Cycling information systems - Bike sharing

BME - Faculty of Transportation Engineering and Vehicle Engineering (KJK), Department of Transport Technology and Economics (KUKG)

Passenger Transportation

Dávid Földes

Cycling

- sustainable mobility ⇨ soft transportation modes

- modal split of cycling increases in cities

- promoting cycling

- goal: enhance modal split of cycling

  in Budapest: 2014: 2% ⇨ 2030: 10%

- cycling is part of urban mobility

  element of multiple mobility chain (B+R, bike sharing, taking bike on PT)

- part of multimodal transportation – integrated management

information systems and services for bikers do not exist or are undeveloped

before riding (e.g. route planner)

during riding (e.g. navigation system, information displays on roadside)

after riding (e.g. workout application)

Analysis of route planner applications

goal: reveal the positive and negative features, determine functions of ideal application:

- applications to cycling (merretekerjek.hu, geologika.hu, KENYI);
- applications where cycle route planning is only supplementary service; primary for PT users (BKK Futár, utvonalterv.hu, OSM, TfL, Google Maps);
- application for multimodal route planning (AnachB).

Aspects:

- *General properties:* operational area, optional language, availability (webpage/mobile app.);

- *Settings*:
  - General settings: input origin and destination [tapping on map, address, POI, coordinates]; select riding time [departure time, arrival time, departure now];
  - Personalization: set preferences (e.g. cycle friendly, fast, safety), avoid heavy road traffic, avoid uphill, consider cycle friendly infrastructure, riding speed setting, multimodal travel [taking bike on vehicle, leaving bike at a station], save user profile

- *Operational processes:* consideration of infrastructure where cycling is permitted, consideration of cycle friendly infrastructure, multimodal planning with cycling, route planning with bike sharing

- *Display route options:* visually on map, amount of text description, amount/detail of supplementary information about route (e.g. used road type, elevation), amount/detail of supplementary information about services (e.g. service point)

BKK FUTÁR (furar.bkk.hu)

- primary goal: route planner application for public transportation based on real-time data (GPS data of vehicles)

- + BuBi (bike sharing) and cycle route planning

- webpage/mobile application

- BuBi: data about station, occupancy, map search

- considering cycling road network

- disadvantage: allowing riding a bike on pavement

- pioneeres:

  – considering zebra crossing (wheeling)

  – multimodal route planning: bike sharing + PT

  – cycle friendly/fast route personalization options


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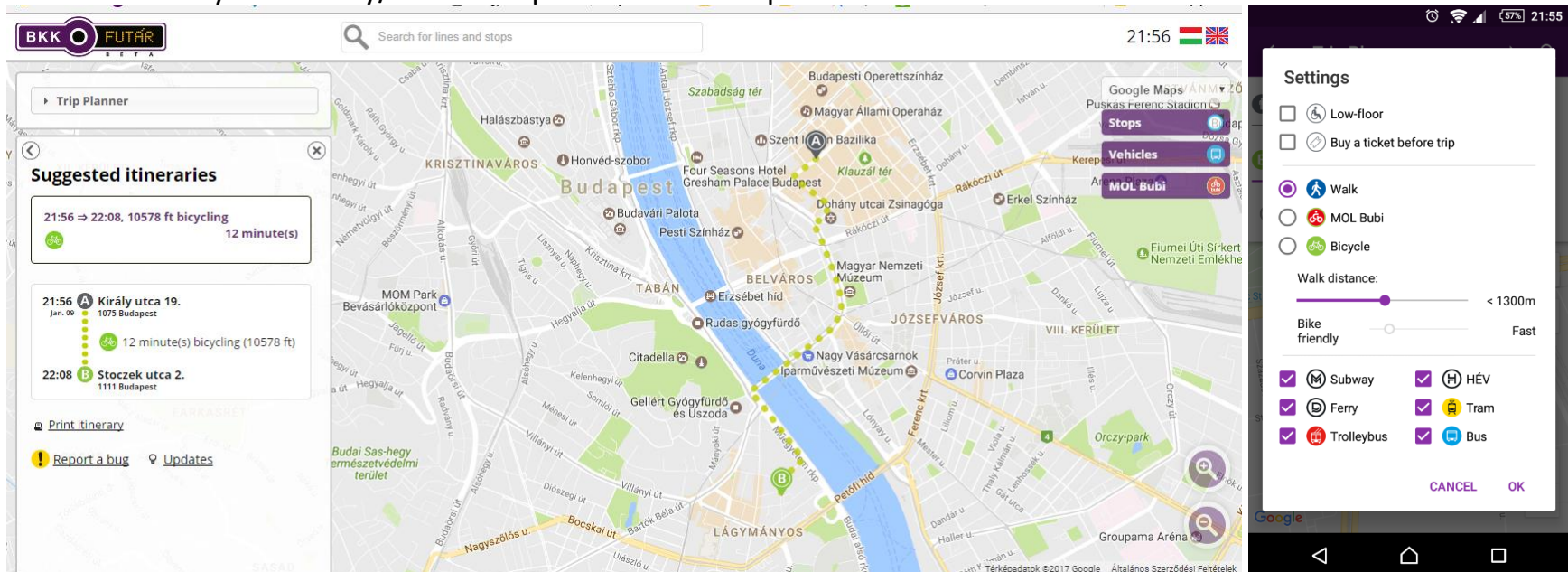
merretekerjek.hu

