BICYCLE DATA AND APPLICATION INVENTORY

CONTENTS

1 INTRODUCTION

1.1 Purpose of the Inventory

This document describes different data sources, tools and applications that exist today and that could be valuable when creating new services and applications.

The target group is primarily system developers, but could also prove to be valuable to innovators, business developers or other interested parties.

1.2 Updates

This inventory will be maintained during 2014, with possible extensions. You will always be able to retrieve the latest version from Öresundskommiteen's Öresund Smart City Hub project or Viendi IT-konsult.

The inventory is not exhaustive by any means, and if you wish to contribute to this list, please contact either Karolina Huss (project leader, kah@oeresund.org) or David Pettersson (maintainer, david.pettersson@viendi.se).

1.3 Revision History

Date	Comment	Author
2014-05-26 @ 12:30	Initial version and scope completed. Sent for review.	David Pettersson
2014-05-26 @ 22:30	Updated version based on feedback from Karolina Huss	David Pettersson

2 DATA SOURCES

2.1 Open vs Closed

The discussion on open vs closed is not entirely easy to grasp. Wikipedia has a good definition of open data – it is "[…] free for anyone to use and republish, without restrictions from copyright, patents or other mechanisms of control".

When using an online service or data that you can access online, always be weary of the terms and conditions regarding its use. Some data is truly open, other data is merely available for limited use (perhaps the publisher requests that you use a pro or premium account for unlimited use).

2.2 Maps and Routing

The following maps have been enriched with bicycle-related data.

2.2.1 OpenCycleMap (based on OpenStreetMap)

OpenCycleMap is the bicycle related information from OpenStreetMap. It contains information on bike paths, whether it is mixed pedestrian and bicycle, speed limits and so on.

Using this data in your own application could prove to be somewhat difficult. The most flexible way of accessing it is by downloading the raw dataset (either the whole planet or just your country or region). Details on how to do this is on the OpenStreetMap wiki.

Parsing it should be fairly simple, there are libraries for most languages. You can always download the data in XML format.

OpenCycleMap: http://www.opencyclemap.org/

OpenStreetMap downloads: http://wiki.openstreetmap.org/wiki/Planet.osm

2.2.2 Google Maps

Google Maps provides a bicycle map view along with an engine that provides bicycle directions. The map itself is most likely based on national databases, and is mostly accurate. It does however lack municipal bike paths in some cases.

Links:

- Google Maps: http://maps.google.com (normal maps application)
- Google Maps API: http://developer.mapquest.com/web/products/open/directions-service

2.2.3 Mapquest

Mapquest provides maps and has recently also released support for bicycle directions. The map is based on OpenStreetMap, but the routing algorithm is their own.

Links:

- Mapquest Directions: http://www.mapquest.com/directions
- Mapquest Open Directions API: http://developer.mapquest.com/web/products/open/directions-service

2.3 Municipal Data

In many countries, the municipality (or city) is responsible for the bicycle paths, parking and so on. The following inventory is from the City of Lund (http://www.lund.se) with some other additions. You should be able to find similar data in our own municipality.

Note that this data is usually not accessible online, and could require talking to your local representatives to get access to it.

2.3.1 Bicycle Maps

A bicycle map has the following key features:

- Bicycle paths, and the networks they belong to.
- Bicycle parking
- Bicycle pumps
- Public toilets

Paths and networks can usually be accessed as geographic data (paths with metadata). Sometimes the bicycle path data is only available as printed maps, and so you might need to create a mash-up to get the necessary level of detail in your final product.

Online bicycle maps:

- City of Malmö: http://www.malmo.se/karta (located under Stadsplanering & trafik – Trafik & hållbart resande – Cykel)
- I Bike Copenhagen: http://www.ibikecph.dk/ (open source bicycle planner, source code on Github)
- ADFC (German cycling association): http://www.adfc-tourenportal.de (in German, and is a service you need to register for)

Online APIs:

- City of Copenhagen (Köpenhamn): http://data.kk.dk/dataset?tags=cykel&_tags_limit=0 (services for getting green bicycle routes and bicycle stands)
- City of Gothenburg (Göteborg): http://data.goteborg.se/ (service called BikeService indicates locations of pumps and repair shops).

