[dcaiti]

Daimler Center for
Automotive Information Technology Innovations

DCAITI-Project: Implementation of a Traffic Light Service on an (Android) Smartphone

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Overview

[dɪsiː ɑrtiː]

I. Background
II. Secure Android Application
III. Features
IV. Layout
V. General Class Diagram
VI. System Architecture
VII. Main Tasks (Implementation, Simulation and Test)
VIII. Milestones
IX. Licenses

1. Background

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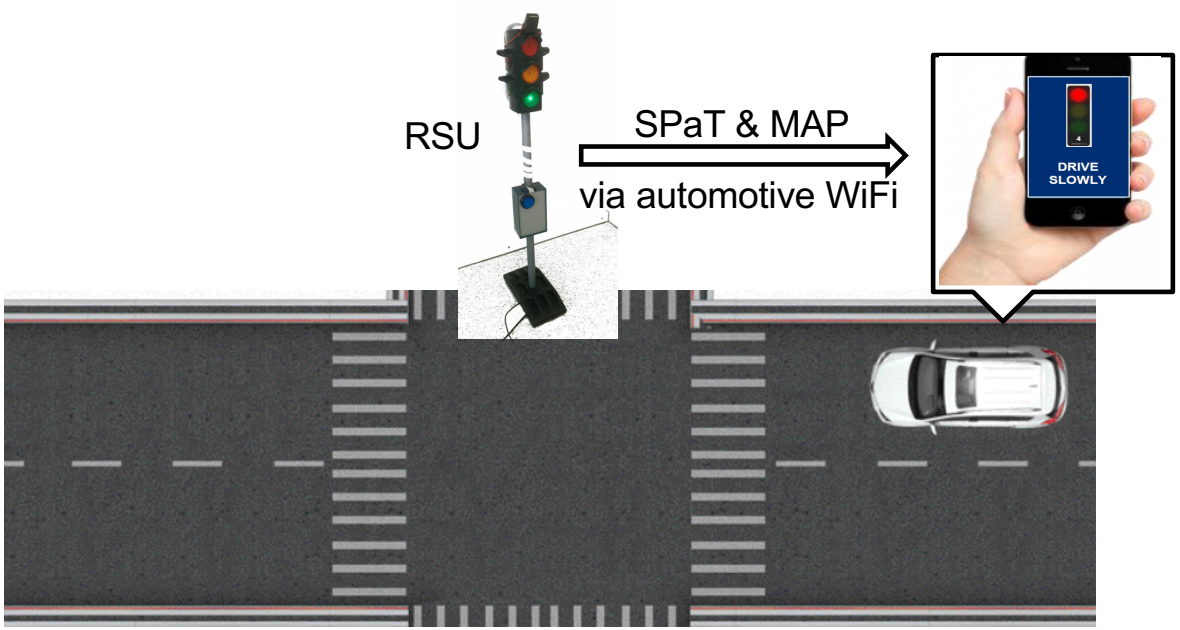
GLOSA (*Green Light Optimized Speed Advisory*)
- suggests speeds to vehicles to pass through an intersection

RSU (*Roadside unit*)

SPaT (*Signal Phase and Time*)
- FOKUS Traffic Light Service

MAP (*Map data*)
- Topology of the intersection

Road Users
- car/ bicycle/ pedestrian
- receive recommendation for action



Source: Lecture slides. First lecture

2. Secure Android Application

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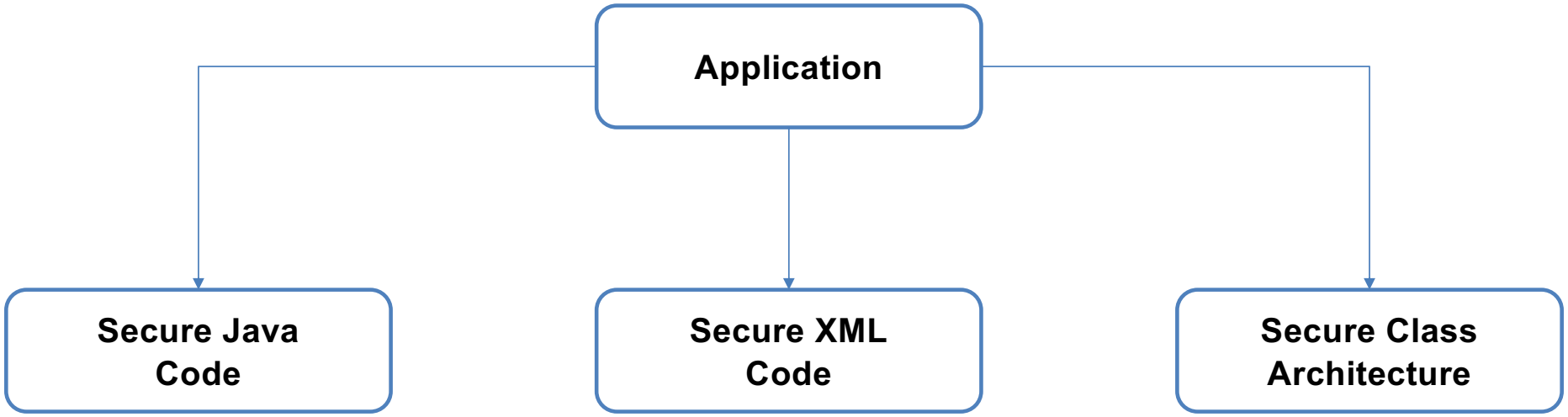
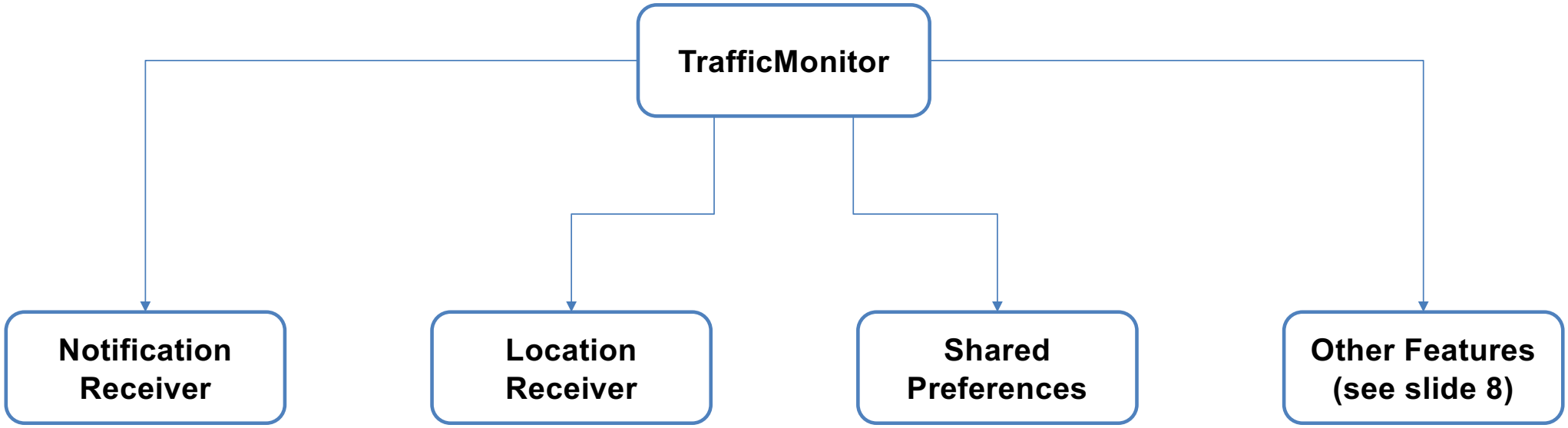