- Hungarian development

- entire Hungary

- detailed route description

- considering cycling infrastructure in a detailed way

- disadvantages:

  – only a few personalization settings

  – setting origin/destination is difficult

  – not providing riding time estimation

  – only webpage, only cycling, only in Hungarian

pioneers:

  – interactive route description

  – displaying infrastructure elements
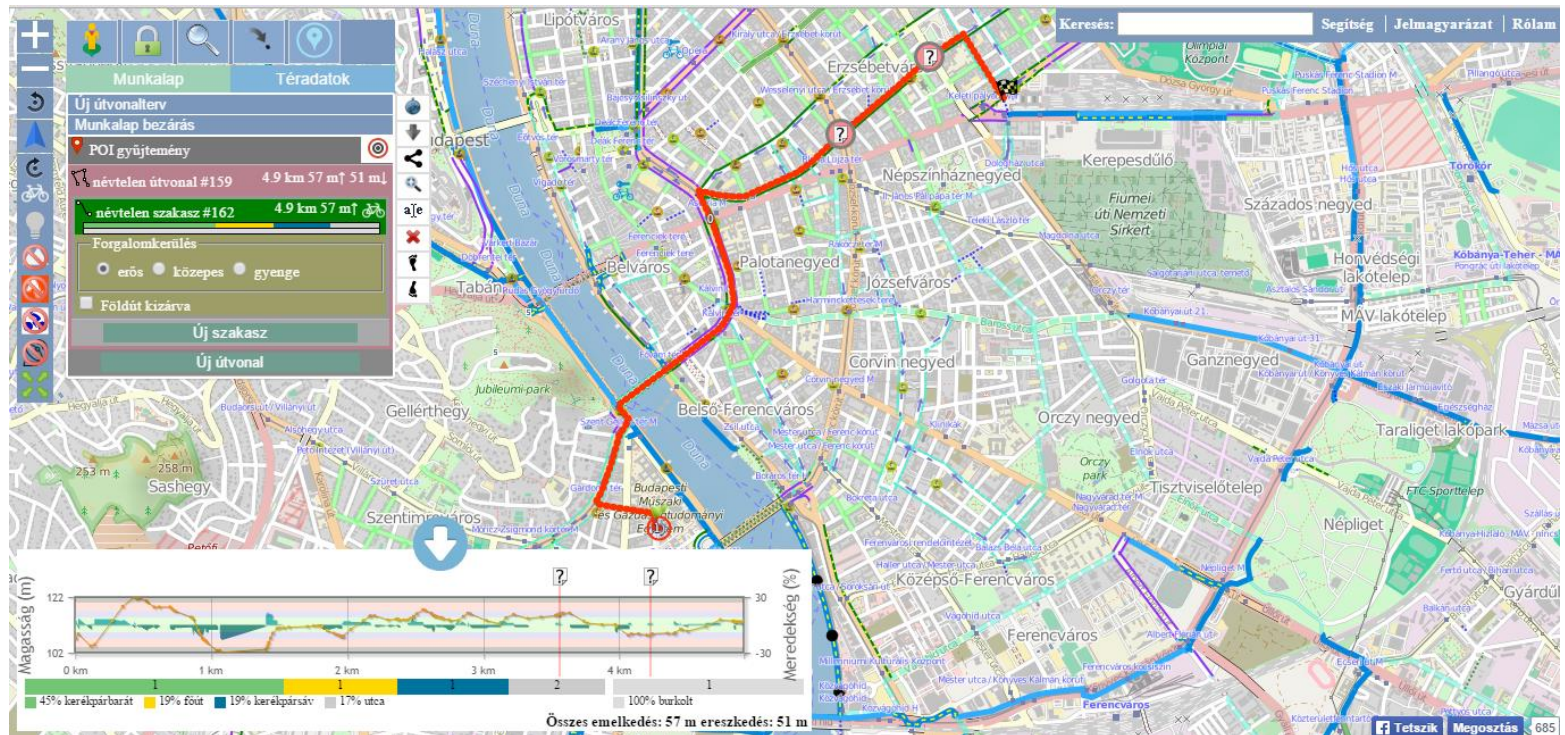
geologika.hu

- Hungarian development

- Budapest and agglomeration

- disadvantages:

  – considering cycling infrastructure imperfectly

  – inaccurate planning (origin, destination)

  – no personalization settings

  – only webpage, only in Hungarian

pioneeres:

