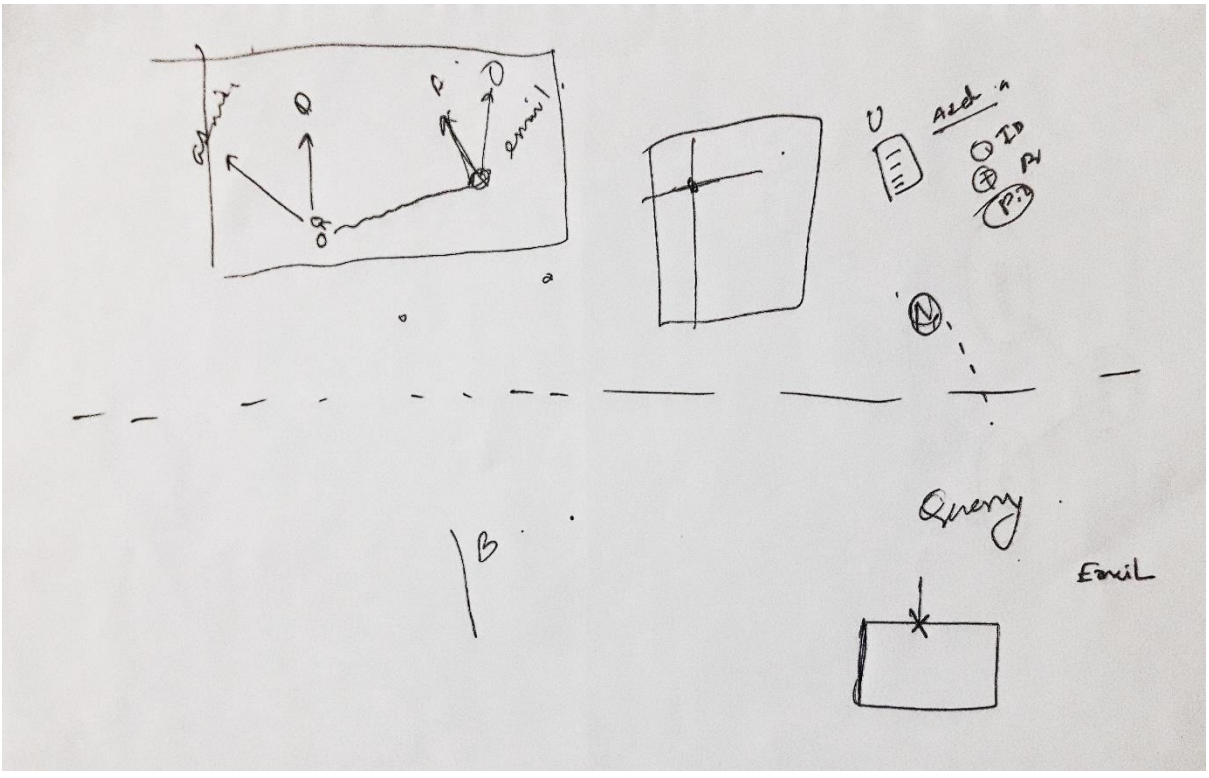