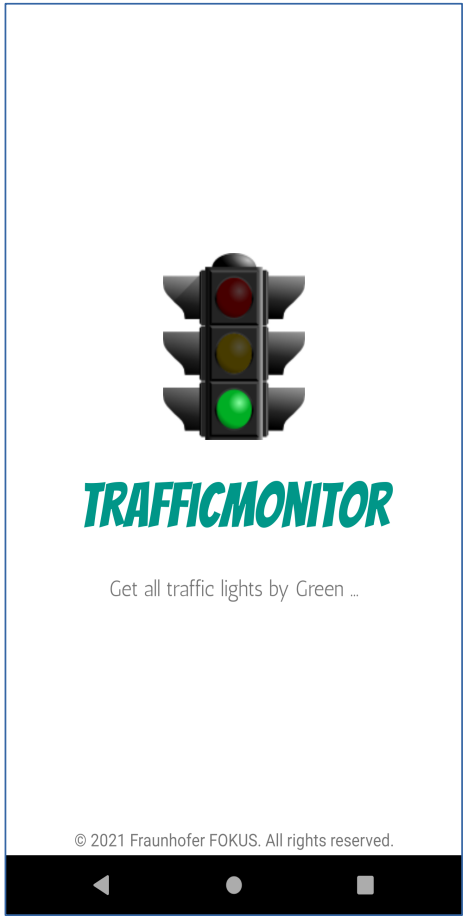
3. Features

[dɪsiː arti:]



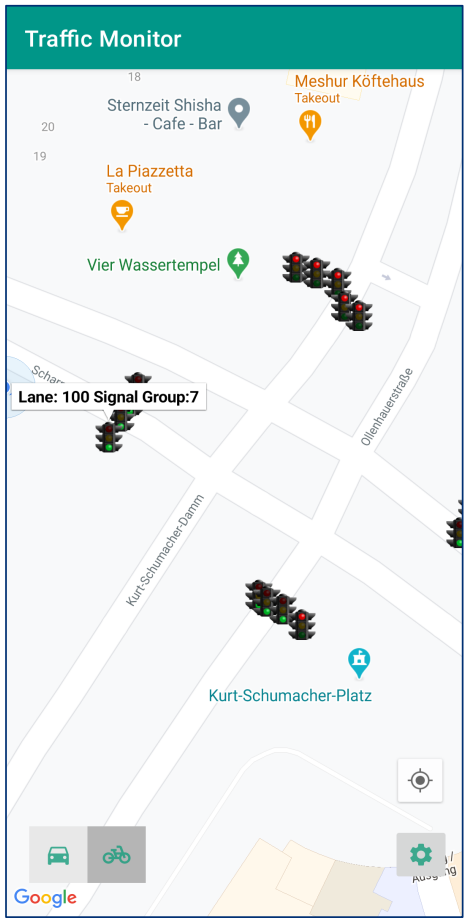
4. Layout (Splash Screen)

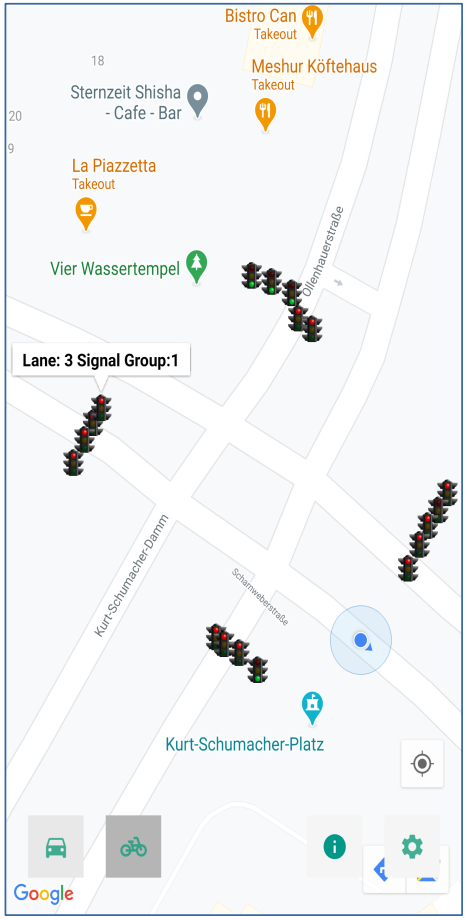
[dɪsi: aɪti:]



4. Layout (Main Screen)

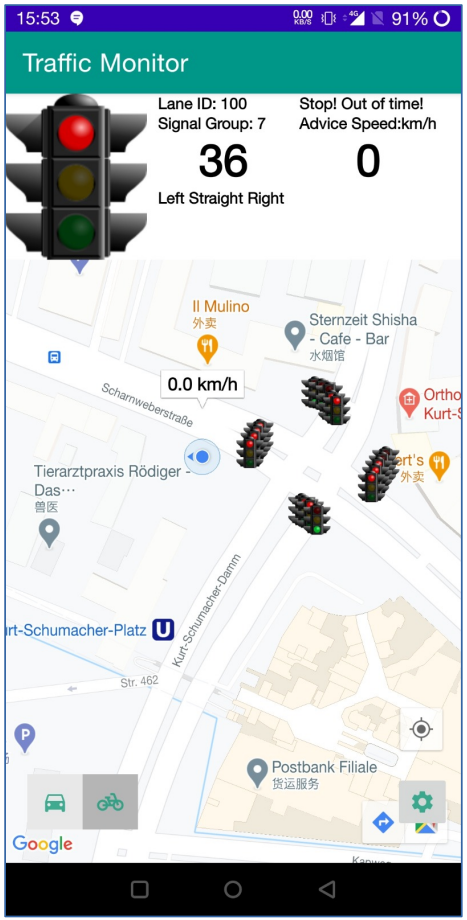
[dɪsiː artiː]