Printed bicycle maps:

- City of Lund: http://www.lund.se/Medborgare/Kommun--politik/Kartor/Cykelkartor/
- Copenhagen: http://www.kk.dk/da/Om-kommunen/Indsatsomraader-og-politikker/Publikationer.aspx?mode=detalje&id=987

In many cases, OpenCycleMap is a good base and could be enriched with data from the online and printed maps.

2.3.2 Traffic Measurement

Most cities and municipalities engage in measuring traffic flows. These measurements are usually very coarse, and performed in selected locations only.

Measurements are made either manual or automatic. Manual measurements means a person counting the number of bicyclists passing a certain spot during a given time period. Measurements are made a few times per year. Automatic measurements is either a permanent measuring unit or a temporary one.

Directional data is not always present, so direction is either implied by location (e.g. if measured on one-way bicycle path), or estimated.

VTI (the Swedish government's road and transport research institute) has an excellent write-up of the different methods used today to capture traffic measurement data for bicycles:

http://www.vti.se/sv/publikationer/tema-cykel--utrustning-for-matning-av-cykeltrafik-en-litteraturstudie/ (in Swedish).

Copenhagen has published historic data for several hundred locations around the city in their open data portal:

http://data.kk.dk/dataset/trafiktal

Aarhus also has an automatic real time service published online in their open data portal:

http://www.odaa.dk/dataset/realtids-trafikdata

Measurement data can normally be obtained from your city or municipality. It will probably not be open, but should at least be available in spreadsheet format.

2.3.3 Bicycle Sharing/Renting Systems

Cities that have deployed bicycle sharing/renting systems can also select to publish this data online. Depending on the bicycle sharing system, the amount of information may vary. A system such as Bixi (employed e.g. in London) has a public API which is accessible to developers.

Gothenburg (Göteborg) has selected the Cyclocity system, and has published data about the different rental bike stations. Data includes how many bikes are available, free slots, location and status of the station and more:

http://data.goteborg.se/ (service called Styr & Ställ)

Copenhagen (Köpenhamn) has also an extensive bicycle rental network, based on GoBike. No data is publicly available, but can probably be acquired if needed.

Unfortunately, statistics on typical travel patterns is not available publicly, but should be possible to obtain from the owner of the system.

2.4 Sports Trackers

Sports trackers contain a large set of data collected by their members. There are several aspects to consider here though:

- Paths selected for workout are rarely the same as for e.g. commuting. Road bike workouts are usually on small roads in outside cities. Mountain bike workouts are usually on trails in forests.
- Speed differs a lot. Commuters travel around 10-15 km/h. Most road bike workouts average 25 km/h or higher.
- Commuters don't necessarily upload their non-workouts to the sports tracking sites.
- Only a few services allow extraction of data via a public API, however, individuals can often download their data for use in other contexts.

Popular sports trackers include:

- Endomondo: http://www.endomondo.com
- Garmin Connect: http://connect.garmin.com
- Runtastic: http://www.runtastic.com
- Runkeeper: http://www.runkeeper.com
- Sports Tracker: http://www.sports-tracker.com/
- Strava: http://www.strava.com

Anonymous data should be possible to acquire from all these services, but

Visualizations can be interesting to study, but also have their drawbacks:

- Where People Run: http://flowingdata.com/2014/02/05/where-people-run/
- Beautiful Maps and the Lies They Tell: http://untappedcities.com/2014/02/20/beautiful-maps-and-the-lies-they-tell-an-op-ed-from-runkeeper/

2.5 Weather

The current weather has a significant effect on when and how people bicycle. Wind is probably the most important weather factor to consider. Commuters usually ride upright, which makes them particularly sensitive.

Forecasts as well as historic wind and rain data is available from different Nordic weather institutes:

- SMHI: http://www.smhi.se/klimatdata/Oppna-data
- YR: http://www.yr.no/verdata/1.3321307
- FMI: http://sv.ilmatieteenlaitos.fi/oppen-data

2.6 Height Models

Bicyclists are in addition to weather also sensitive to ascents. A hilly road is less fun to ride than a flat one. Height models can also be used to assess if a bicycle path is protected from wind, or if crossing are obstructed by buildings, tree, hedges and similar.

Height data is available via the Swedish surveying body (Lantmäteriet), and is licensed to municipalities and cities. Some municipalities and cities also have detailed height data with down to 10 cm resolution. This allows for very accurate height calculations.

