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Bike tracking via smartphones

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Introduction

- A mobile application for identifying a biking user and recording data
- Server and database infrastructure for collecting data from a possibly large amount of users
- A web interface for displaying biking patterns

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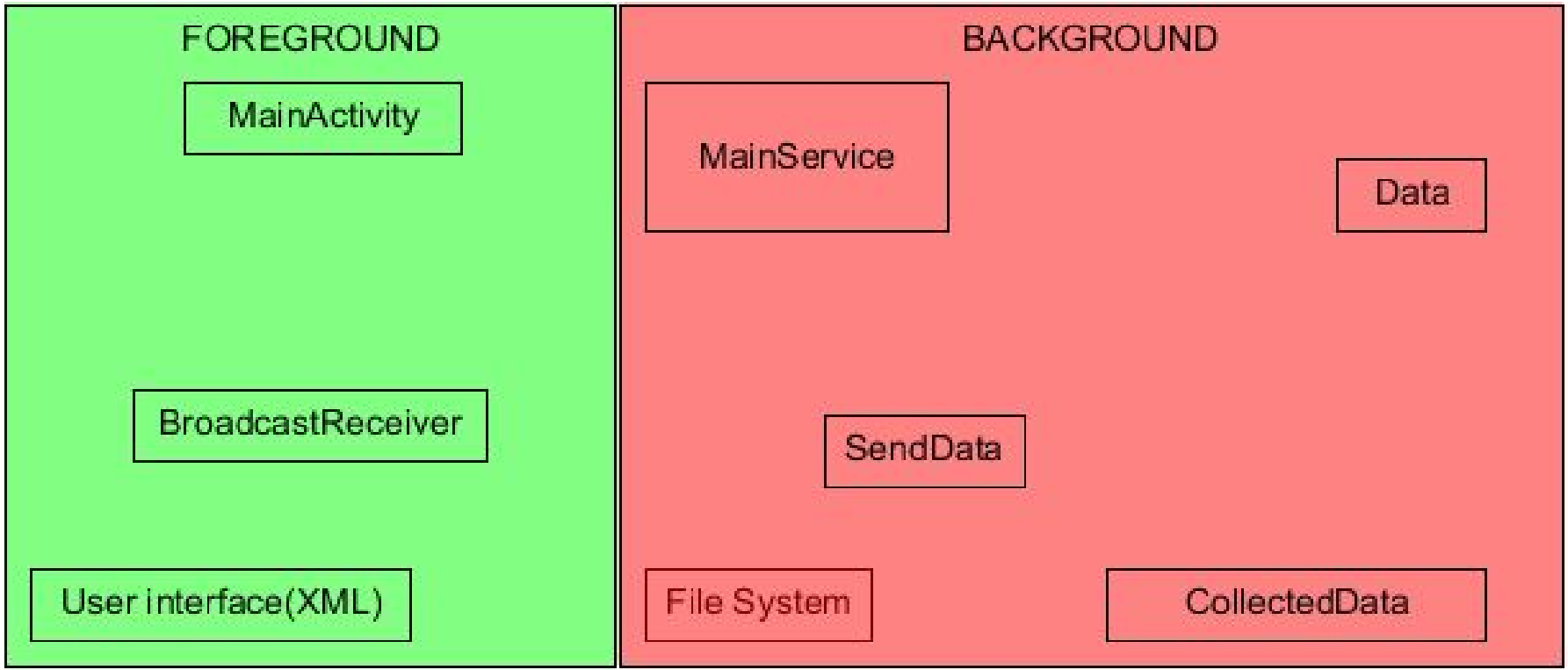
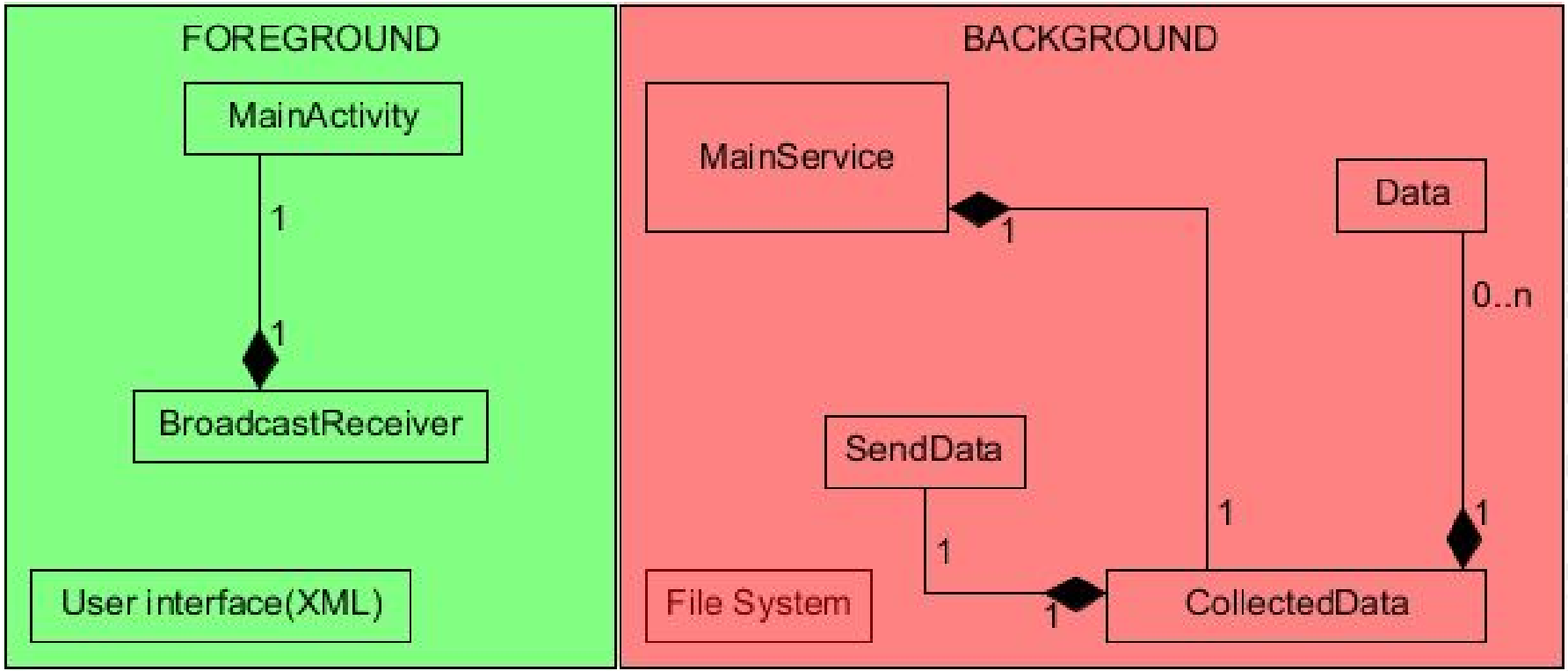
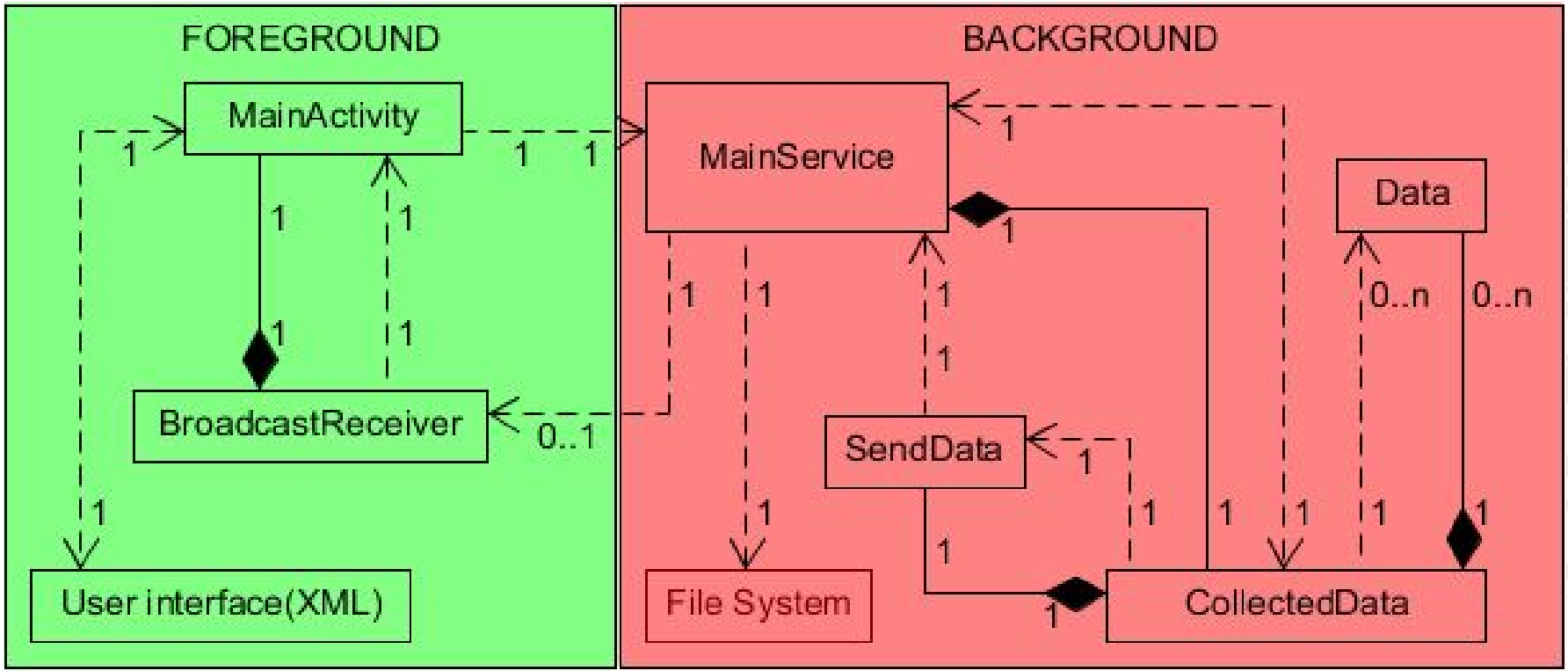
A simple classdiagram for the application