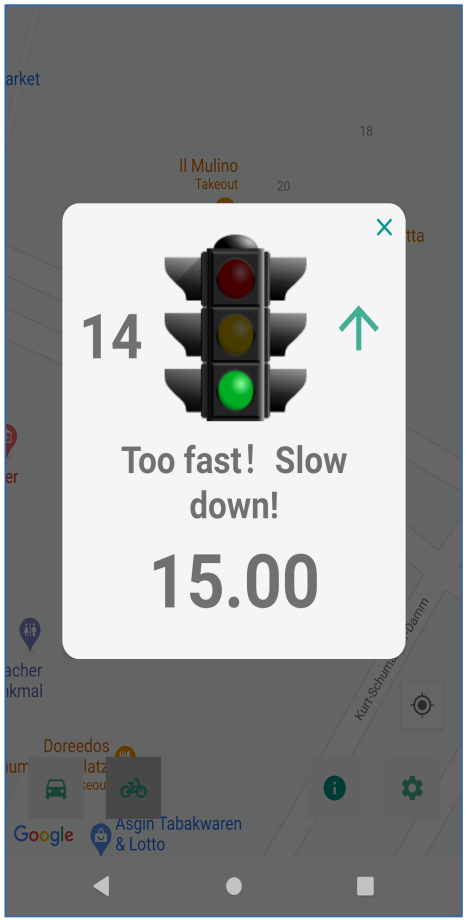




4. Layout (Popup Screen)

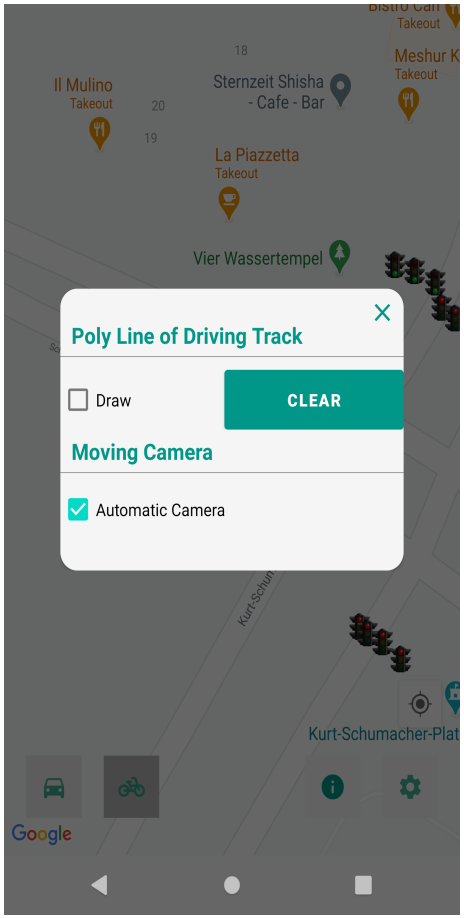
[dɪsiː arti:]



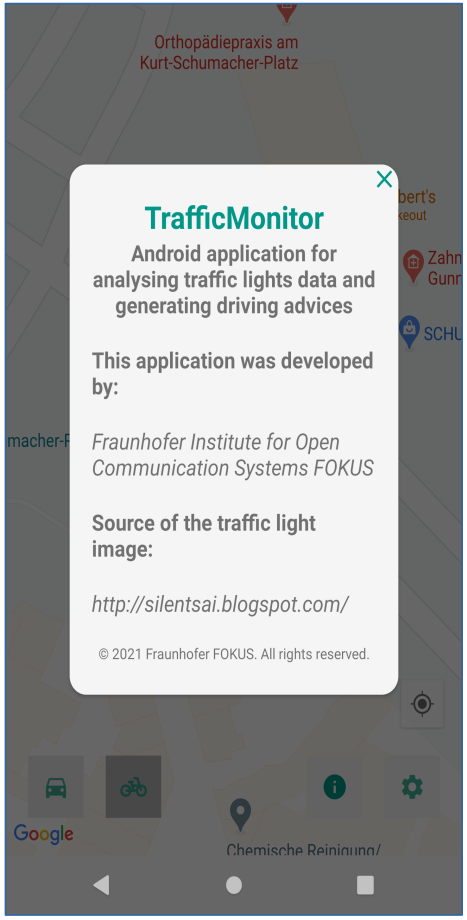


4. Layout (Settings Screen)

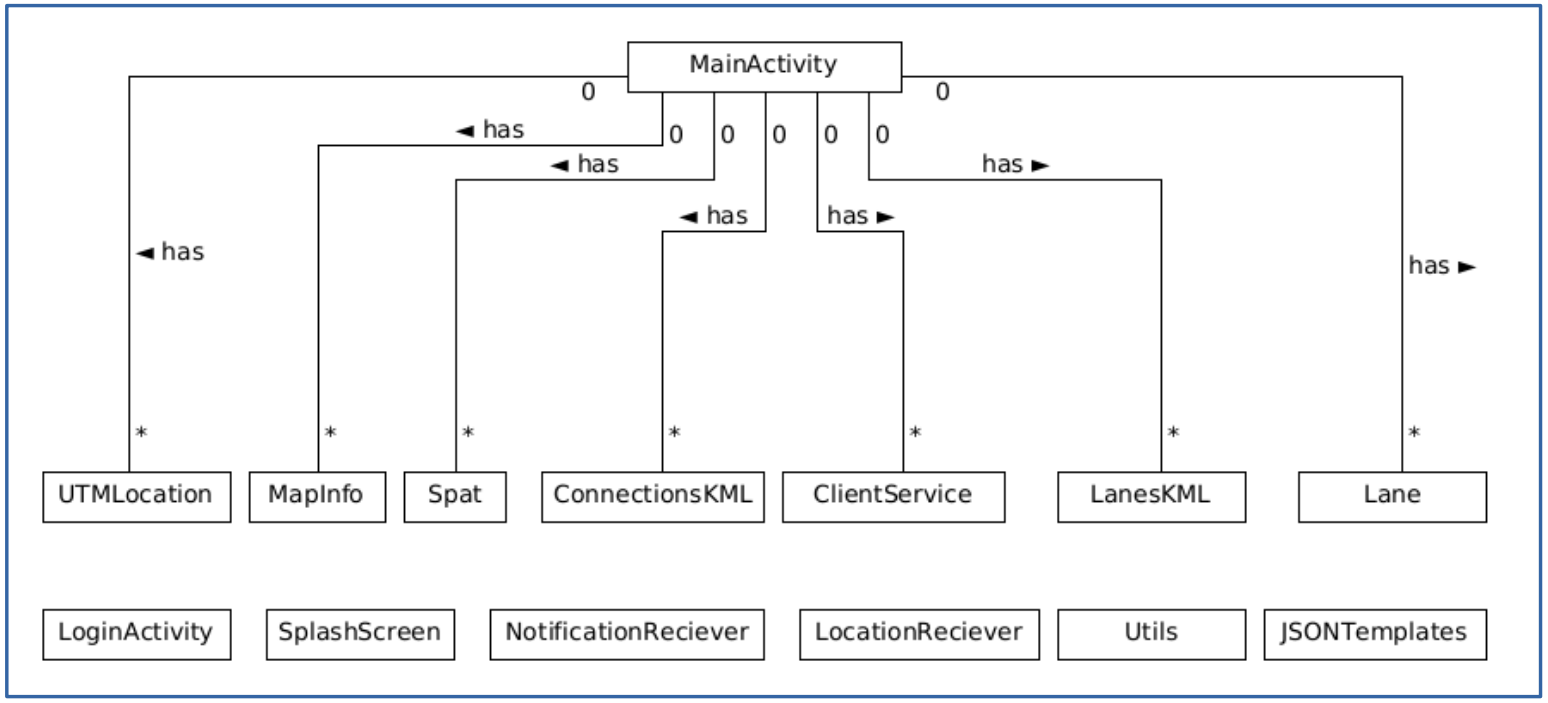
[dɪsiː artiː]



