



Daimler Center for
Automotive Information Technology Innovations

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

Oday Kabha

Yiyang Song

Yuanheng Mu

oday.kabha@ipk.fraunhofer.de

yiyang.song@campus.tu-berlin.de

johanmu1994@mailbox.tu-berlin.de

Supervisor: Birgit Kwella

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- III. Features
- IV. Layout
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- VI. System Architecture
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- X. Licenses



1. Background

[diːsi: aɪtiː]

GLOSA (*Green Light Optimized Speed Advisory*)

- suggests speeds to vehicles to pass through an intersection

RSU (*Roadside unit*)

SPaT (*Signal Phase and Time*)

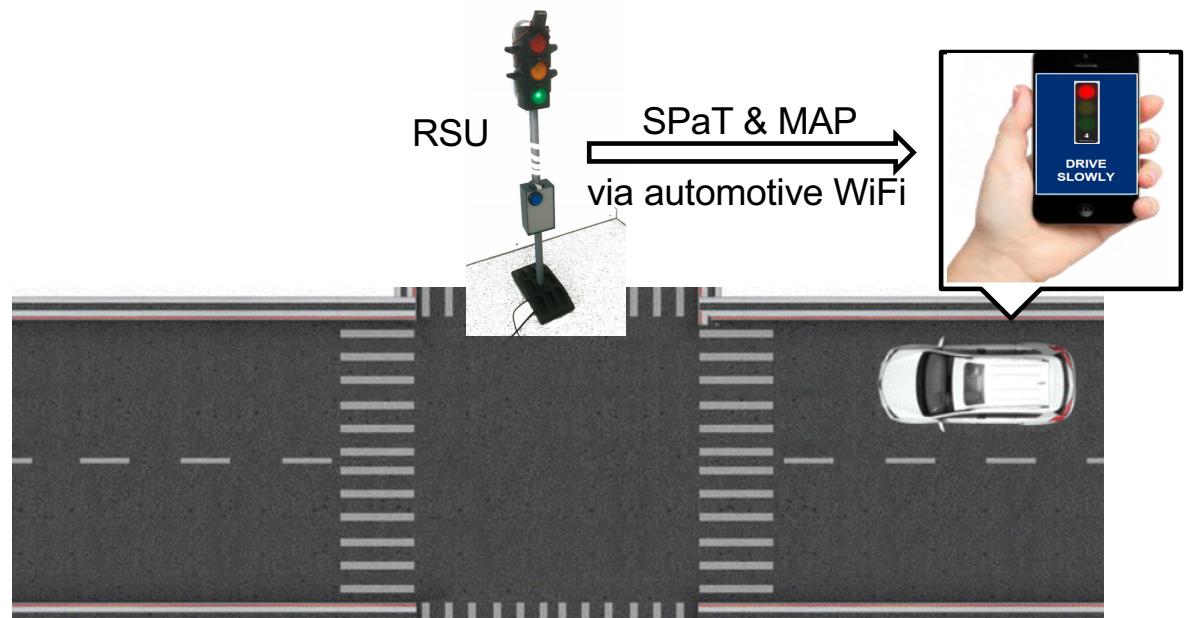
- FOKUS Traffic Light Service

MAP (*Map data*)

- Topology of the intersection

Road Users

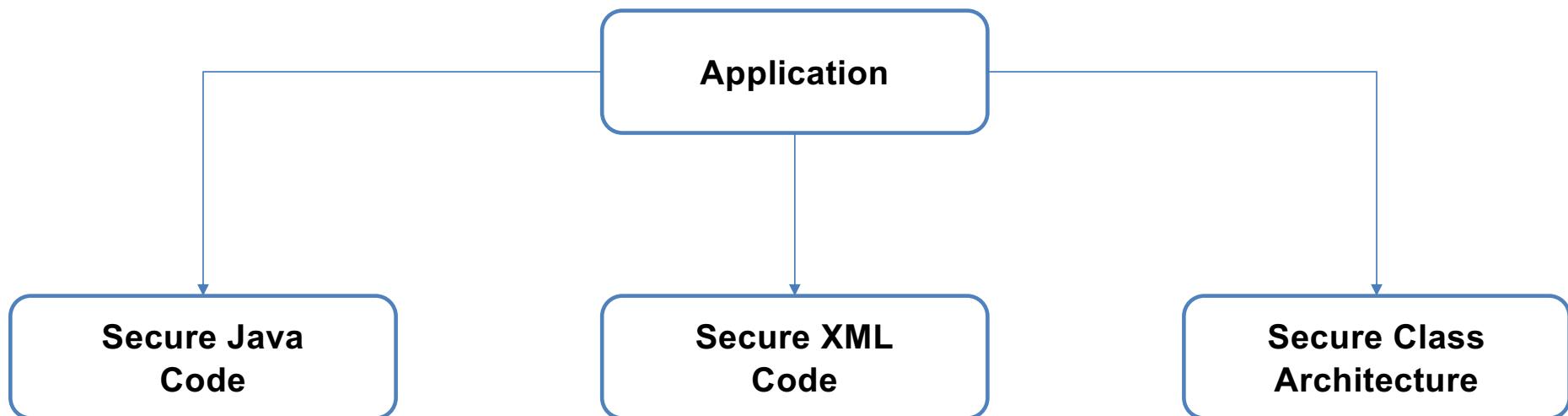
- car/ bicycle/ pedestrian
- receive recommendation for action



Source: Lecture slides. First lecture

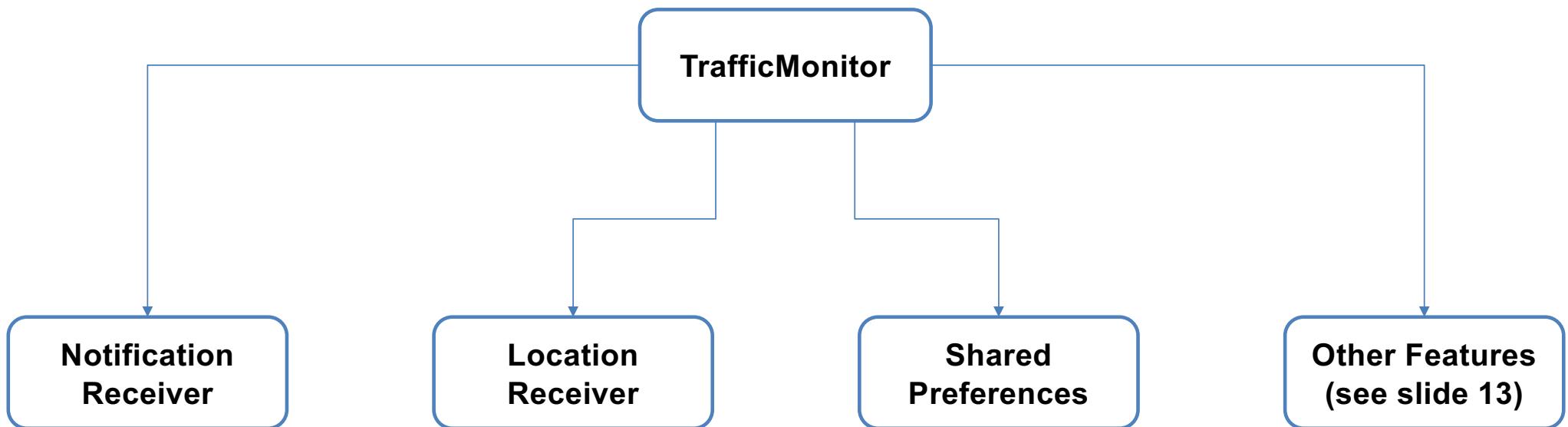
2. Secure Android Application

[disi: aiti:]