A simple classdiagram for the application



A simple classdiagram for the application



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Data class

- Session ID
- Coordinate point
- Time in ms
- Speed in m/s
- Accuracy in meters

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CollectedData class

- Add
- Get
- Remove
- Import
- Prepare

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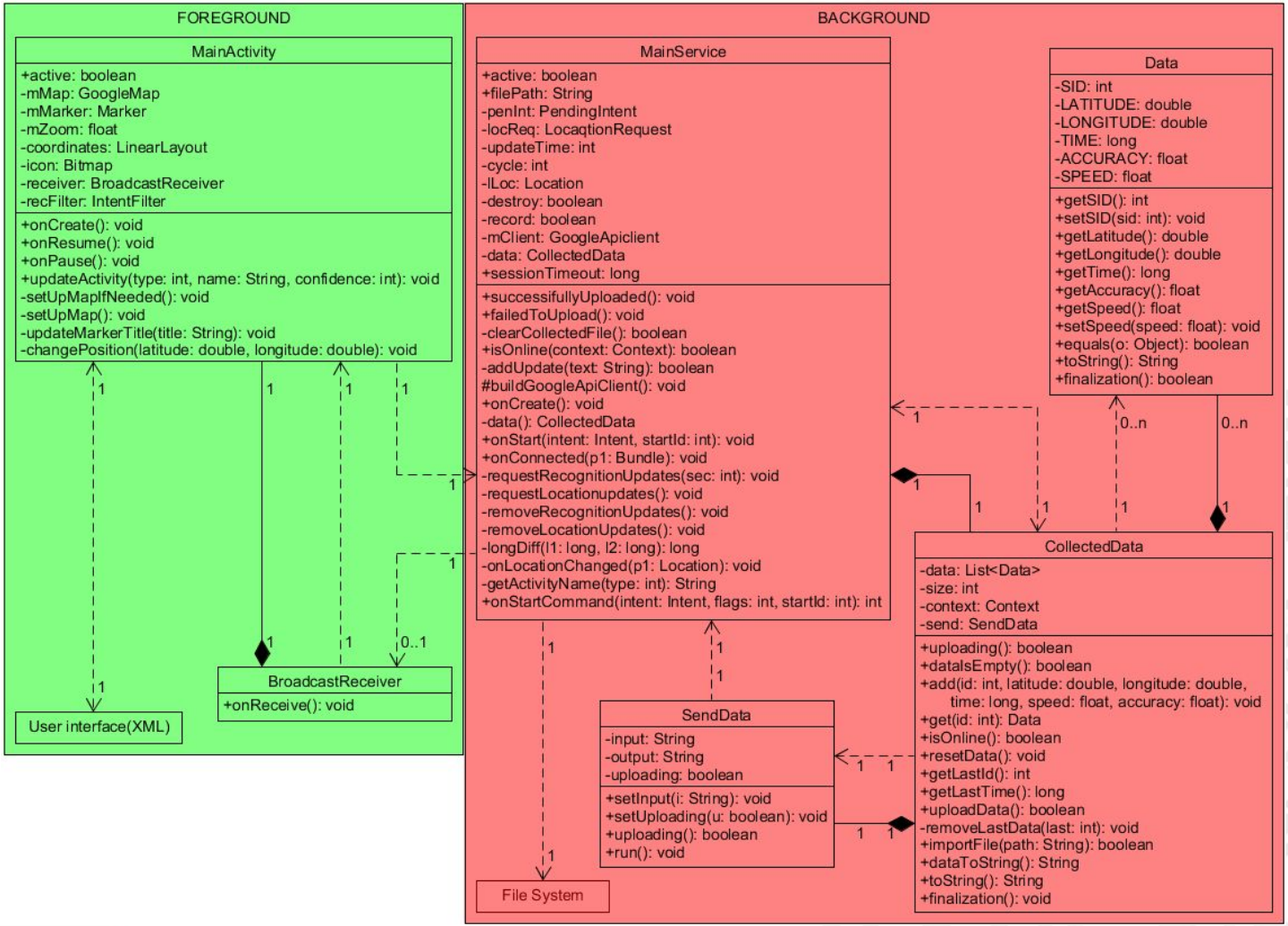
MainService class