4. Layout (About Screen)

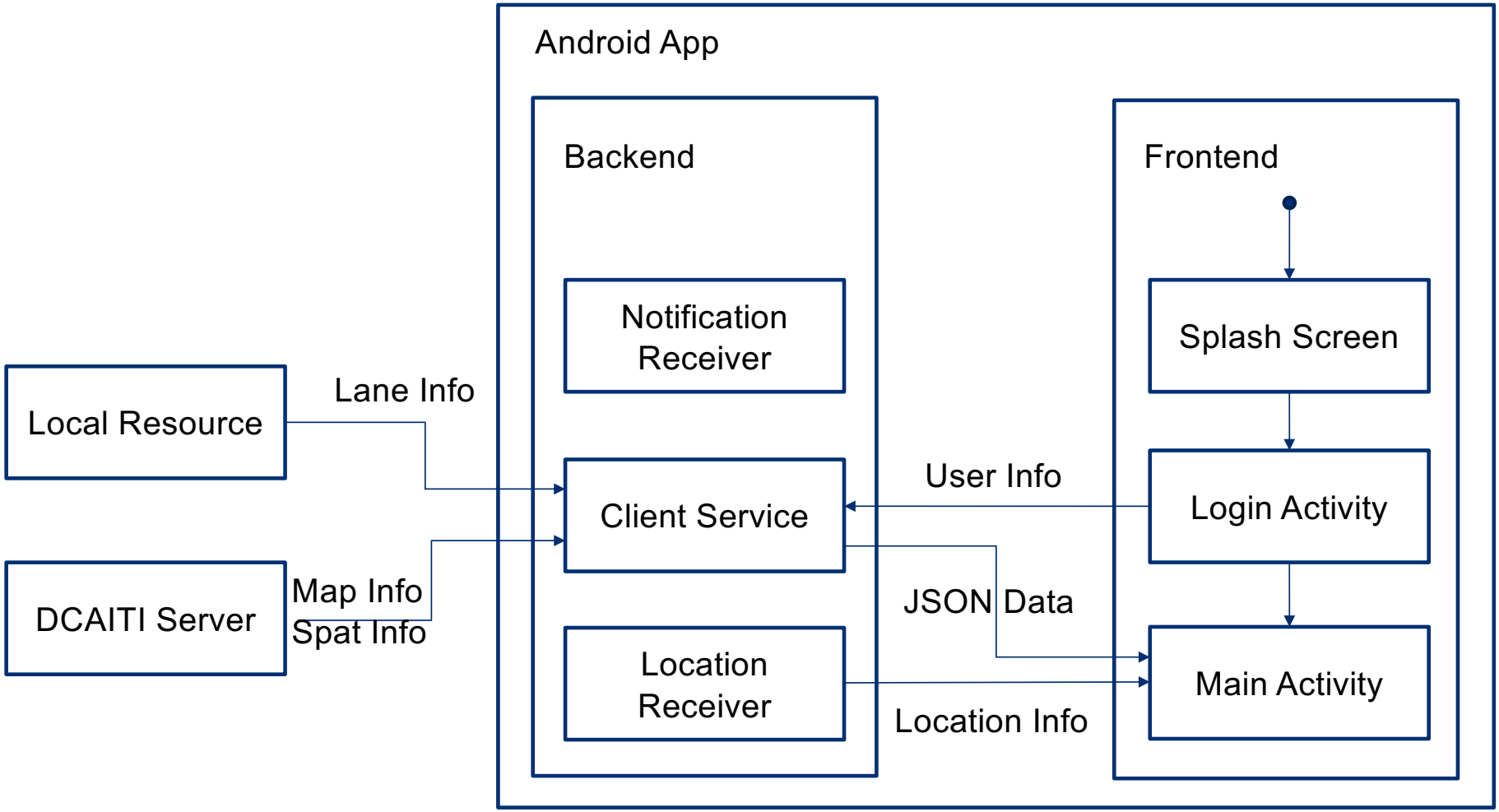


5. General Class Diagram



6. System Architecture

[dɪsiː ɑrtiː]



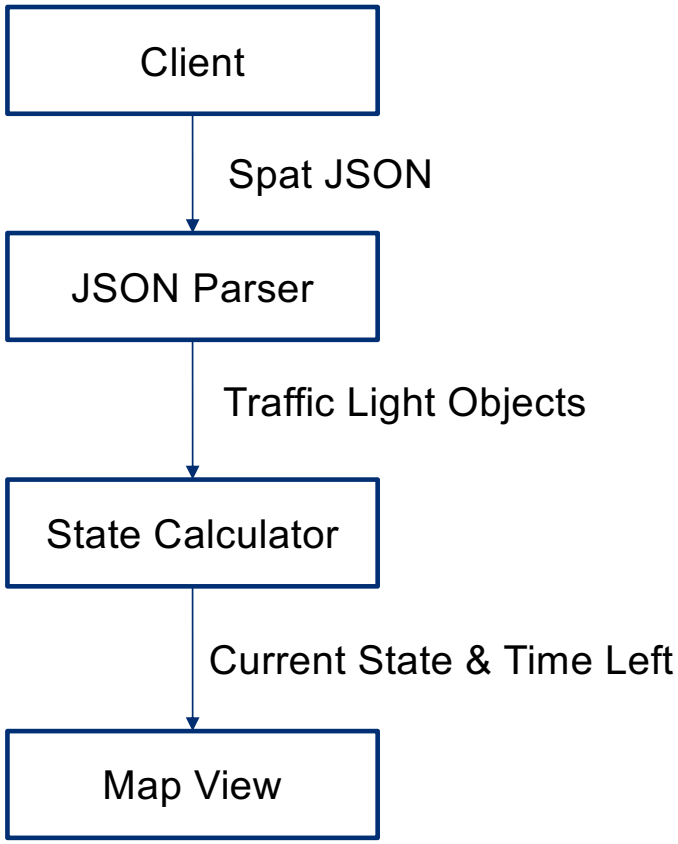
7. Main Tasks

[dɪsi: aɪti:]