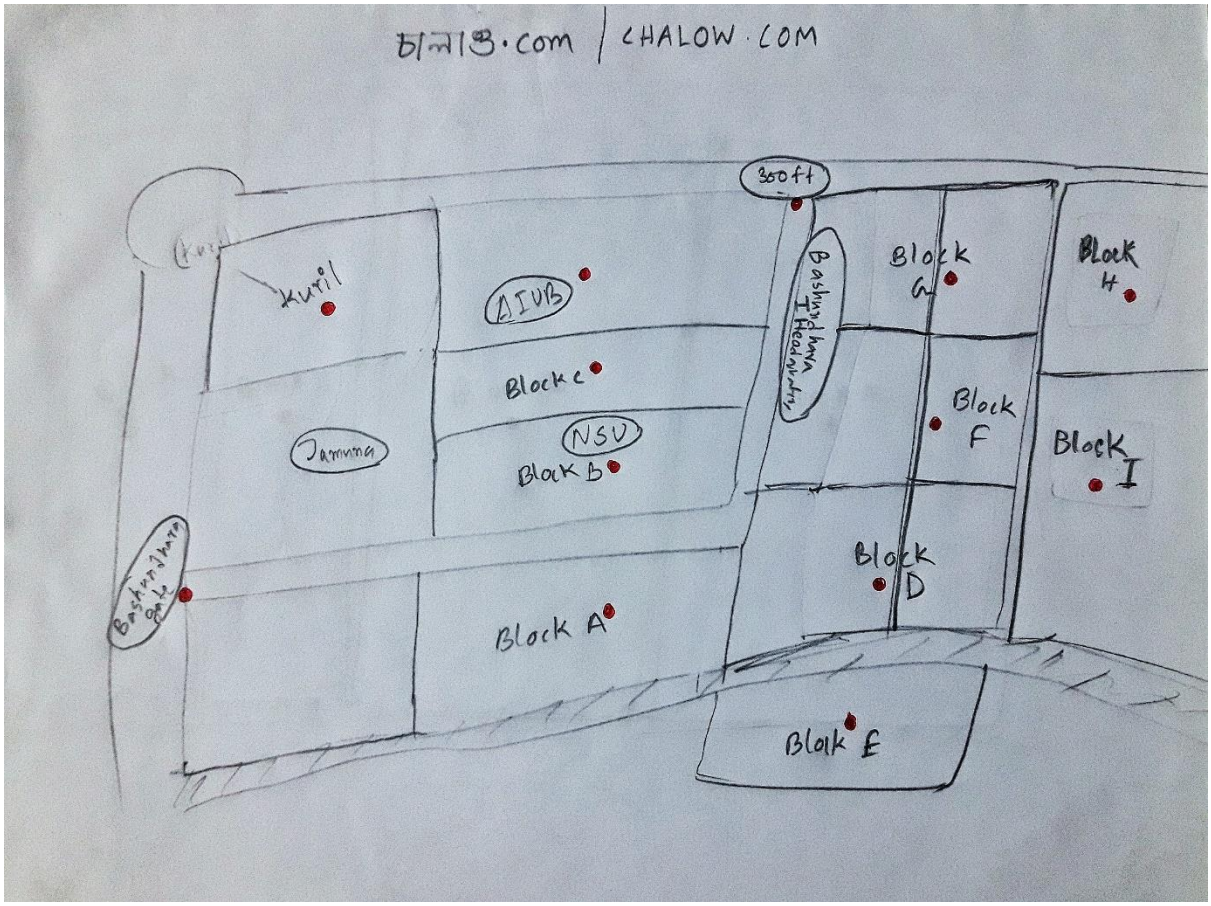