  – displaying infrastructure elements

  – providing road type

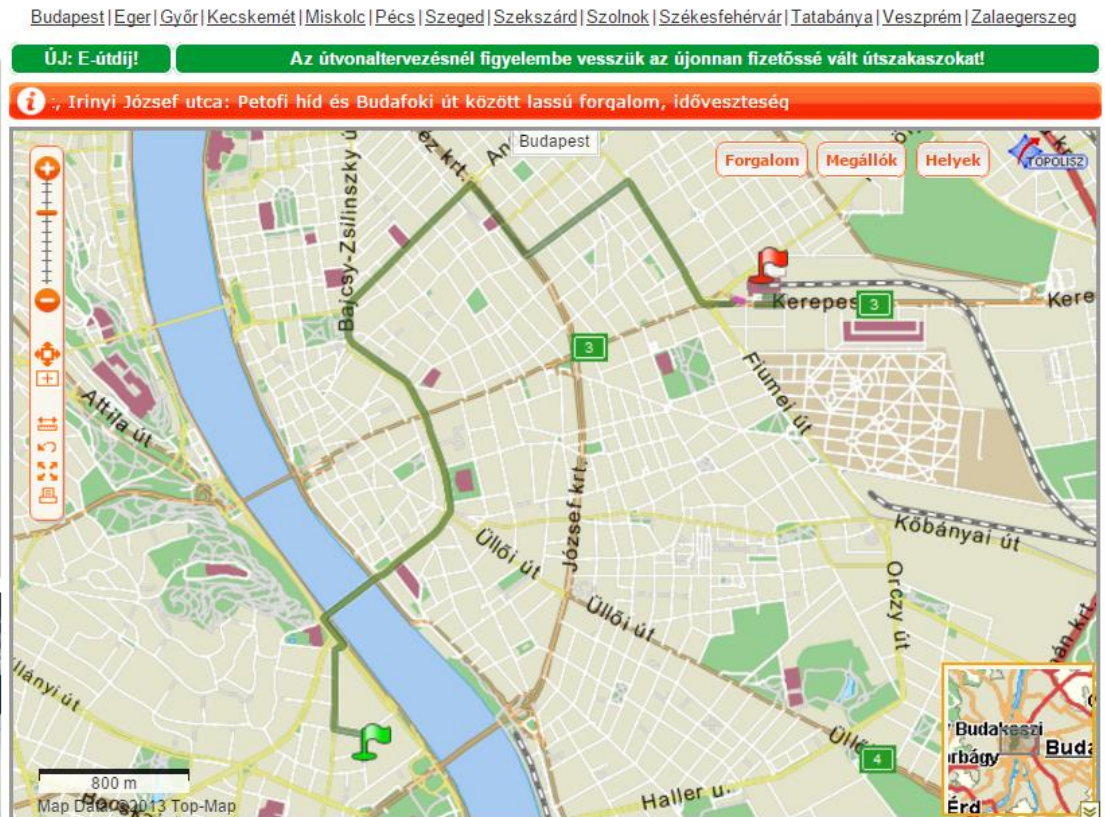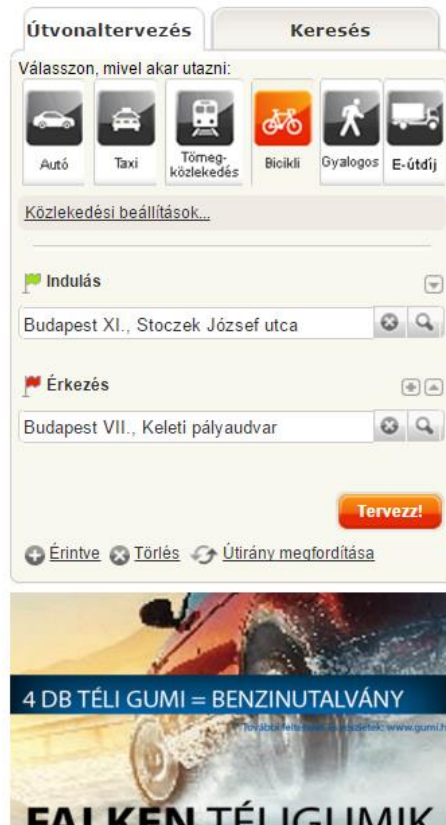**KENYI (Kerékpáros Nyilvántartó Rendszer – Cycling Registry System)**