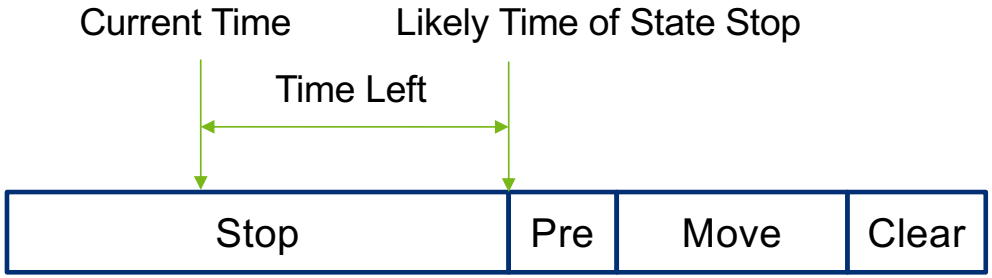
- Request, analysis and visualization of traffic lights information
- Determination of signal group
- Generation of strategies

7.1 Traffic Light Monitor: Implementation

[dɪsi: arti:]



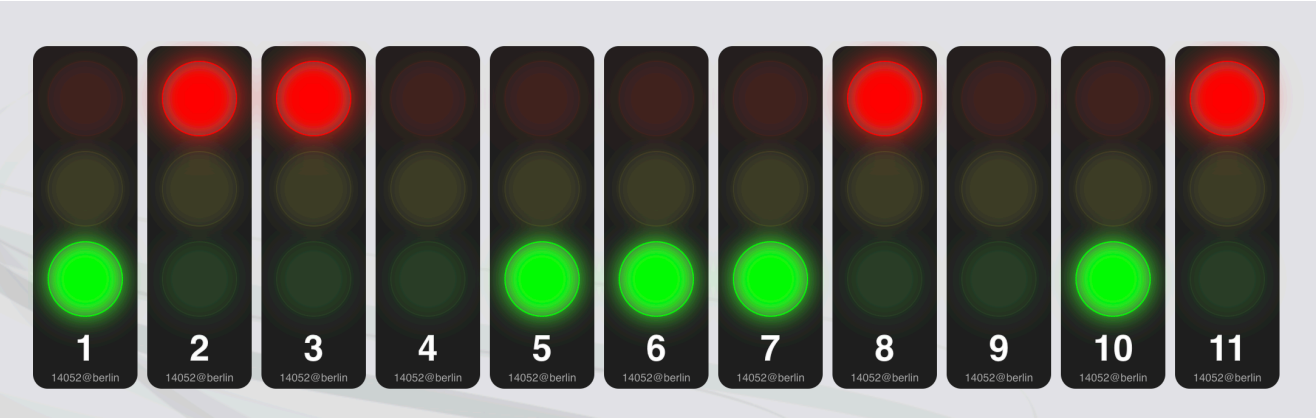
Traffic light phase examples:



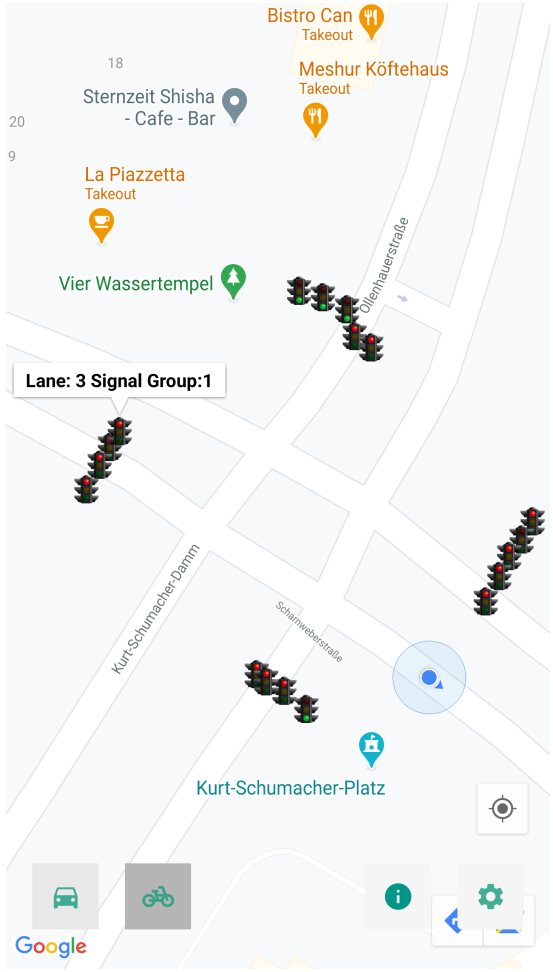
7.1 Traffic Light Monitor: Simulation & Test

[dısi: arti:]

- Traffic lights contain 11 signal groups in intersection 14052
- Every lane has one visual traffic light with the corresponding label about information of lane id and signal group id. Position Info from MapInfo JSON
- Test, validation with the live view of dcaiti website, almost synchronous but our traffic lights delay a little bit (less than one second)



Source: https://werkzeug.dcaiti.tu-berlin.de/0432l770/trafficlights/



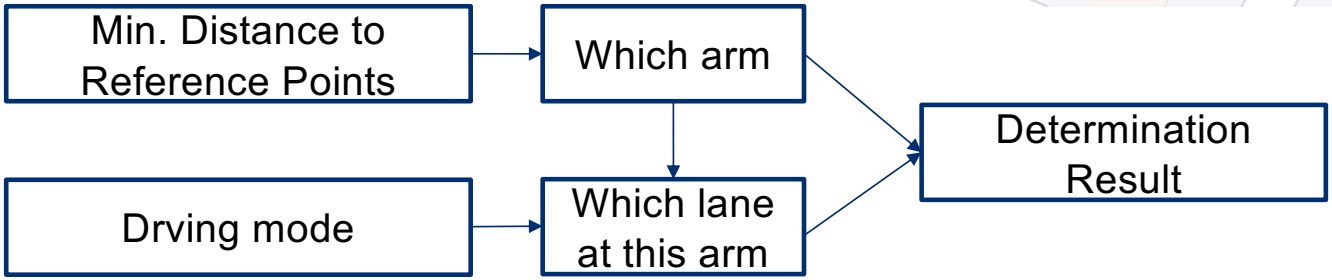
7.2 Determination: Implementation

[dısi: arti:]

Algorithm 1 : ✖
Linear Regression -> Not suitable for real lane, which often in curve not straight line

Algorithm 2 : ✖
Min. Distance to Lane Reference Points -> GPS not accurate at lane level

Algorithm 3 : ☺
Drving mode & Min. Distance to Reference Points



7.2 Determination: Simulation & Test

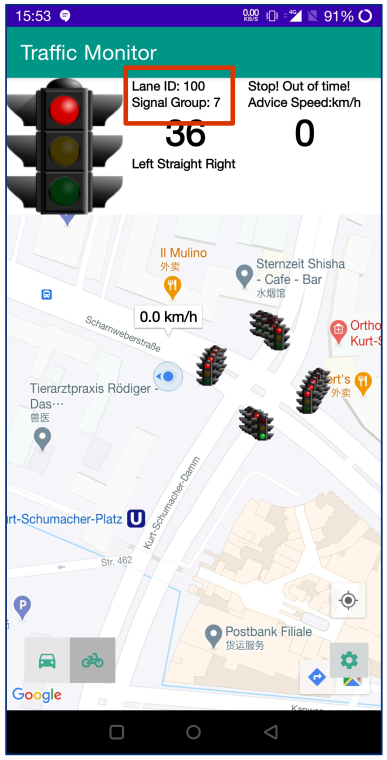
- Testcases with handy at intersection 14052
  - Simulation of the bicycle users with the corresponding four driving directions in right picture
  - The determination results of lanes with id 100, 102, 104 and 106 are expected