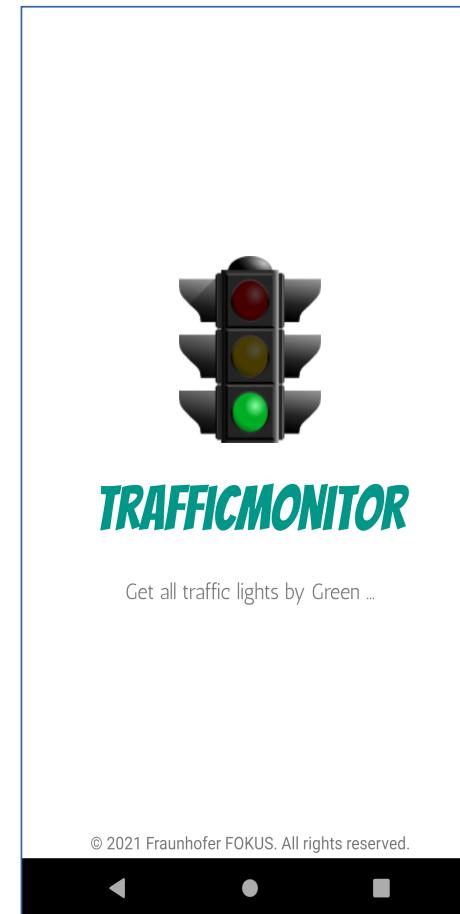
3. Features

[diːʃ ətɪː]



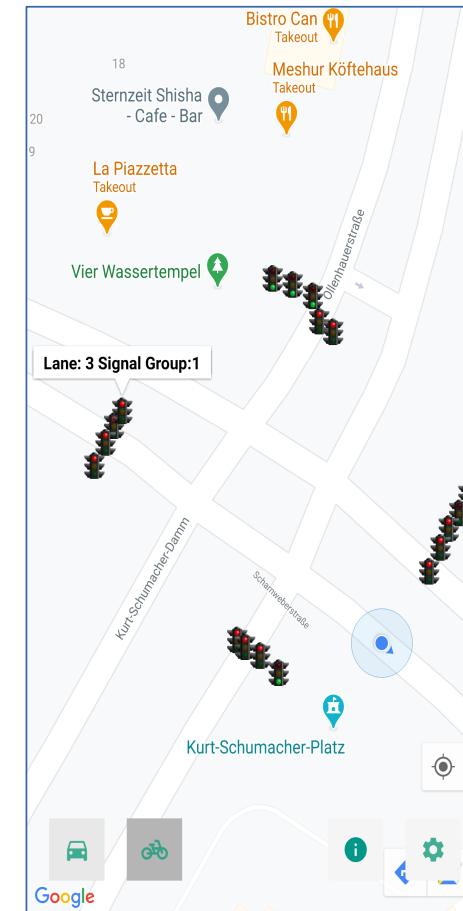
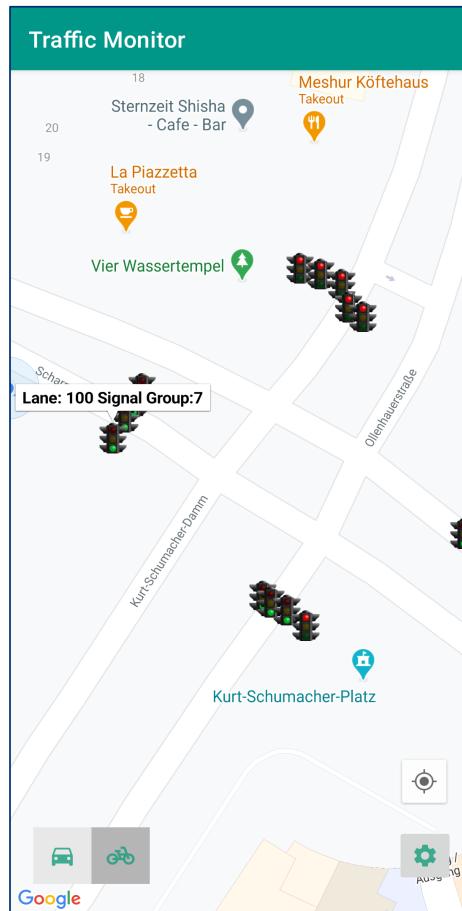
4. Layout (Splash Screen)

[disi: aiti:]



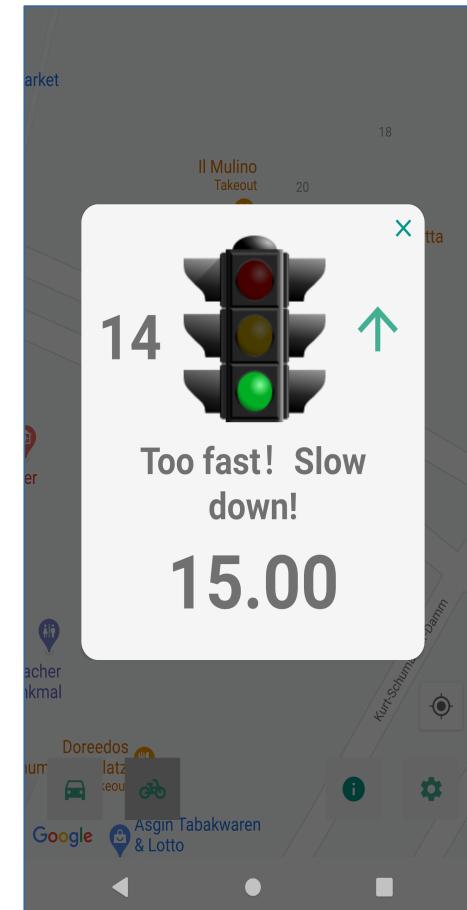
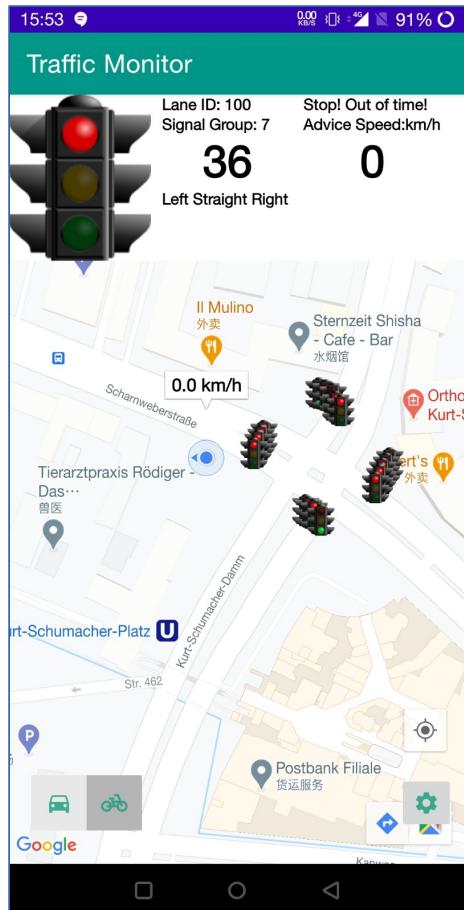
4. Layout (Main Screen)

[disi: aiti:]