- Nationell höjdmodell: http://www.lantmateriet.se/Kartor-och-geografisk-information/Hojddata/Fakta-om-laserskanning/

You can also obtain some height data using a GPS or bicycle computer (see below).

2.7 Road Quality

Bike paths today can be of varying quality. Depending on the type of bike, the speed that you are traveling at, and the current season all have an impact on the riding experience. A touring cyclist will most likely want to avoid old asphalt roads with pot holes and loose gravel as this will make the ride most uncomfortable and bumpy (putting strain on both body and bike).

There is an international standard for defining road quality (or rather roughness):

- Wikipedia: http://en.wikipedia.org/wiki/International_Roughness_Index
- Roadroid (Swedish startup): http://www.roadroid.se/

Municipalities and governments hold this data, and it should be possible to acquire. For bike paths, it might be more difficult to get hold of. Roadroid (and probably other similar alternatives) offer solutions to this problem.

3 SOFT STUFF

This section contains information on software that could be useful to work with bicycling data of different sorts.

3.1 Online Maps

When presenting maps on the web, you need to consider two things:

1) How will I render it?

2) How will I serve it?

Some services solve both problems. Google Maps is such an example, where the service provides you with software that you can use on your homepage, and a backend serving tile data. It also allows you to enrich the map with your own data.

3.1.1 Rendering Geographic Data

Rendering geographic data is pretty straightforward – you acquire a geographic data source (see below), and then simply render it using a front-end library. There are a few simple options to consider:

- Google Maps API: https://developers.google.com/maps/
- Bing Maps API: http://www.microsoft.com/maps/choose-your-bing-maps-API.aspx
- ArcGIS Online: http://www.arcgis.com
- Leaflet: http://leafletjs.com/ (only rendering, open source)

Note that some online services put constraints how you may mix and match data. E.g., you might not be allowed to overlay directions from Bing on a Google map. Read the terms and conditions.

3.1.2 Serving Geographic Data

If you want to serve your own geographic data, you will need to use a software stack allowing you to provide geographic data services (WMS services). An excellent open source alternative is GeoServer, backed by e.g. PostGIS:

- GeoServer: http://geoserver.org/

You should also investigate serving (static) files such as:

- GeoRSS: http://www.georss.org
- KML: https://developers.google.com/kml/

4 HARD STUFF

This section contains data that could provide to be useful if you intend to acquire your own data (or have it crowd-sourced).

4.1 Bike Sensors

There are two easy ways to capture sensor data from a bicycle:

1) Using a GPS-based bicycle computer (e.g. the Garmin Edge 500 or similar)
2) Using a mobile phone with a GPS.

Examples of sensory data that can be recorded:

- Time and date
- Location (based on GPS, down to a few meters accuracy)
- Velocity (based on GPS, some bicycle computers also measure wheel revolutions)
- Elevation (based on GPS for phones and bicycle computers – some bicycle computers also use barometric pressure which is very accurate)
- Acceleration (based on an accelerometer, can also be used to measure vibrations)
- Temperature (usually only bicycle computers)

- Heart rate (usually only bicycle computers, if the rider is wearing a heart rate monitor)
- Power (usually only bicycle computers, if the bike has a watt meter mounted (expensive))
- Cadence (number of pedal strokes per minute, requires cadence sensor (cheap))

Sensor data is usually exported as GPX files from bicycle computers (depends on the manufacturer). For mobile phones, you either need to write a custom application or find one that exports the data you need.

Keep in mind that accuracy and resolution varies a lot between devices.

4.2 Road Sensors

There are a few different kinds of ways to track bicyclist using road sensors (in the meaning sensors that are fixed to the road, buildings or similar and not the bicycle itself).

To count cyclists, see the VTI documentation above. It is thorough in its description.

To detect presence, one can use IR sensors (similar to what is used in automatic light switches). This is used in e.g. traffic light situations to detect movement. In the city of Lund, there are a few traffic lights that prioritize cyclists when they approach the cross and turn the lights.

To detect individual bicycles, you can use passive radio-field badges. These are used for e.g. bicycle competitions and can detect a cyclist passing by on a few meters distance. It requires a transponder which is similar to a contactless access card (with a longer range). The transponders are cheap, but the stationary equipment can be pretty expensive.