LastMile v2.0

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Problem Statement

IIT Bombay is proposing to provide 400 new bicycles to all campus residents.Your job is to help IITB to decide where to distribute the locations of these 400 bikes spread optimally all over the campus so that maximum number of residents can use them. Also, select locations (i.e. leave the bicycles so that they can be collected every evening) where the bicycles can be left after a person rides it.

Solution Provided by our Seniors(Ankit Kothari and Rishabh Jain)

A Survey was conducted by our seniors to identify the most convenient place to pick the cycle and drop the bicycle respectively.

The survey gave the following results :

Convenient Places to pick up the cycle and the respective cycle count

Location	No. Of Cycles
Shailesh J. Mehta School of Management	263
Hostels 15 & 16	209
Main Gate	194
Central Library, Lab & Workshop area	155
Hostels 1, 2 & 3 and Old SAC	148
YP Gate/Market Gate	143
Hostels 12, 13 and 14	112
CSRE, CESE and Victor Menezes Convention Centre	67
Hostel 10 and Gulmohar	58
Hostels 8 & 11 and New SAC	57
Hostels 4, 5 and Tansa House	50
Hostels 6, 7 & 9	23

Convenient Places to drop the cycle and the respective cycle count

Location	No. Of Cycles
Shailesh J. Mehta School of Management	279
Main Gate	197
Hostels 15 & 16	187
Central Library, Lab & Workshop area	152
Hostels 1, 2 & 3 and Old SAC	144

CSRE, CESE and Victor Menezes Convention Centre	144
YP Gate/Market Gate	142
Hostels 12, 13 and 14	97
Hostel 10 and Gulmohar	64
Hostels 8 & 11 and New SAC	50
Hostels 4, 5 and Tansa House	45
Hostels 6, 7 & 9	18

The above survey results suggested 8 optimal locations for bicycle dock stations in the IIT-B campus namely-like peak time gave them the optimal location.

Location	No. of Bicycles
Shailesh J Mehta School of Management	75 bicycles
Midway between hostels 15 and 1, facilitating hostels 16 and 2	60 bicycles
In front of Hostel 6, facilitating hostels 7,9,12, 13 and 14	35 bicycles
In front of Hostel 4, facilitating hostels 2,3,5 ,8,11 and Tansa House	70 bicycles
Hostel 10 and Gulmohar	20 bicycles
CSRE, CESE and Victor Menezes Convention Centre	30 bicycles
Main Gate	55 bicycles
YP Gate/Market Gate	80 bicycles

Basically the idea was to build bicycle pooling system for the institute where a student can book a bicycle through an android app. The steps to book an bicycle are followed :

Locate Bike

Scan QR Code

Ride

Park and Lock

Solution Provided by Us (Amrata, Aditya, Moni, Punit)

The above system was Docked based, where the bicycle will be located and parked only in the dock stations. This puts a constraint on the user to go to the nearest dock to book a cycle as well as while ending the ride, it may happen that dock is not located very near to user, where he might have to walk several meters to reach the dock. To remove this constraint in the LastMile v2.0(LastMile name was given by Ankit and Rishabh), so

taking the name legacy forward, we made the second version of this system by making Dockless Bicycle pooling app. LastMilev2.0 will remove the constraint of parking the bicycles at the dock stations. User will have flexibility to park it anywhere, but at sensible locations. Will provide a list of Docks and Sensible Locations later in the document.

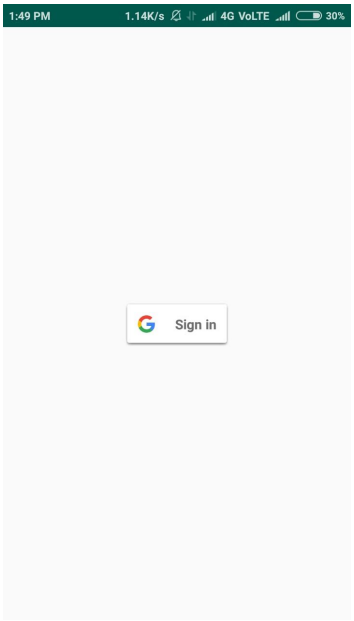
The Workflow of the App is followed :

0) Install the LastMilev2.0 app given in the project folder.

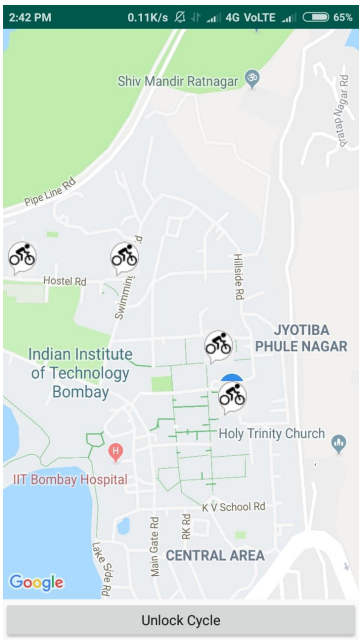
1) Enable Location Services permission for the app, by going to your phone settings.

2) Open the App

3) Sign In using Google Account



4) Locate Bike - Bikes if available nearby to your location will be visible in the map opened after launching the app, Bikes can be found in the dock stations.