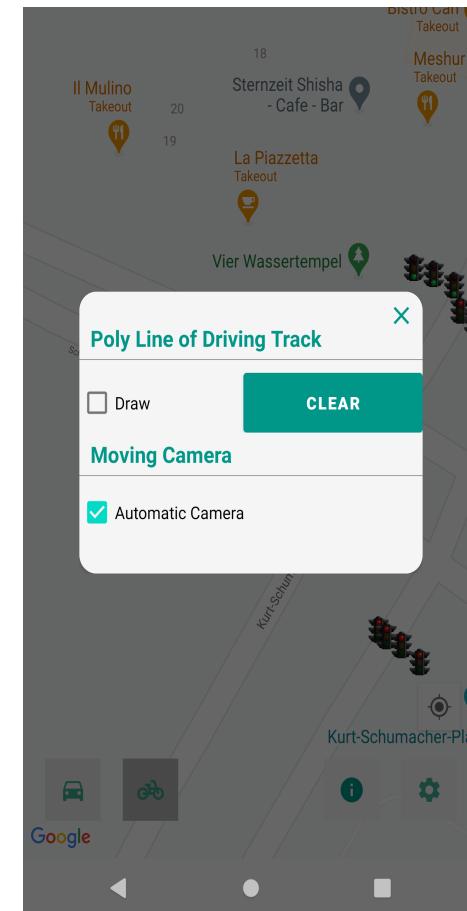
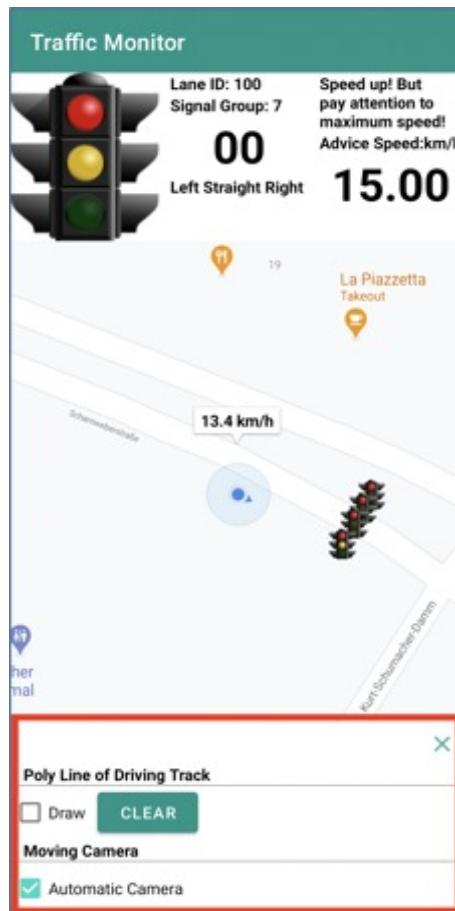
4. Layout (Popup Screen)

[disi: aiti:]



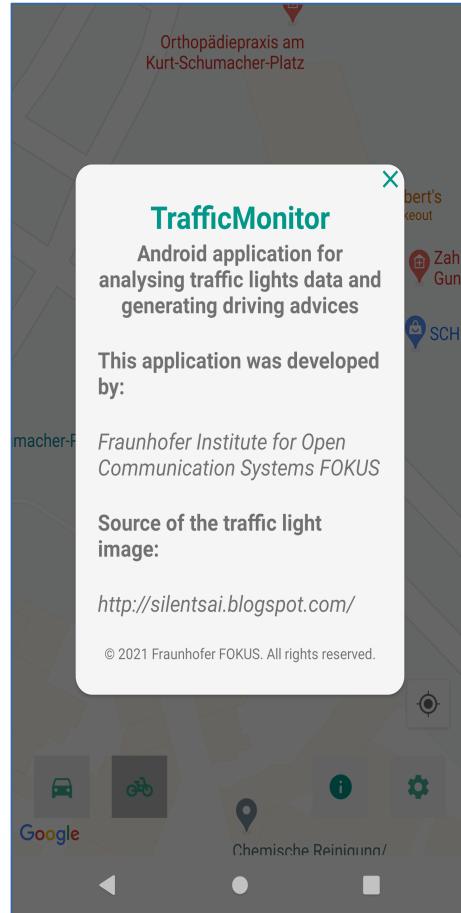
4. Layout (Settings Screen)

[disi: aiti:]



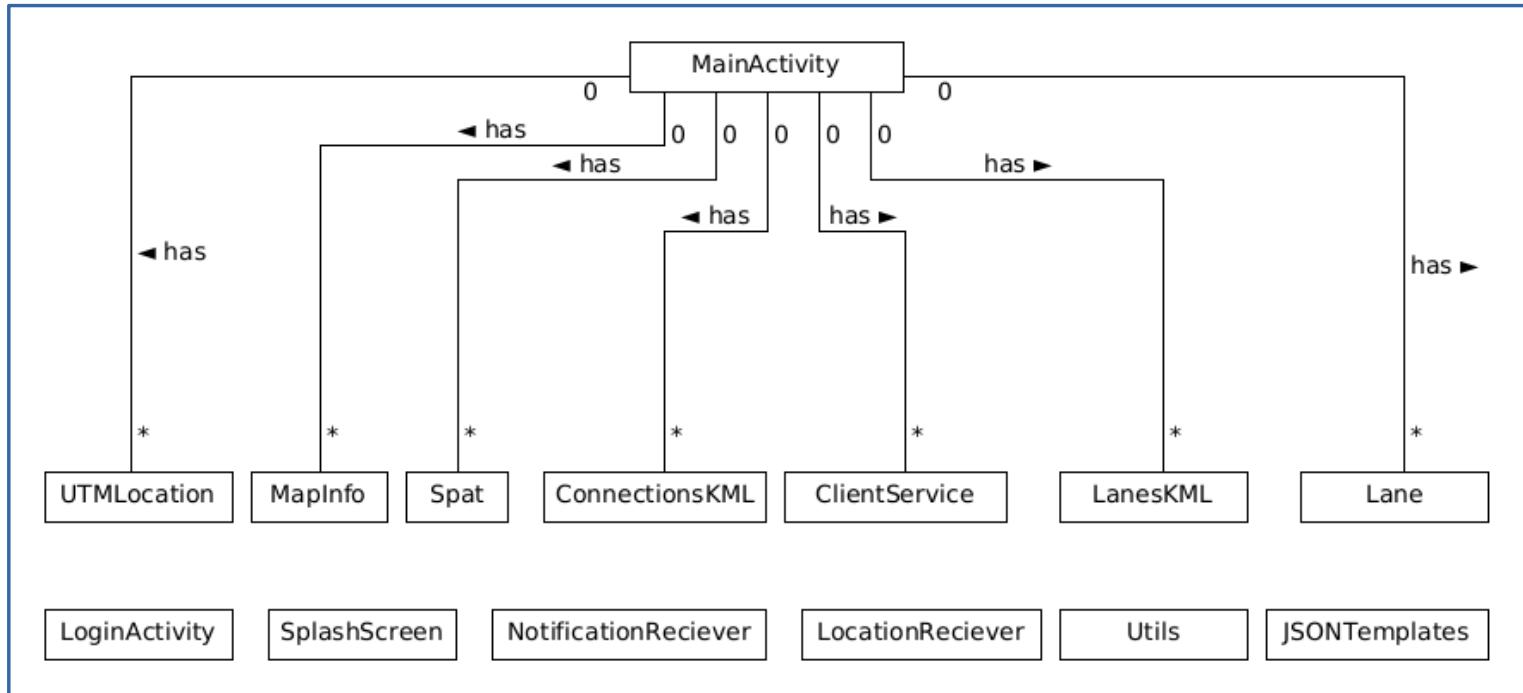
4. Layout (About Screen)