- primary goal: registry data of infrastructure – state development
- supplementary function: cycle route planning
- disadvantages:
  - considering only cycle infrastructure
  - no personalization setting, only in Hungarian
- pioneers:
  - providing information about condition network element
  - detailed POI
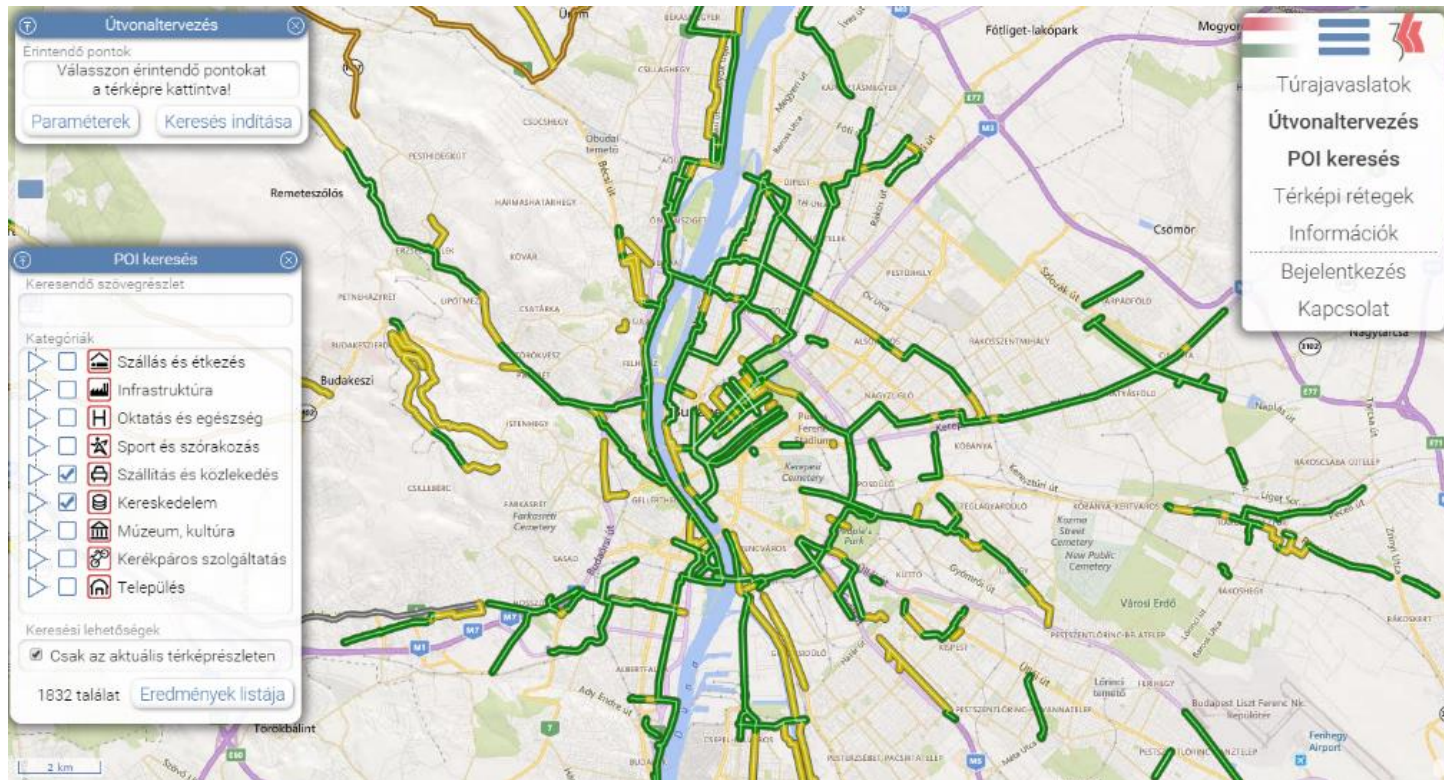
utvonalterv.hu

- national
- route planning with several modes
- disadvantages:
  - no multimodality
  - inaccurate cycling infrastructure
  - inaccurate route offer
  - no personalization setting, only in Hungarian

OSM

- open source, nyílt forráskódú, developed by private personons

- worldwide

- cycling route planning module (opencyclemap),

- disadvantages: pioneer:
  – low detailed   – displaying infrastructure
  – no personalization setting

AnachB

- Austria, national

- complete multimodal planning (combining cycling, bike sharing, public transportation, car usage, car -sharing)

- webpage, mobile application

- disadvantage: not detailed bike sharing systems

- pioneers:

  – detailed cycling infrastructure

  – personalization settings: avoiding motorized traffic, using cycle friendly infrastructure, taking bike on PT vehicle, B+R

  – information about supplementary services
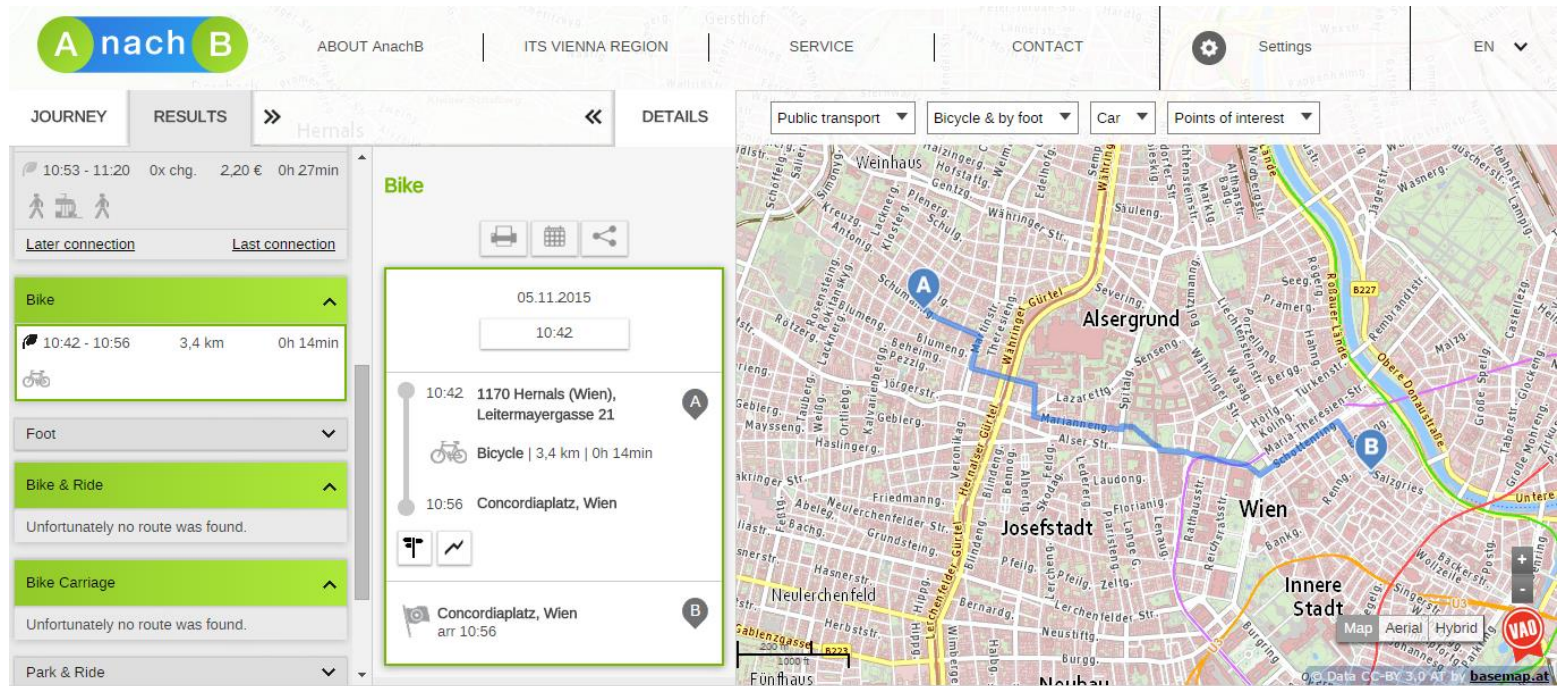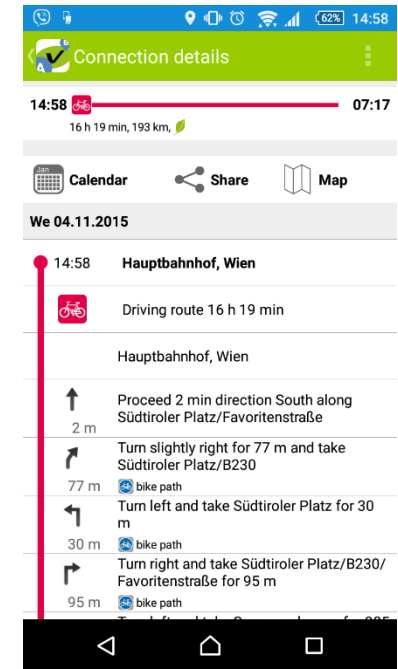
TfL