- Manage of activities
- Save data
- Cooperate with MainActivity
- Clear data


FOREGROUND
MainActivity
+active: boolean
-mMap: GoogleMap
-mMarker: Marker
-mZoom: float
-coordinates: LinearLayout
-icon: Bitmap
-receiver: BroadcastReceiver
-recFilter: IntentFilter
+onCreate(): void
+onResume(): void
+onPause(): void
+updateActivity(type: int, name: String, confidence: int): void
-setUpMapIfNeeded(): void
-setUpMap(): void
-updateMarkerTitle(title: String): void
-changePosition(latitude: double, longitude: double): void
BroadcastReceiver
+onReceive(): void
User interface(XML)
BACKGROUND
MainService
+active: boolean
+filePath: String
-penInt: PendingIntent
-locReq: LocaqtionRequest
-updateTime: int
-cycle: int
-lLoc: Location
-destroy: boolean
-record: boolean
-mClient: GoogleApiclient
-data: CollectedData
+sessionTimeout: long
+successifullyUploaded(): void
+failedToUpload(): void
-clearCollectedFile(): boolean
+isOnline(context: Context): boolean
-addUpdate(text: String): boolean
#buildGoogleApiClient(): void
+onCreate(): void
-data(): CollectedData
+onStart(intent: Intent, startId: int): void
+onConnected(p1: Bundle): void
-requestRecognitionUpdates(sec: int): void
-requestLocationupdates(): void
-removeRecognitionUpdates(): void
-removeLocationUpdates(): void
-longDiff(l1: long, l2: long): long
-onLocationChanged(p1: Location): void
-getActivityName(type: int): String
+onStartCommand(intent: Intent, flags: int, startId: int): int
Data
-SID: int
-LATITUDE: double
-LONGITUDE: double
-TIME: long
-ACCURACY: float
-SPEED: float
+getSID(): int
+setSID(sid: int): void
+getLatitude(): double
+getLongitude(): double
+getTime(): long
+getAccuracy(): float
+getSpeed(): float
+setSpeed(speed: float): void
+equals(o: Object): boolean
+toString(): String
+finalization(): boolean
CollectedData
-data: List<Data>
-size: int
-context: Context
-send: SendData
+uploading(): boolean
+dataIsEmpty(): boolean
+add(id: int, latitude: double, longitude: double,
time: long, speed: float, accuracy: float): void
+get(id: int): Data
+isOnline(): boolean
+resetData(): void
+getLastId(): int
+getLastTime(): long
+uploadData(): boolean
-removeLastData(last: int): void
+importFile(path: String): boolean
+dataToString(): String
+toString(): String
+finalization(): void
SendData
-input: String
-output: String
-uploading: boolean
+setInput(i: String): void
+setUploading(u: boolean): void
+uploading(): boolean
+run(): void
File System