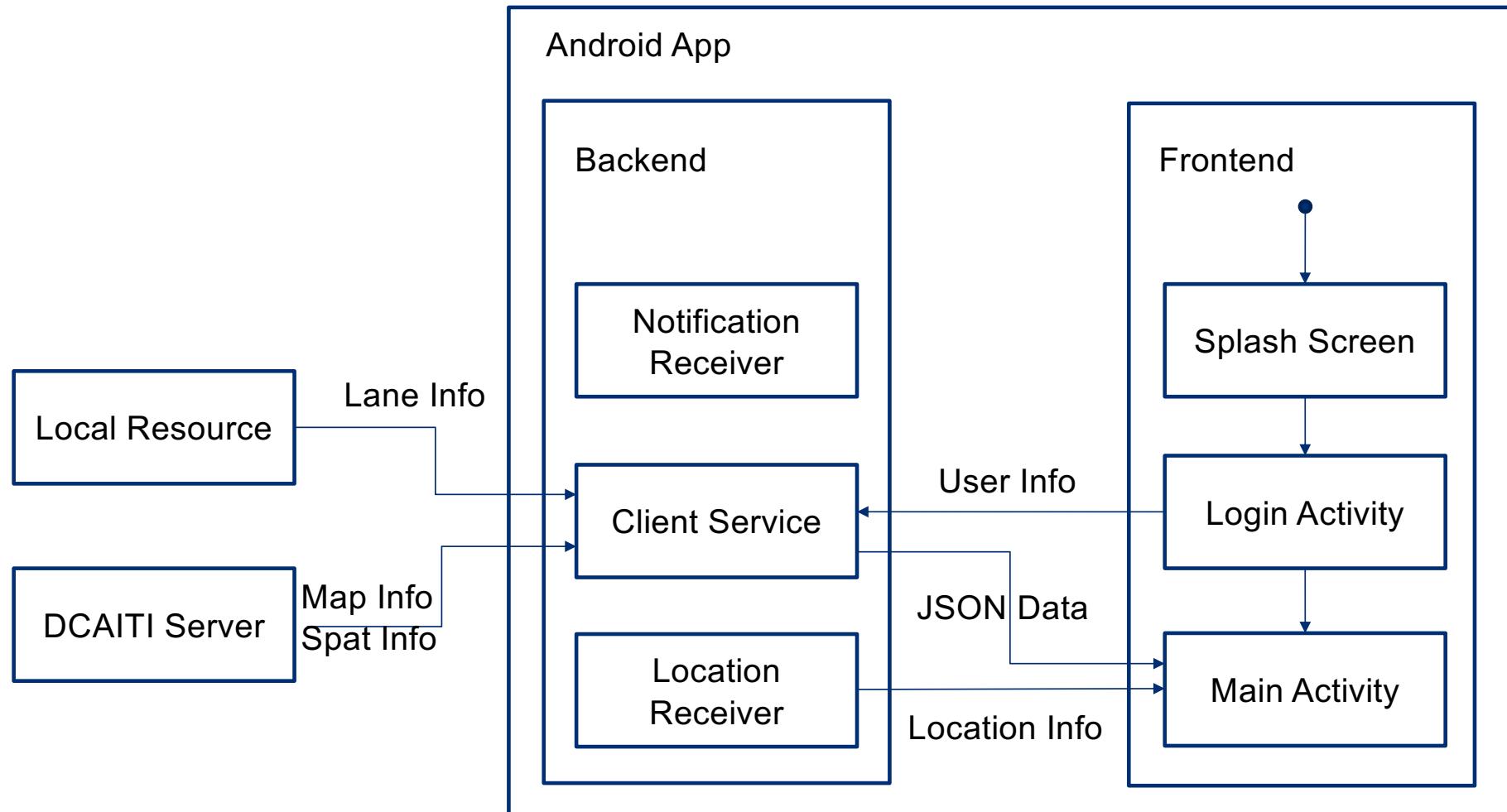
[disi: aiti:]



5. General Class Diagram

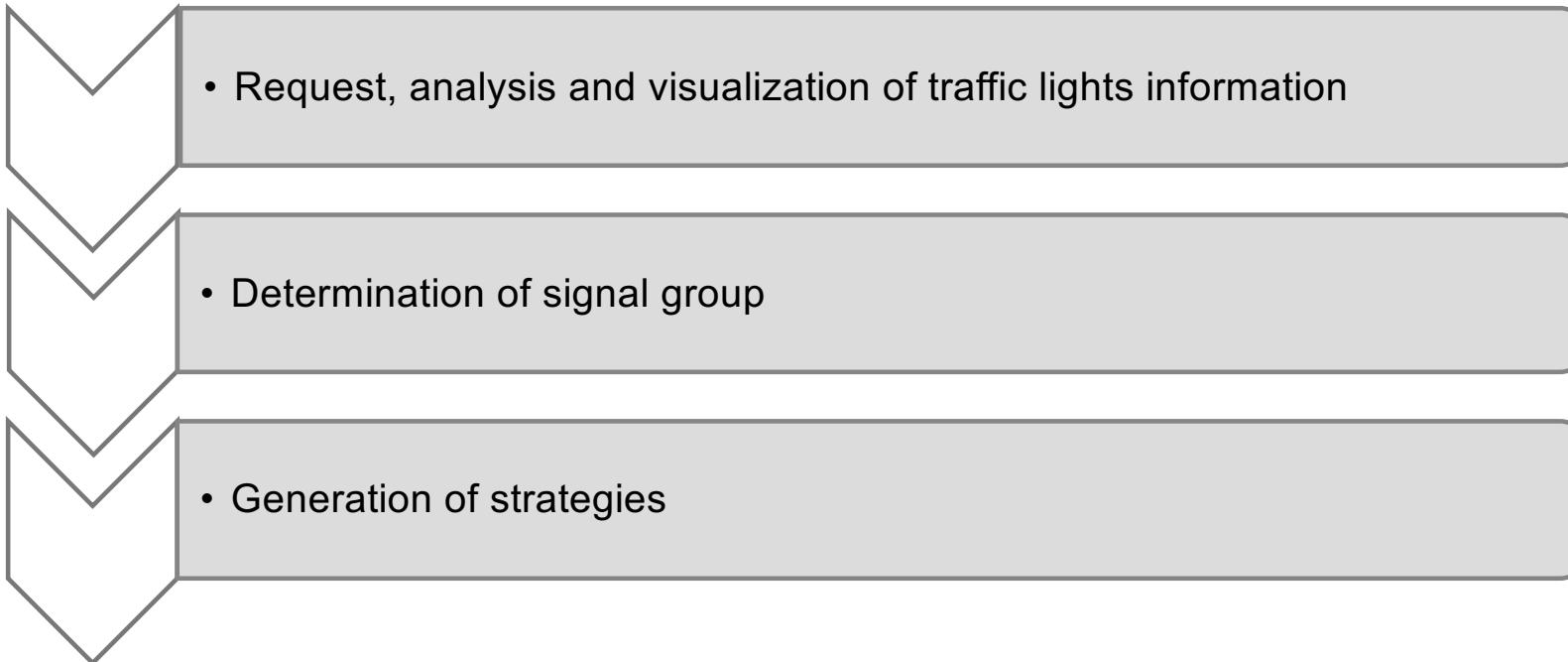
[disi: aiti:]





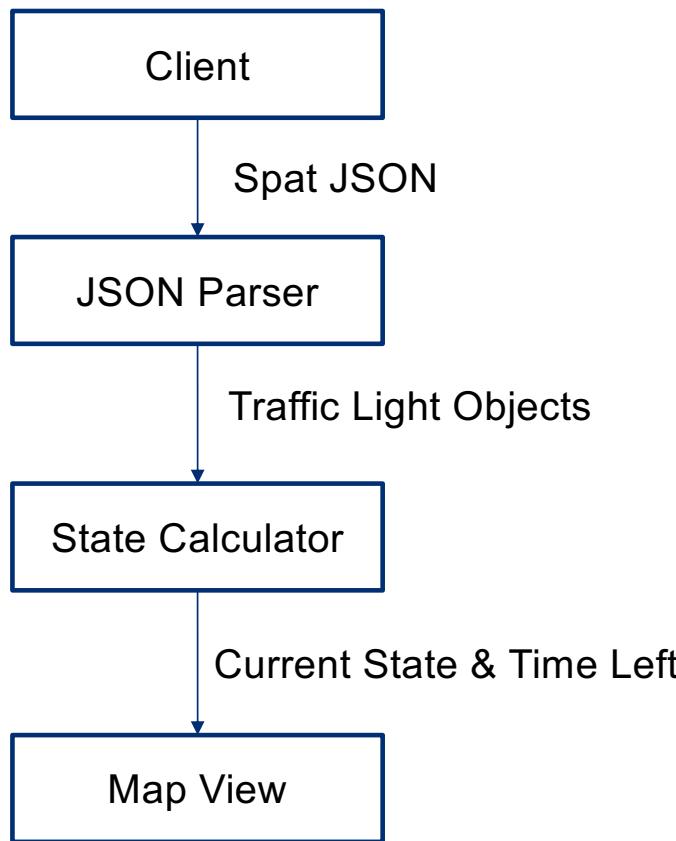
7. Main Tasks

[diːt̪ɪ: aɪt̪ɪ:]