- primary goal: route planner application for PT in London (real time)

- + cycling and bike sharing route planning

- detailed cycling infrastructure

disadvantage: only a few personalization settings

pioneers:

- multimodal planning: cycling + PT (taking, parking)

- providing three route offers

Google Maps

- available services are different accoring to operational city/country

- cycle route plannig in given cities

- no multiomdality

- detailed cycling infrastructure

- webpage, mobile application

- disadvantages:

    – inaccurate planning (overtour)

    – no personalization settting

pioneers:

    – displaying cycling infrastructure (only on mobile)

    – two route offers
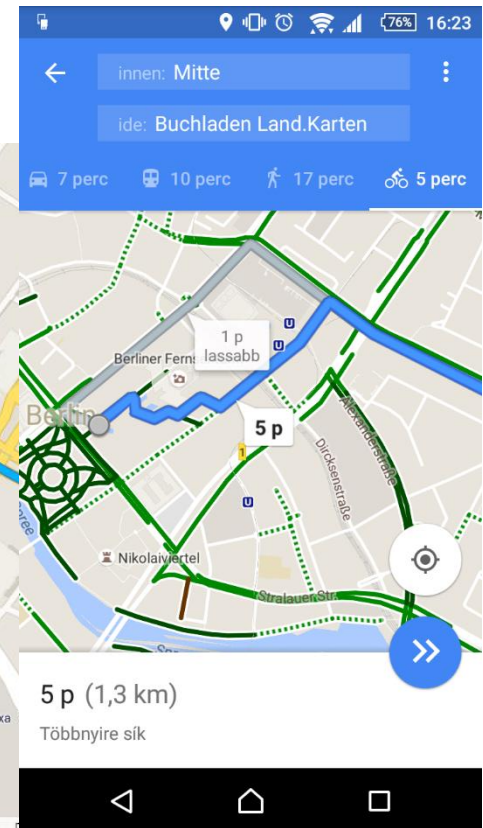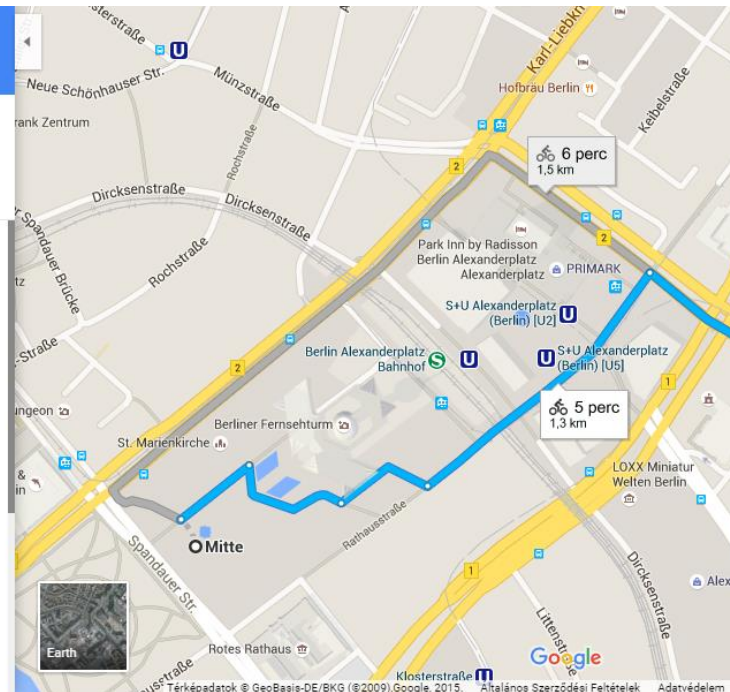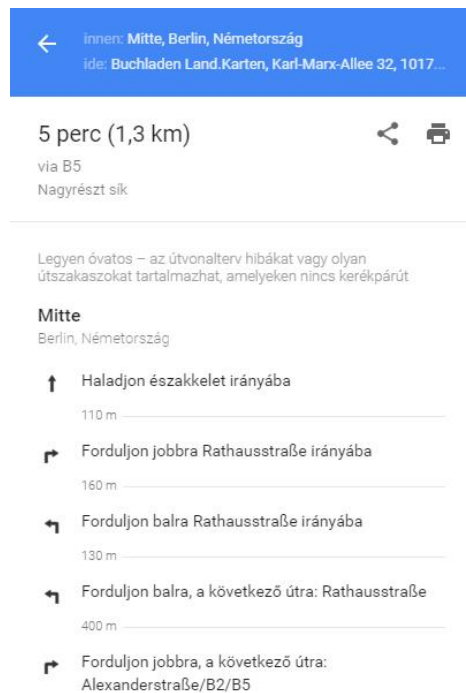
Results:

			BKK Futár	merretekerjek.hu	OSM	AnachB	TfL	Google Maps
1. General properties		a, operational area	Budapest	Hungary	world-wide[a]	Austria	London	world-wide[b]
		b, optional language	Hungarian/ English	Hungarian	depends on the country	German/ English	English	depends on the country
		c, availability	web/smart phone	web	web	web/smart phone	web	web/smart phone
2. Settings	**2.1. General settings**	a, input of origin and destination — a1, tapping on map	✓	✓		✓		✓
		a2, address	✓		✓	✓	✓	✓
		a3, POI	✓			✓	✓	✓
		a4, coordinates						✓
		b, selection of riding time — b1, departure time	✓			✓	✓	
		b2, arrival time	✓			✓	✓	
		b3, departure now	✓	✓	✓	✓	✓	✓
	2.2 Personalization	a, set preferences	✓					
		b, avoid heavy road traffic	✓	✓				
		c, avoid uphill				✓		
		d, consider cycle friendly infrastructure	✓			✓		
		e, riding speed setting				✓		
		f, multimodal travel — f1, taking bike on vehicle				✓**	✓**	
		f2, leaving bike at a station	✓*			✓	✓**	
		g, save user profile		✓			✓	
3. Operational processes		a, consideration of infrastructure where cycling is permitted		medium	high	low	high	high
		b, consideration of cycle friendly infrastructure		medium	high	medium	high	high
		c, multimodal planning with cycling		✓*			✓	✓**
		d, route planning with bike sharing		✓				✓
4. Displaying route options		a, visually on map		✓	✓	✓	✓	✓
		b, amount of text description		low		medium	high	medium
		c, amount/detail of supplementary information about route			high		medium	
		d, amount/detail of supplementary information about services			medium	medium	high	

✗ especial road planning for bikers (completely mapping cycle infrastructure and considering cycle friendly infrastructure)
✗ only few personalization settings
✗ neglecting static (e.g. potholes) and dynamic (e.g. icy road) properties of the roads

Results:

1. General settings:

- ✓ smart phone application covers the same functions as web-based application (BKK Futár, AnachB).

2. Personalization:

- ✓ planning only with cycle friendly roads or fastest roads (where not only the cycle friendly roads are considered) (BKK Futár),
- ✓ excluding dirt roads, avoiding heavy road traffic (merretekerjek.hu),
- ✓ avoiding uphill, preferring cycle roads, setting riding speed (AnachB),
- ✓ multimodal travel with taking bike on vehicle or leaving bike at a station (AnachB, TfL),
- ✓ using bike sharing systems (BKK Futár, TfL),

3. Operational processes

- ✓ detailed consideration of cycle infrastructure (merretkerjek.hu, AnachB),
- ✓ consideration of zebra crossings (with taking the bike) (BKK Futár),
- ✓ multimodal planning combining public transportation and cycling (TfL),
- ✓ multimodal planning combining public transportation and bike sharing (BKK Futár),
- ✓ complete multimodal planning (combining cycling, bike sharing, public transportation, car usage, car-sharing) (AnachB).

4. Displaying route options

- ✓ road type (bike lane, bike road, etc.), elevation profile (merretekerjek.hu, AnachB),
- ✓ detailed text description (AnachB),
- ✓ denoting surrounding cycling infrastructure (merretekerjek.hu, OSM),
- ✓ supplementary information about services (AnachB - service points, bike stands).