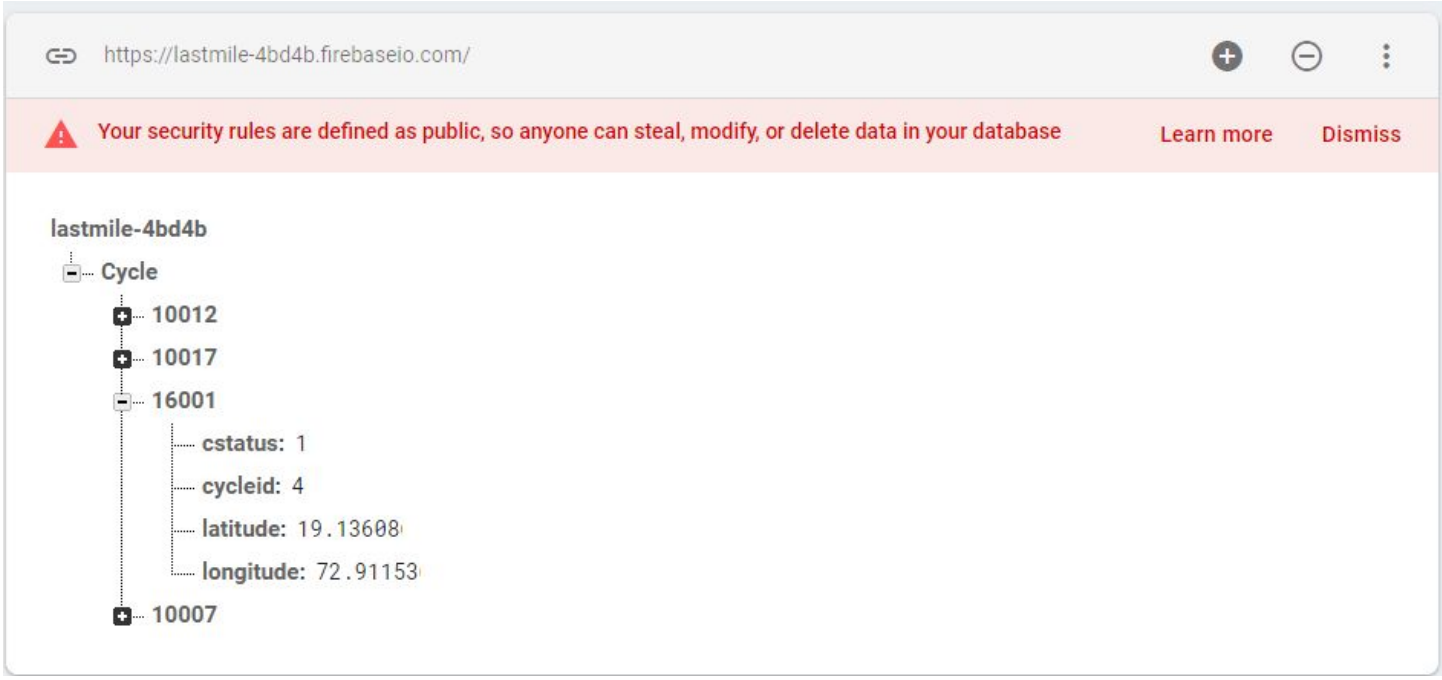
5) Unlock the cycle - Go to the nearest located bike, Scan the QR code on the bike to unlock it.

3) Ride - Ride without any time constraint

4) Park and Lock - While Parking you don’t have to look for the docks, park anywhere.

Coding Workflow of the App :

1) The app is built for Android Phones only.
2) We have used Firebase for Google Sign In Authentication and storage of Cycle Details in the database.
3) The Cycle details will be Cycle Number, Status & Lat - Long of where it is located at that particular moment. When the cycle is booked, It status will be 0, 1 means the cycle is available.



4) Lat-Long of cycle will be updated by the User's GPS while booking the cycle or ending the trip.
5) Scanning of QR code unlocks the cycle. The cycle has smart lock with IOT Sensor named(Node MCU, which contains wifi sensor)
6) The QR code contains the details of Wifi name and password of the respective cycle's wifi sensor. For simplicity, we had planned to keep the wifi name and password same as Cycle's Number.
7) On Scanning QR code, it will automatically be connected to the WiFi sensor of that cycle, once it is connected you can click on Unlock the cycle, It will automatically trigger the lock of the cycle to unlock it and the cycle status in our DB will be updated to 0. Along with it, the GPS Lat-Lon Coordinates of that particular location will be updated as the Lat-Long of the cycle. Basically the Lat-Long will be sent by the user's location and phone. We don't have any inbuilt GPS in the cycle.
8) We had planned to update the Lat-Long of the cycle at regular time intervals to keep the track of the cycle.
9) Once the User's ride has been completed, They can end the trip, once the end trip button is clicked from the phone, The Lat-Long and Cycle Status will be updated.
10) Our vendor will have an admin interface too keep the track of cycles and they will pick up them from that location and redistribute the cycles at appropriate dock stations at regular time intervals considering the peak timings.

Future Work : We are yet to work on point no. 8 and 10

Proposed list of Dock Stations :

1) Every Hostel Parking Lot .
2) Every Department Parking Lot.
3) Every external Labs / Power Stations etc.
4) Main Gate
5) YP/Market Gate
6) Gulmohar/Guest House
7) Convocation Hall
8) Main Building
9) VMCC
10) Tum-Tum Stations

Housing area and LaKe side area is still unexplored, there can be some dock stations there as well like Anatha, Aravali etc.

When for parking the cycle or ending the trip we suggest to park it in sensible locations, By sensible location we mean, e.g If you want to end the trip near CSRE department, Instead of parking it anywhere near the road,Park it in a predefined location like CSRE Dept Parking Lot. It will help our vendor while collecting the cycles. And by parking it at any sensible location or bringing the bicycles back from where it is picked from will fetch you the next ride free.

Sensible Locations can be any dock station or any Landmark instead of random road corner.