Query
Email


বাংলা.com / CHALOW.COM
Kuril
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Block C
NSU
Block B
Jamuna
Block A
300 ft
Bashundhara Headquarter
Block G
Block H
Block F
Block I
Block D
Block E

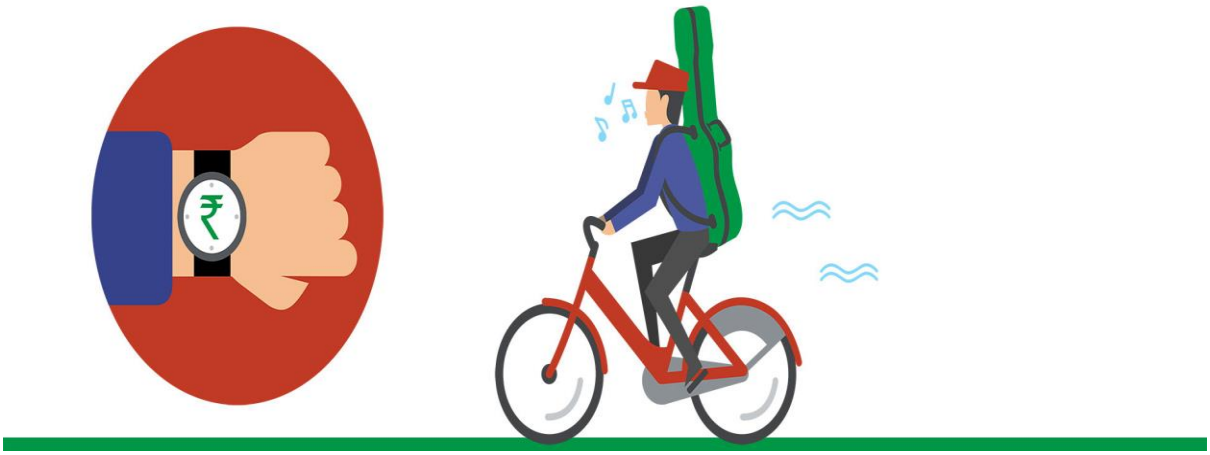

Block J
Block K
Block L
Block M

CONCLUTION AND FUTURE PLAN

The main purpose for our project is to increase bicycle usage and ease of use in particular area for student or public use. Cycle sharing is one option that the particular area can pursue to achieve its goals to reduce transportation emissions and increase the use of active transportation and it is a pollution-free mode of transport. However, at this time it is clear that certain prerequisite steps must be taken before large-scale cycle sharing can be successfully implemented for student or public use. First and foremost, the bicycle infrastructure such as bikeways and parking must be improved. Secondly, bicycle education and enforcement must be utilized to ensure that cyclists, pedestrians, and vehicle drivers can all function safely together. The main advantages of this approach are that it provides a quick assessment and it can be adapted to other towns and cities according its characteristics. The method can help in decision-making for transportation planners, policymakers and investors. The method is useful in the full design of the system, including the location of bike-sharing stations and in the dimension of the fleet, as well as in the scheduling of the investments. Further studies can include the consideration of other socio-economic characteristics, such as population density, non-institutionalized group quarter population density, job density, retail job density, commute trip reduction companies, tourist attractions, parks/recreation areas, topography, regional transit stations, bicycle friendly streets, streets with bicycle lanes and local transit stops etc.

In this paper, we have represented detailed design, implementation plan and evaluation of smart bike sharing system along with sensor networking techniques. The bike sharing system represents the first comprehensive mobile sensing system conveying the cyclist experience. Bike sharing provides the collection and communal environmental sampling. It also supports two modes of operation in support of delay tolerant and real-time sensing. Collected data could be presented both locally to the cyclist and to others as well through back-end services. Bike sharing portal concept promotes social and friendly network among cyclists. Our smart bike sharing system allows the users to easily book a bike using the website at any time without human intervention. There is no need of human for conducting this smart bike sharing system. A user can take a bike from the station using his/her smart card (a smart card that will be given to the user after the Signup) and start the ride and after completing the trip drop the bike to the

station which is near to his/her destination. The Simulator in our system is using the sensor to trace the bike and to update the information of the bike position at each time. The sensor will send packets to its nearest station and these all station will be connected to the website and send the information regarding the bike's status to the app which will update the record. The data send by the bike can include Traffic data, Air Quality data, Road Conditions data etc., which will benefit the operator in solving the redistribution problem as well as users of the system thus saving on operational cost as well as the time of users. In the future when conventional sources of energy would be scarce, bike share system will provide an effective means of transport and within the city, it can be made compulsory to travel through bicycles. In future, our smart bike sharing system can be improved by using collaborative software agents on user's and station details store on ontologies. Ontologies can easily expand with the addition of users and stations in the system, provide a secure environment, and machine-readable data for agent's interaction. Software agents can monitor data packets at heterogeneous stations to provide real-time information.



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