During riding

Navigation applications

- route planning

- finding POI

- offline route planning

- navigation (on map, voice-based)

- tracking

- warning

- takeover functions

- paid application e.g. bike citizens, shokabell

- free application e.g. Bringamánia

requirements: accurate network mapping, real-time data
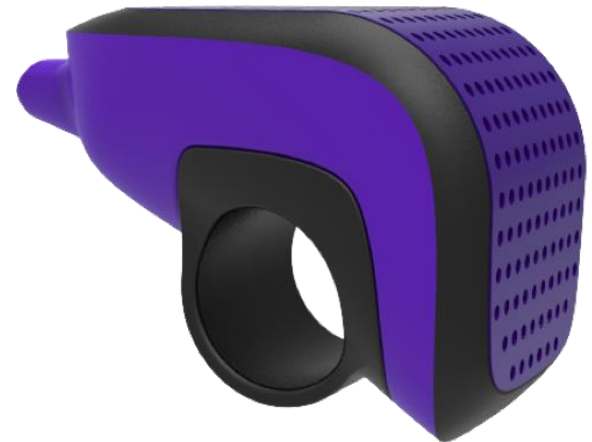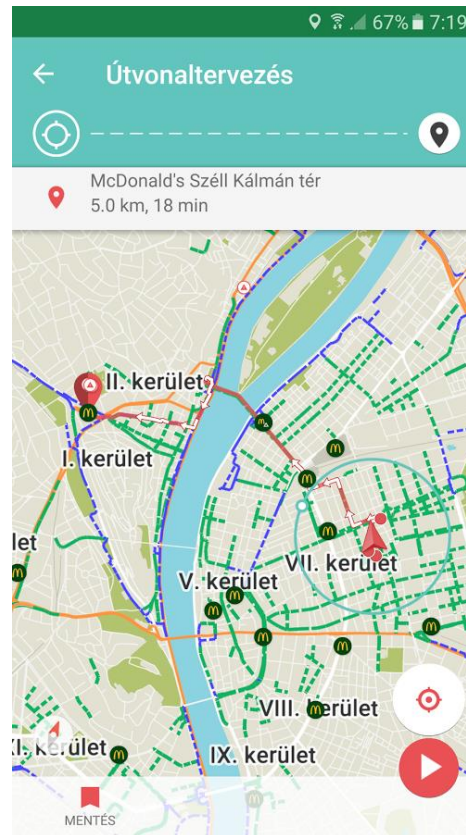
(During) After riding

Workout applications

- tracking

- afterwards assessment of riding

- comparison of workouts

- creating statistics

- workouts, milestones

- providing information during riding)average speed, time, covered distance)

applicaiton not only for cycling

e.g. runkeeper, endomondo
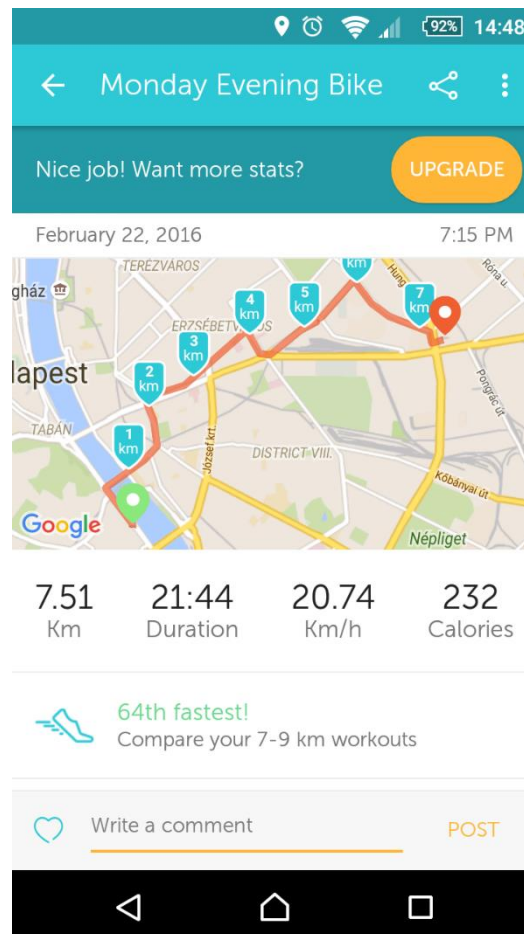
Generations:

1. generation: Amszterdam (1965)