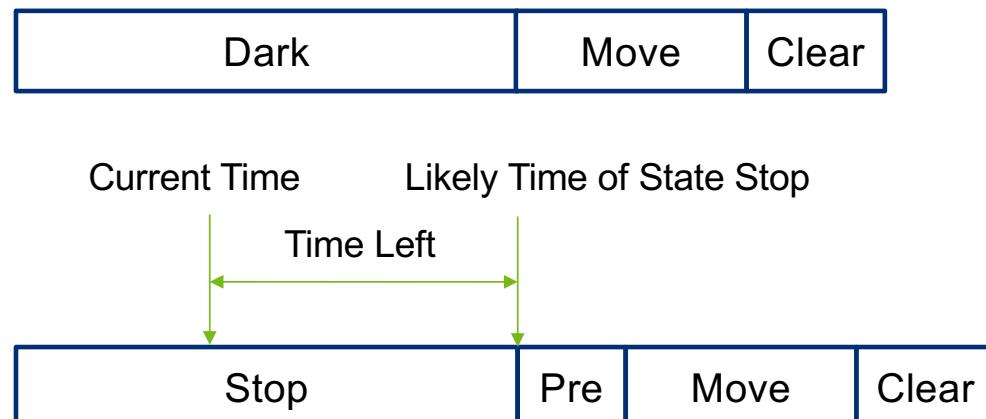
- 
- Request, analysis and visualization of traffic lights information
 - Determination of signal group
 - Generation of strategies

7.1 Traffic Light Monitor: Implementation

[disi: aiti:]



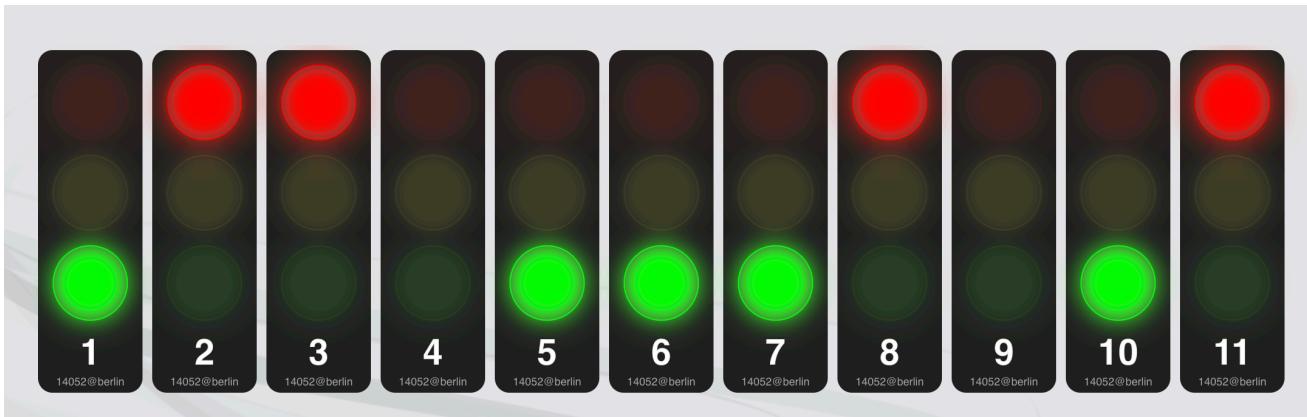
Traffic light phase examples:



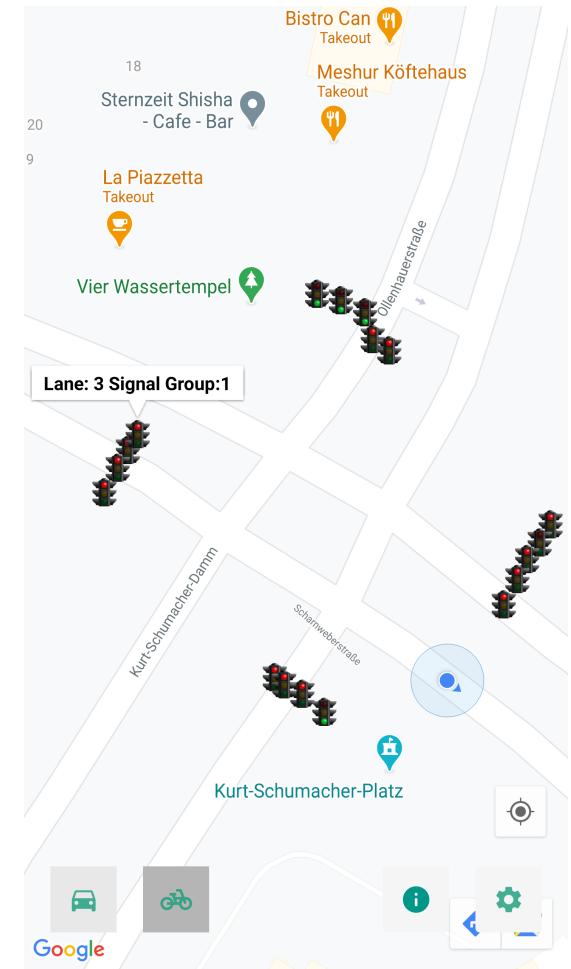
7.1 Traffic Light Monitor: Simulation & Test

[disi: aiti:]

- 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

[disi: aiti:]

Algorithm 1 : ❌

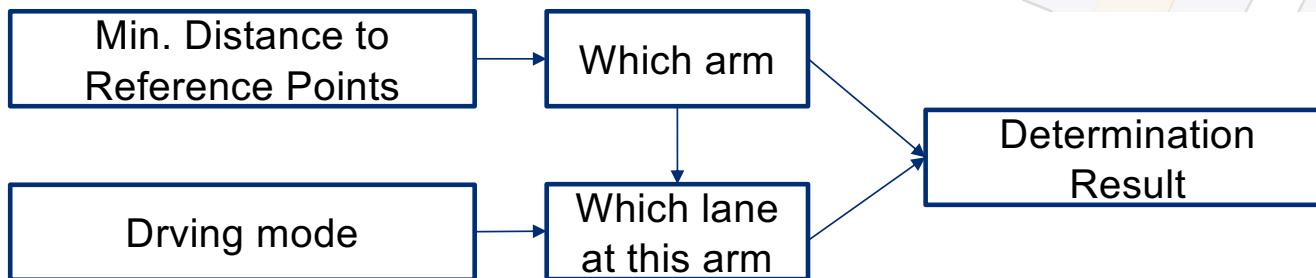
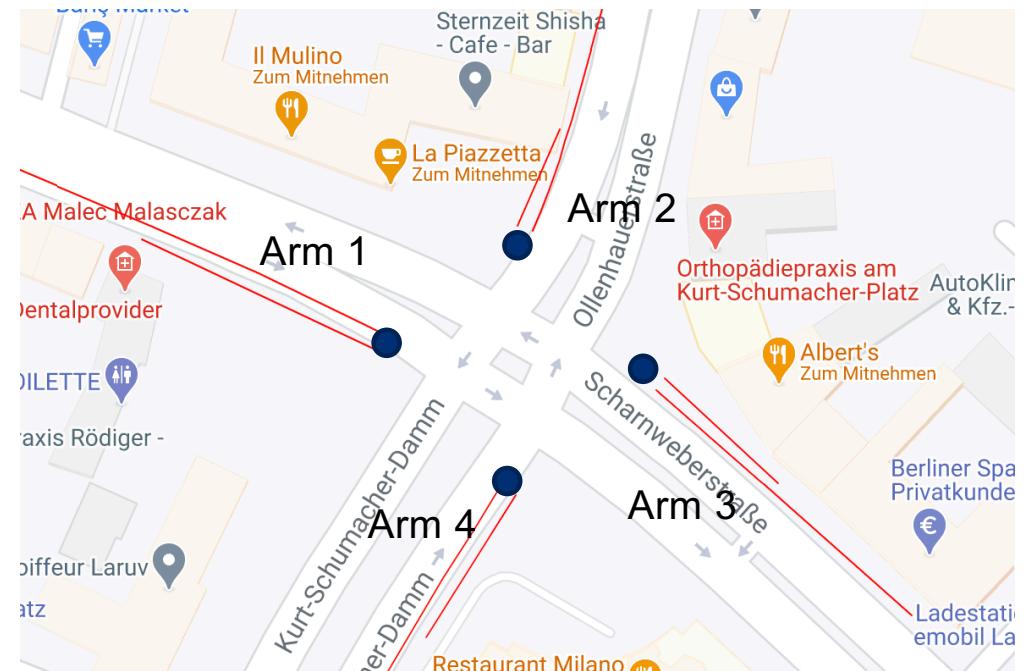
Linear Regression -> Not suitable for real lane, which often in curve not straight line