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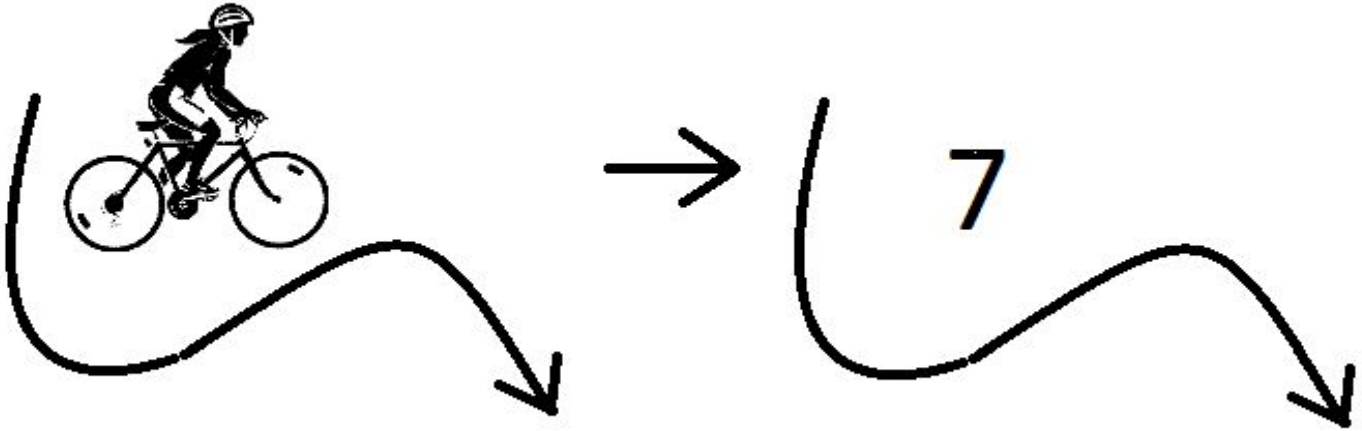
Database

nodeID	sessionID	time	longitude	latitude	speed	acc
1	30	2015-04-02 19:15:00	59.2911795	17.9327775	0	0
2	30	2015-04-02 19:15:06	17.9327751	59.2911714	0.15560926	0
3	30	2015-04-02 19:15:13	17.9327764	59.2911692	0.03642012	0
4	30	2015-04-02 19:15:16	17.9327764	59.2911692	0	0
5	30	2015-04-02 19:15:20	17.9327764	59.2911692	0	0
6	30	2015-04-02 19:15:25	17.9327763	59.2911685	0.018607348	0
7	30	2015-04-02 19:15:25	17.9327763	59.2911685	0	0
8	30	2015-04-02 19:15:26	17.9327743	59.2911663	0.34300482	0
9	30	2015-04-02 19:15:28	17.932772	59.2911653	0.10154643	0
10	30	2015-04-02 19:15:30	17.9327715	59.2911659	0.039553877	0
11	30	2015-04-02 19:15:32	17.9327704	59.2911654	0.045550734	0
12	30	2015-04-02 19:15:33	17.9327713	59.2911656	0.036359243	0
13	30	2015-04-02 19:15:35	17.9327713	59.2911656	0	0
14	30	2015-04-02 19:15:36	17.9331182	59.2913051	25.425995	0
15	30	2015-04-02 19:15:36	17.9331182	59.2913051	0	0
16	30	2015-04-02 19:15:42	17.9331182	59.2913051	0	0
17	30	2015-04-02 19:15:45	17.9331182	59.2913051	0	0
18	30	2015-04-02 19:15:49	17.9331182	59.2913051	0	0
19	30	2015-04-02 19:15:54	17.9331182	59.2913051	0	0
20	30	2015-04-02 19:16:00	17.9329572	59.2915921	5.5464964	0
21	30	2015-04-02 19:16:03	17.9329572	59.2915921	0	0
22	30	2015-04-02 19:16:04	17.9329572	59.2915921	0	0
23	30	2015-04-02 19:16:07	17.9329572	59.2915921	0	0
24	30	2015-04-02 19:16:11	17.9329572	59.2915921	0	0

Database



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Server

- A scalable, RESTFUL web service
- Simply handles HTTP POST requests containing JSON data and makes insertions into our database
- Data processing
- Anonymization - no information is kept about individual users

Display the data

- Display on the mobile app?

  No,the screen is quite small so it is hard to analyze

- Develop a software for different platforms?

  That is very time-consuming and money-consuming

- Display on a website

  Available for all different systems

Related work

Generating bicyclist counts using volunteered and professional geographic information through a mobile application by Patricia Jula
(http://spatial.usc.edu/wp-content/uploads/2014/03/Jula_Patricia.pdf)

- Tracking bicyclists with the goal of preventing motor vehicle - bicycle collisions
- Provides an application for designated evaluators to report bicyclist counts from some area (as opposed to using pen and paper, simplifying their task)

Future work/Improvements

The mobile application

- A bit more simplified
- Individual application
- Implement the website on the phone

The website

- Flexible time
- Save maps
- Additional data

The database

- Expand
- Increase anonymity
- Individual service reflected in the database

The server

- Security
- Process the data

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Questions