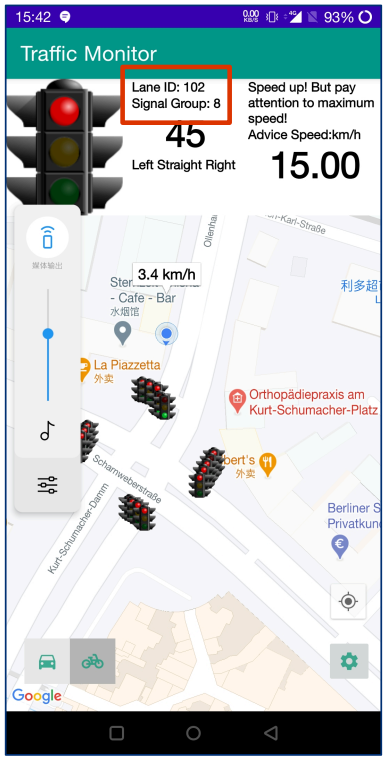
Source : Photo of the arm 1 of intersection 14052 taken by Yiyang and contains bicycle lane 100

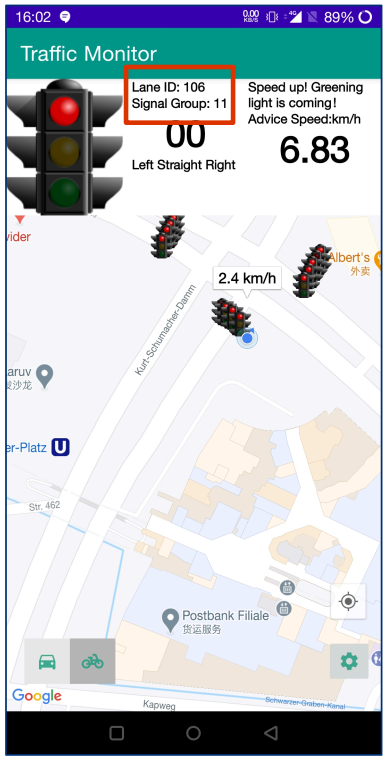
7.2 Determination: Simulation & Test

[dısi: arti:]

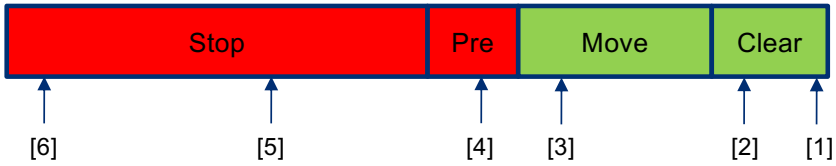
- Test results with handy at intersection 14052
  - The lanes with id 100, 102, 104 and 106 are determined successfully.