Algorithm 2 : ❌

Min. Distance to Lane Reference Points -> GPS not accurate at lane level

Algorithm 3 : 😊

Driving mode & Min. Distance to Reference Points



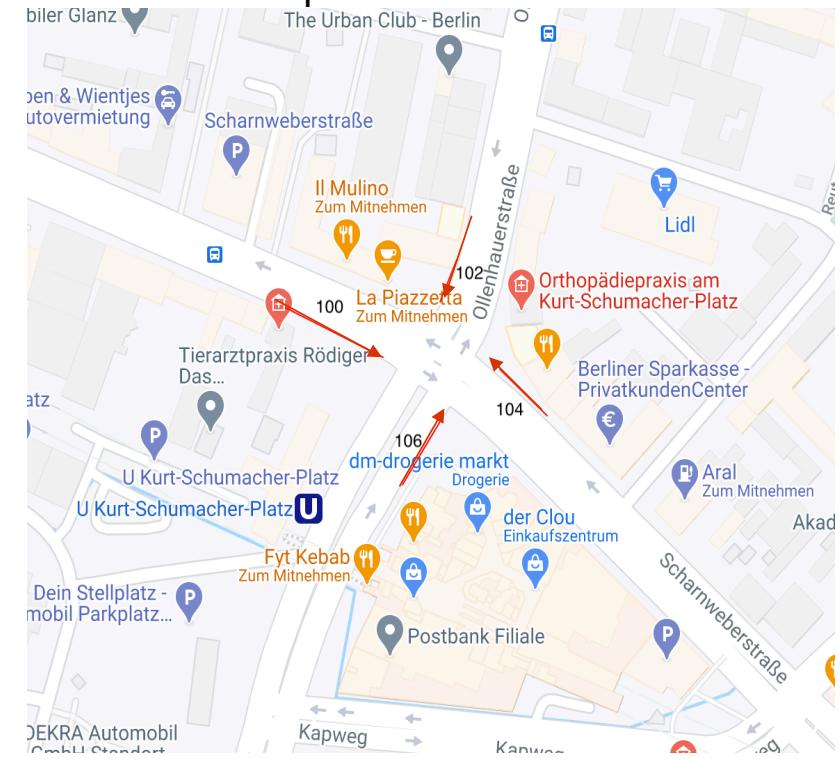
7.2 Determination: Simulation & Test

[disi: aiti:]

- 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



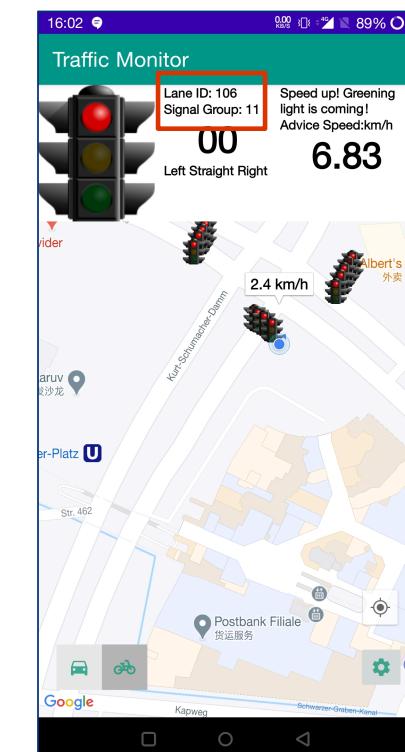
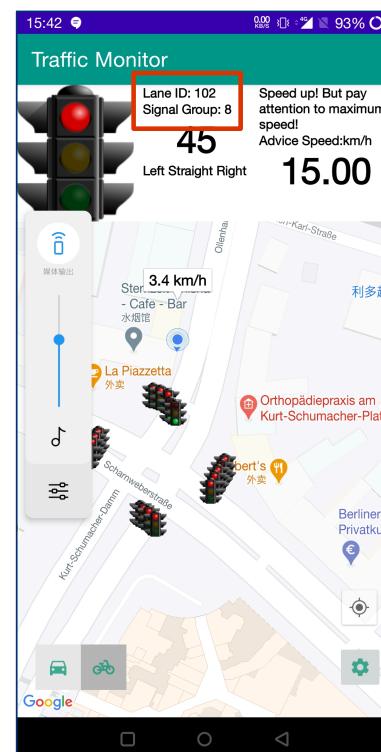
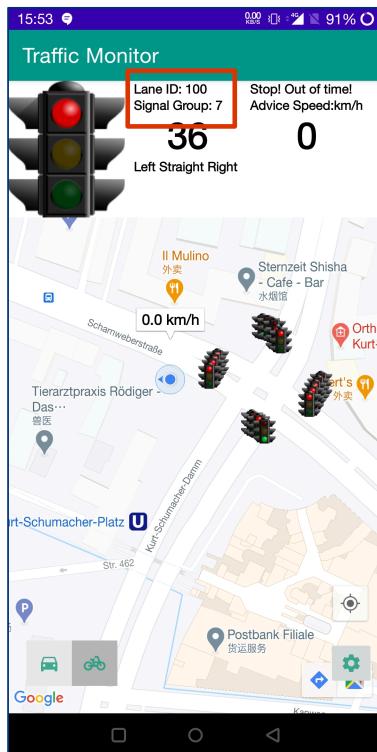
Source : Photo of the arm 1 of intersection 14052 taken by Yiyang and contains bicycle lane 100



7.2 Determination: Simulation & Test

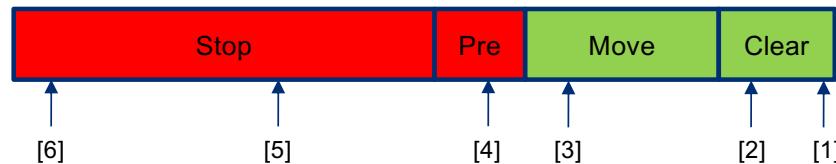
[disi: aiti:]

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



7.3 Driving Strategies: Implementation

[disi: aiti:]

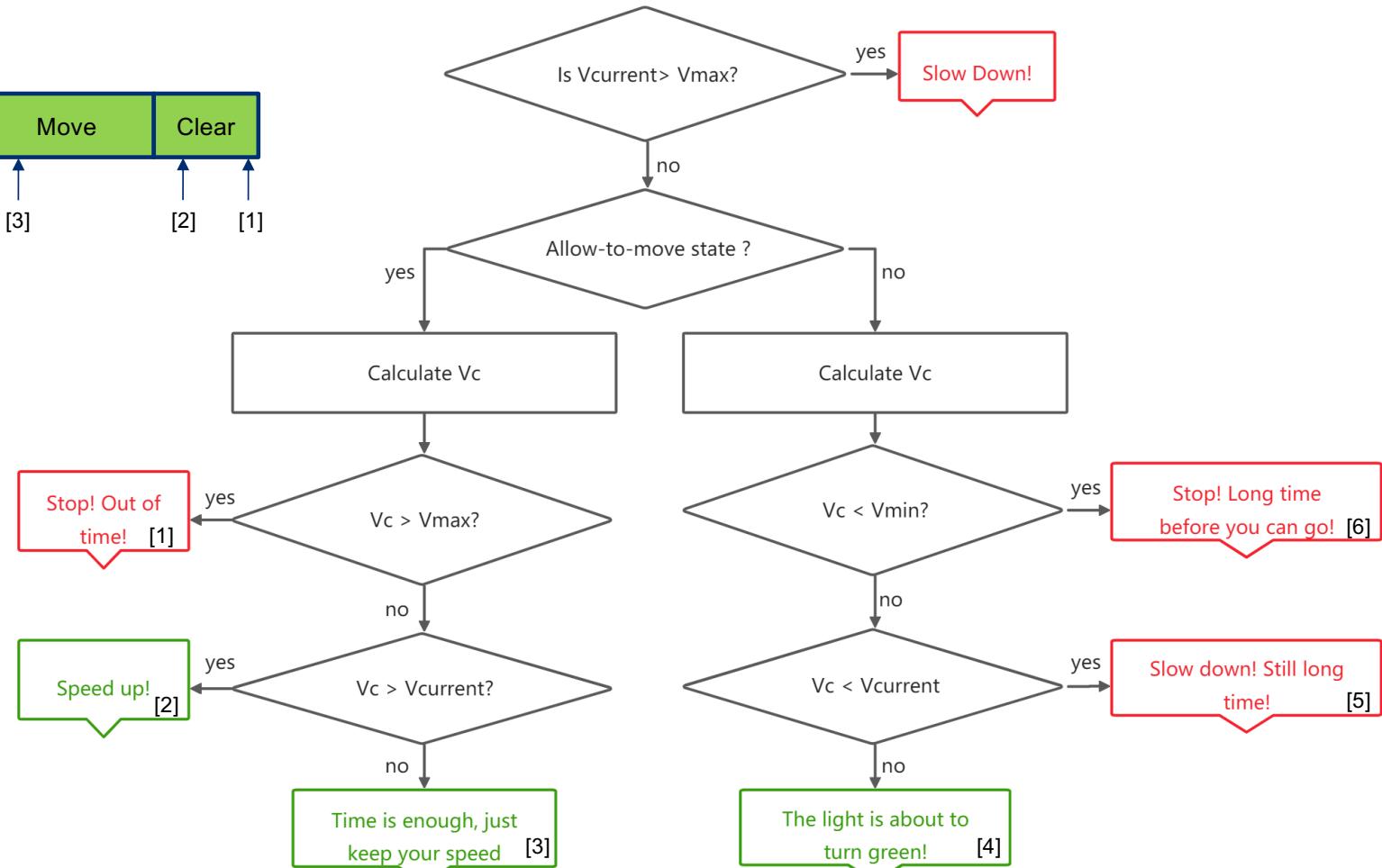


Vcurrent: current speed

Vmax: maximum permitted speed

Vmin: minimum permitted speed

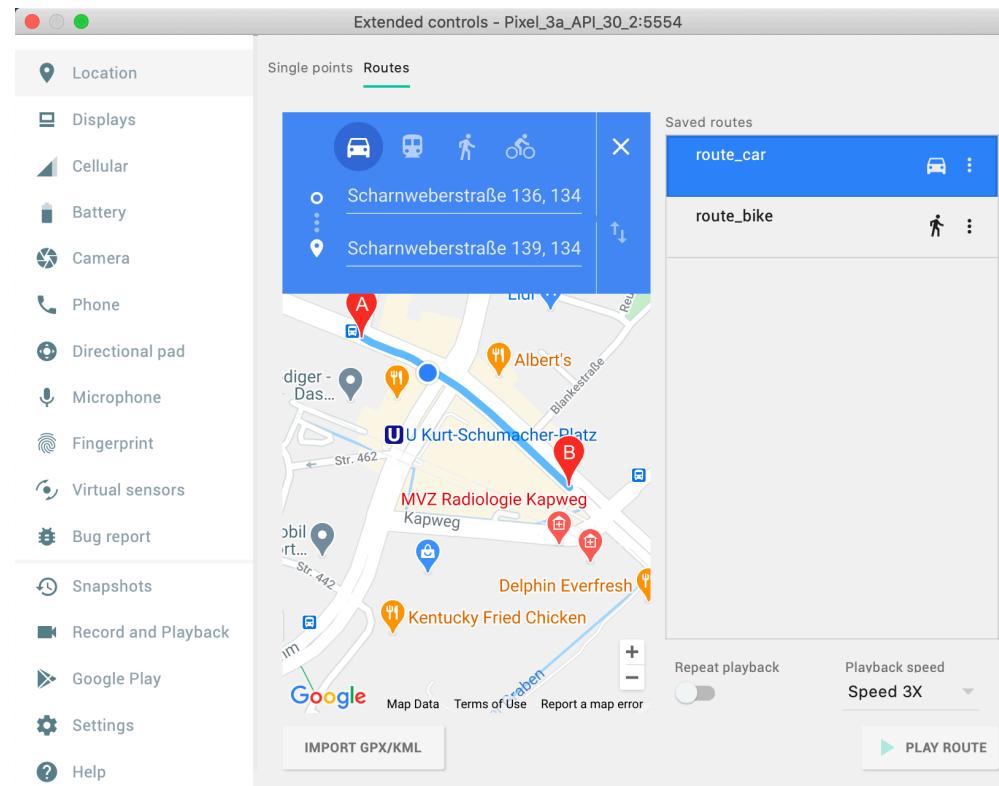
Vc: calculated speed to reach the intersection in the remaining time



7.3 Driving Strategies: Simulation & Test

[disi: aiti:]

Route Simulation with Emulator



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

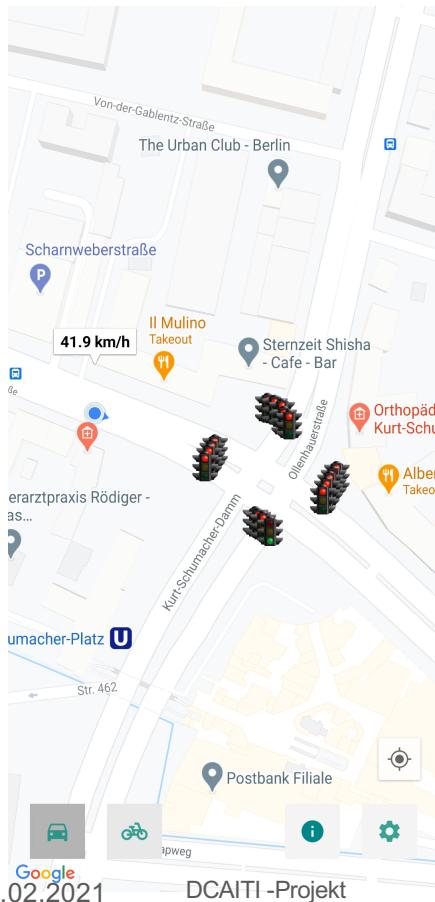
7.3 Driving Strategies: Simulation & Test

[disi: aiti:]

Case No.1: Car;

State: Move & Clear;

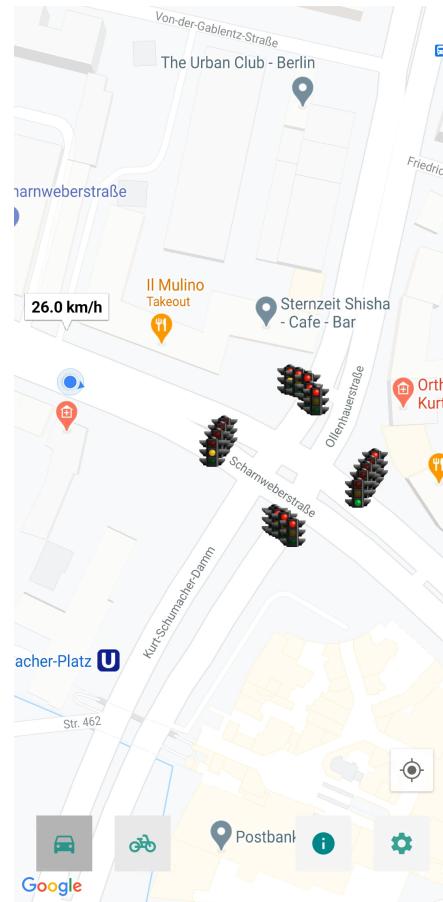
Enough time to pass



Case No.2: Car;

State: Move & Clear;