7.3 Driving Strategies: Implementation

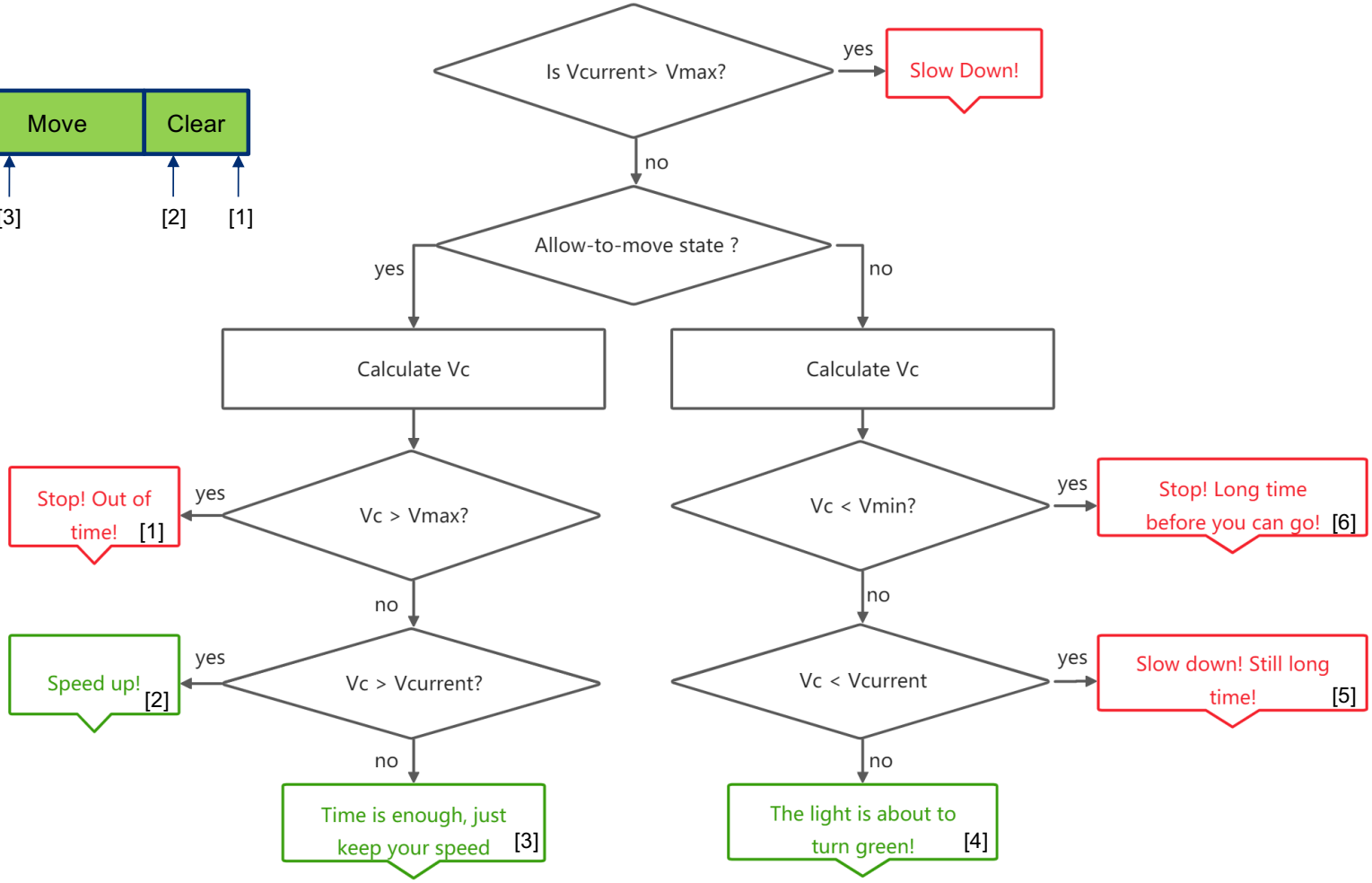


Vcurrent: current speed

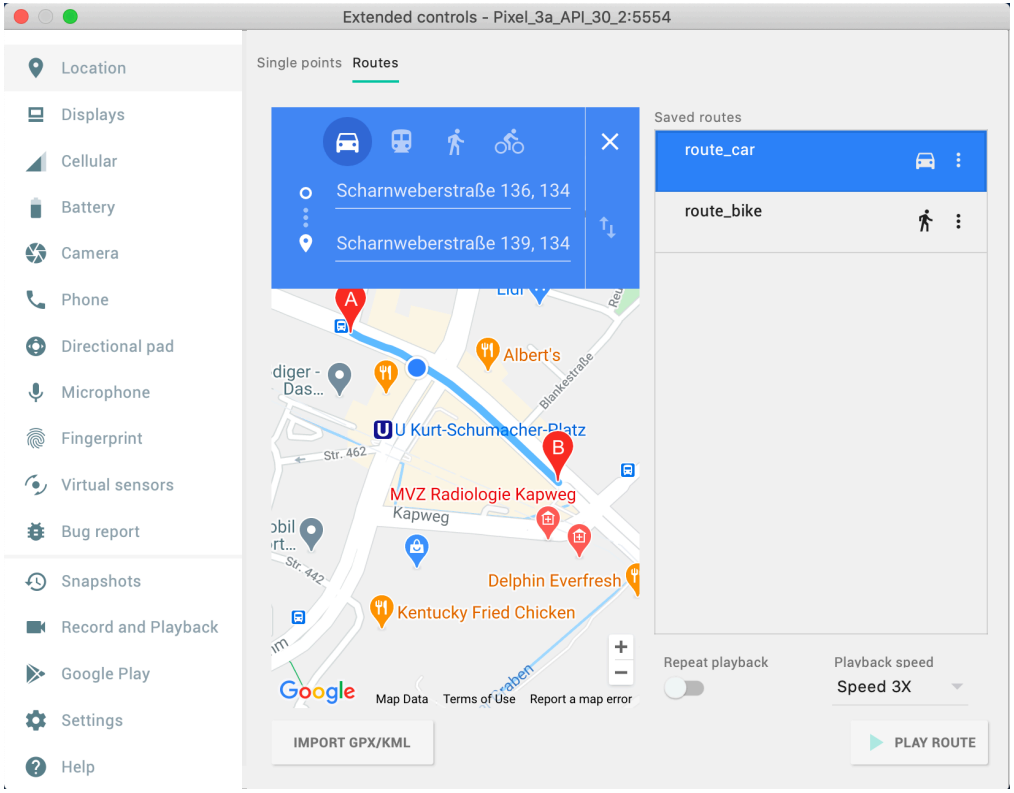
Vmax: maximum permitted speed

Vmin: minimum permitted speed

Vc: calculated speed to reach the intersection in the remaining time



Route Simulation with Emulator



For example: the route of car with Speed 3X: around 45 km/h

7.3 Driving Strategies: Simulation & Test

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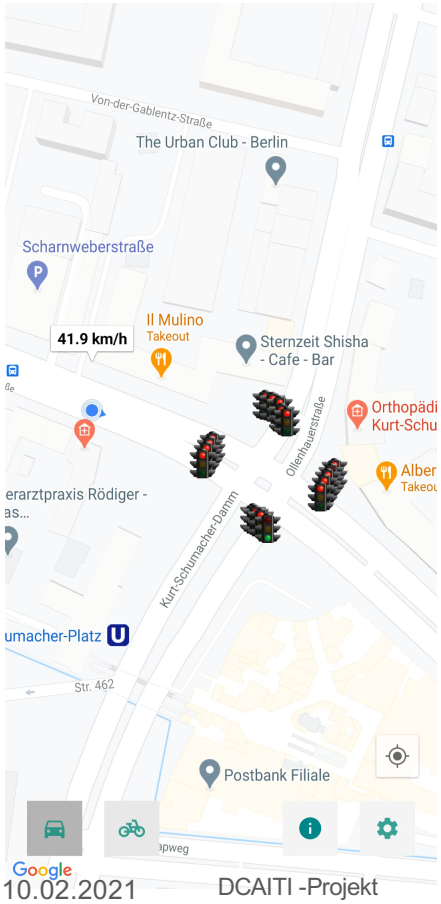
Case No.1: Car;

State: Move & Clear;

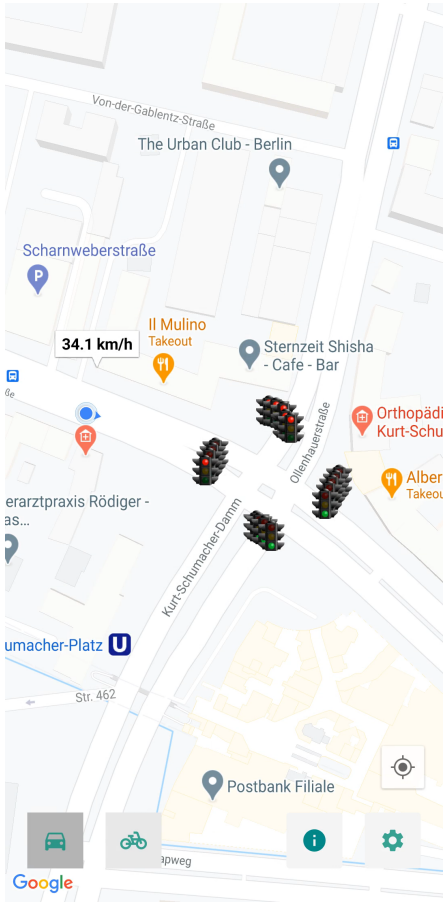
Enough time to pass



Case No.2: Car;

State: Move & Clear;

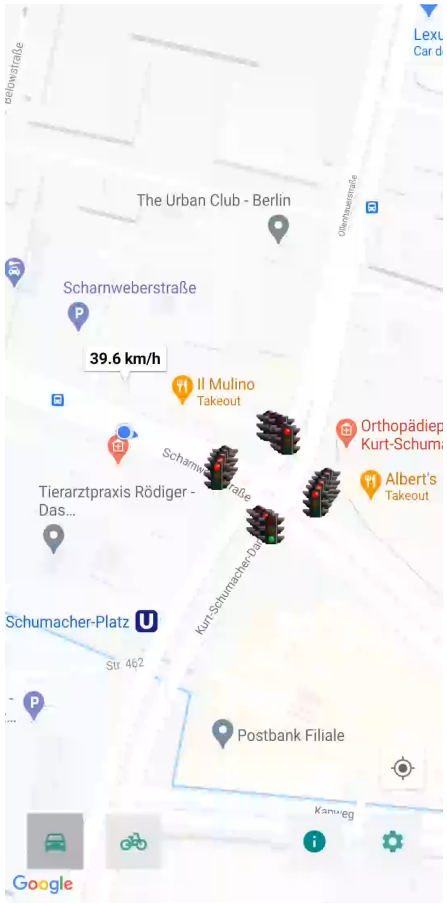
No enough time to pass



Case No.3: Car;