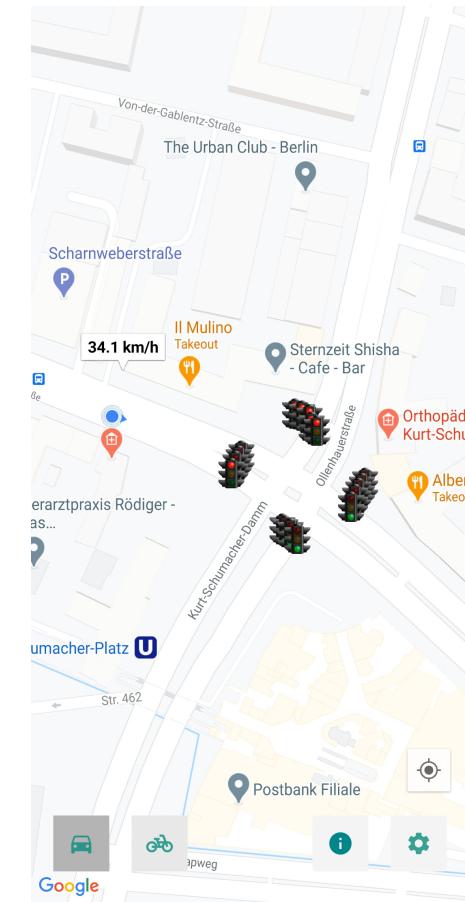
No enough time to pass, need to speed up



Case No.3: Car;

State: Move & Clear;

No time to pass

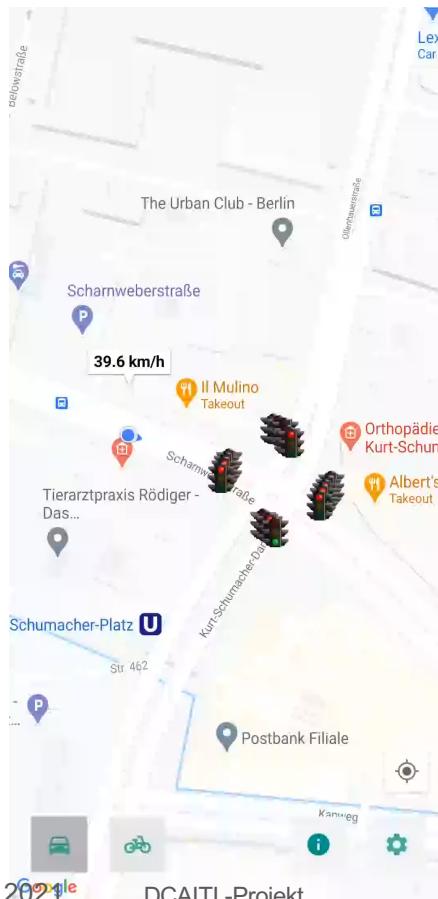


7.3 Driving Strategies: Simulation & Test

Case No.4: Car;

State: Stop & Pre;

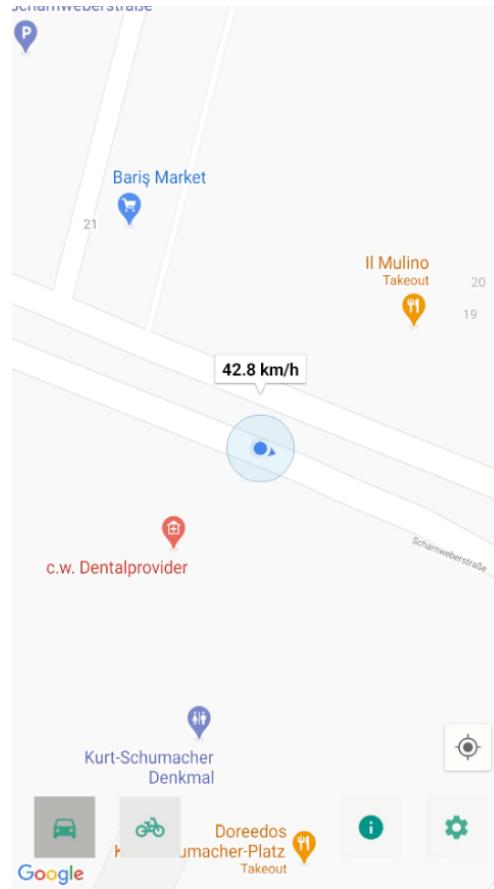
Very long time to wait for green (just stop)



Case No.5: Car;

State: Stop & Pre;

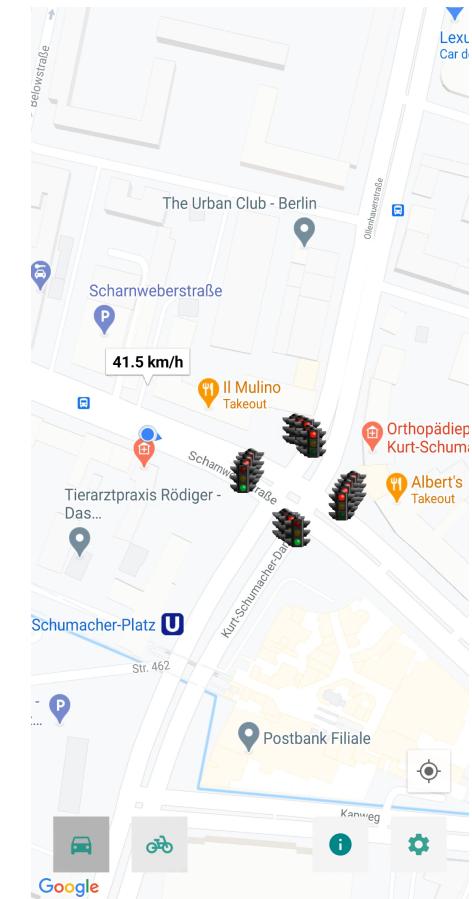
Still a little time to wait for green (slow down)



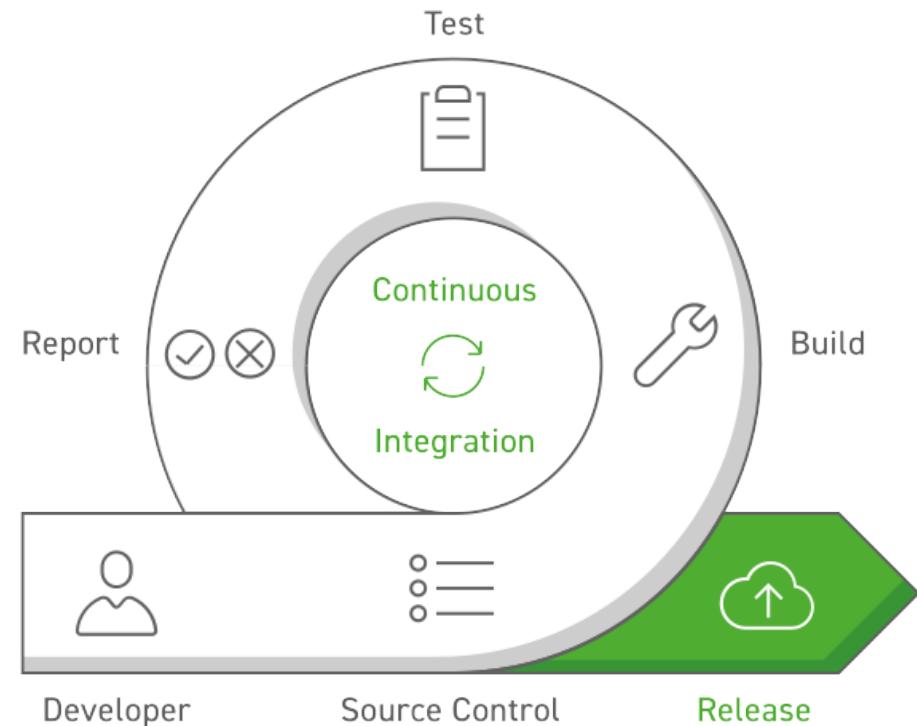
Case No.6: Car;

State: Stop & Pre;

Green light is about to come



- Makes team work easear
- Writing unit tests using Android testing libraries
- This cycle runs automatically after each commit
- Checks outdated packages



Source: <https://www.kubes.ch/labview-jenkins-plugin/>

9. Milestones

[disi: aiti:]

CWTasks	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

- 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/>



Thanks for your attention!

Oday Kabha
Yiyang Song
Yuanheng Mu

oday.kabha@ipk.fraunhofer.de
yiyang.song@campus.tu-berlin.de
johanmu1994@mailbox.tu-berlin.de