State: Stop & Pre;

Long time to wait for green



Case No.4: Car;

State: Stop & Pre;

Green light is about to come

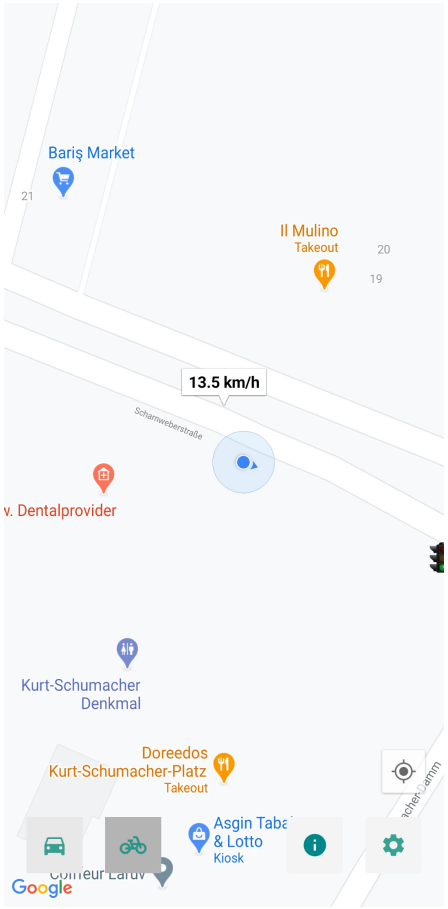
7.3 Driving Strategies: Simulation & Test

[dısi: arti:]

Case No.5: Bicycle;

State: Move & Clear;

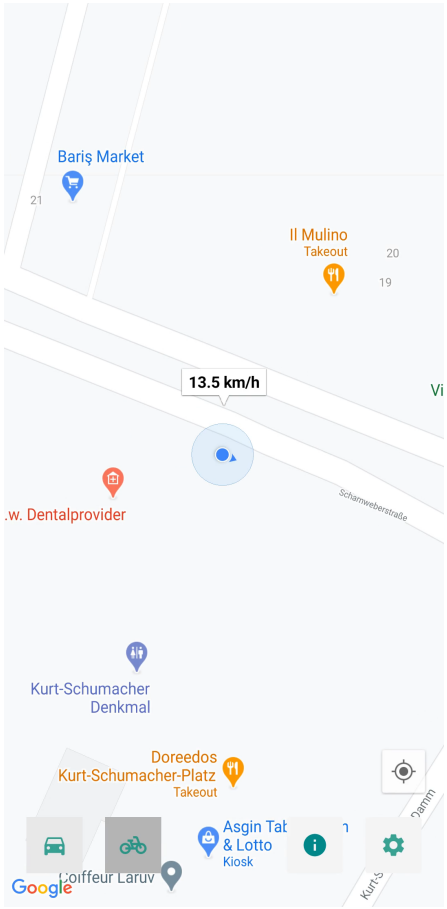
Enough time to pass



Case No.6: Bicycle;

State: Move & Clear;

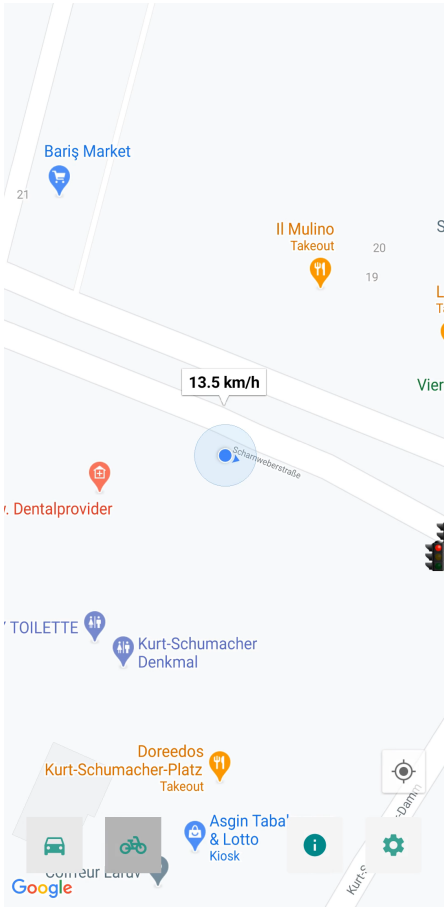
No enough time to pass



Case No.7: Bicycle;

State: Stop & Pre;

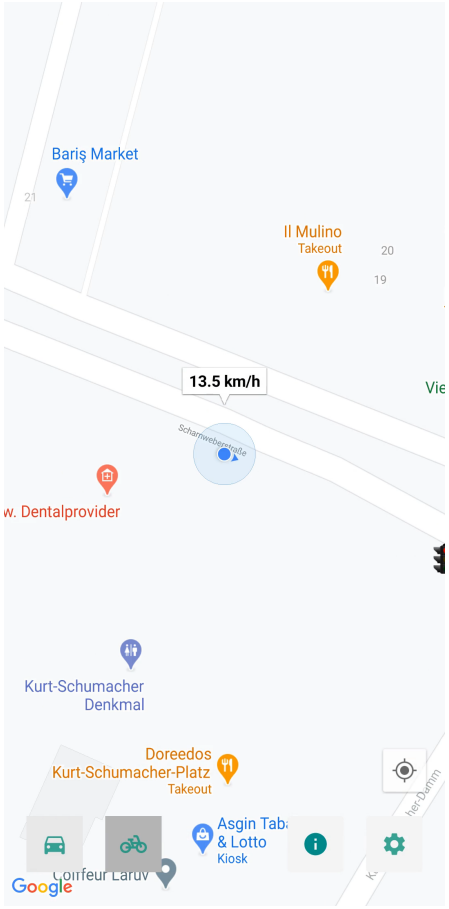
Long time to wait for green



Case No.8: Bicycle;

State: Stop & Pre;

Green light is about to come



8. Milestones

[dɪsi: arti:]

CW\Tasks	Literature Research	Framework & Libs Test	SPaT Analysis & Visual	Determination of signal group	2nd Pre.	Work about driving strategies	Simulation and Evaluation	3rd Pre.	Documentation
47									
48									
49									
50									
51									
52									
53									
1					6-Jan				
2									
3									
4									
5									
6								10-Feb	
7									
8									
9									
10									10-Mär

9. Licenses

[dɪsi: aɪti:]

- Source of the traffic light image:

  http://silentsai.blogspot.com/

- Google Map SDK for Android (API-Key apply):

  https://console.cloud.google.com/google/maps-apis/

[dısı: arti:]

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Thanks for your attention!

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