2. generation: Copenhagen

3. generation : Hangzhou, New York, Paris, Milan, Berlin

    Budapest

4. generation: Copenhagen

Countries with Bike-Sharing Programs, January 2000 to April 2013
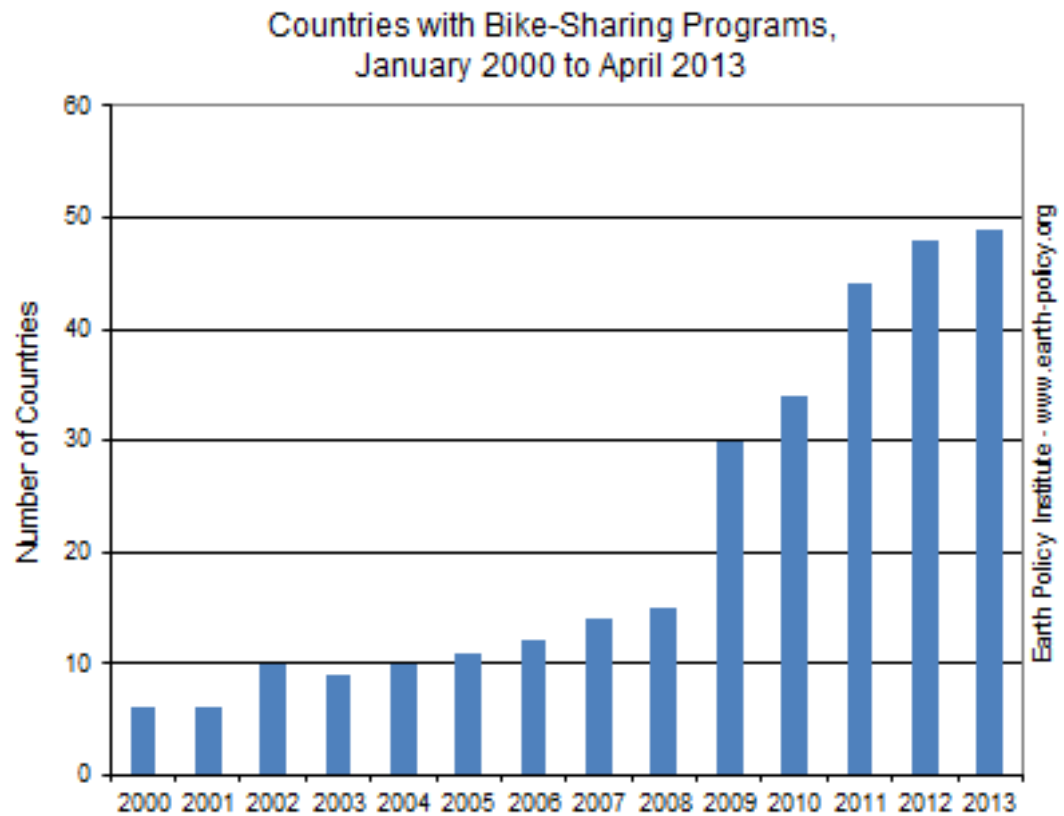
Source: EPI based on Midgley; Meddin and DeMaio; Shaheen et al.

Source: Janet Larsen: Bike-sharing programs hit the streets in over 500 cities worldwide. 2013. Earth Policy Institute.

Public bike sharing systems

- municipality (Cambridge – 1.)

- transport operator (DB - Call a Bike - 3.)

- nonprofit company (Amszterdam – 1., Koppenhága – 2.)

- advertising agency (JCDecaux: Paris – 3., Marseilles – 3., Luxemburg – 3., Brusseles – 3.; Clear Chanel: Milan – 3.)

- profit oriented company (Coppenhagen – 4., Next Bike: Berlin – 3., Warsaw – 3.)

- mixed (BuBi (Budapest): BKK/Nextbike/MOL – 3., Lyon: Grand Lyon/JCDecaux – 3.)

Non-public bike sharing systems:

- university (University of Portsmouth – 3.)

- profit oriented company (Magyar Telekom, Budapest – 3.)

1. generation

- Amszterdam, 1965

- **Witte Fietsen – White Bikes**

- bikes could left anywhere

- available for anybody

- no registry

- no information system

- no controlling, guarding

coll IISG

- goal: symbolize simplicity and cleanness against authoritarian car

- bikes were damaged, dropped into channels, stolen

- the system collapsed during a few days

2. generation

- Grenå (Denmark, 1991), Nakskov (Denmark, 1993; 26 bikes in 4 stations)

- Copenhagen (Denmark, 1995) – Bycyklen, City Bikes

    – cycling modal split is huge in Copenhagen: 26% (2012) – 36% of commuters are riding bike

    – special bikes

    – rent with coins – similar than shopping trolley – 2 EUR

    – wheels are advertisement surface

    – no registry, users were unowned

    – till 2014 -> 4. generations

2. generation

Copenhagen – stations:

3. generation

General features

- advanced information system, on-board computer

- user registry

- tracking bikes

- real-time information about usage

- smart card, smart phone access

- automatic docking stations

- unique bikes

- (30 minutes free riding)

First systems:

- first: Bikeabout (Portsmouth University, England, 1996) – students with magnetic card

- Rennes (France, 1998 - Vélo à la Carte),

- Lyon (France, 2005 - Velo'v, 1500 bikes) – the biggest in those days

- from 2008 outside Europe too

3. generation – Hangzhou (China, 2008)

- 50.000 bikes, 2204 stations (2008)

- current: 66.500 bikes, 3354 stations

- operator: municipal

- operating hours: 6-22 (at night reallocation)

- 325.000 renting/day

- tariff system

  - first hour is free, second hour is 1 RMB = 0.3 EUR, third hour is 2 RMB, over 3 hours: 3 RMB

  - deposit 200 RMB = 27 EUR

- access

  - registration in advance

  - smart card

- no available application

3. generation – Citi Bike, New York (2013) https://www.citibikenyc.com/

- 10.000 bikes, 600 stations

- operator: municipal + citi bank

- 0-24

- tariff system:
  - daily ticket: 12 USD (deposit 101 USD)
  - 3-days ticket: 24 USD (deposit 101 USD)
  - monthly pass: 15 USD + agreement
  - annual pass: 155 USD + agreement

- access:
  - PIN code (in case of daily, 3-days ticket) – request new code in every ride in the terminal with credit card
  - member key (in case of pass) – delivered by post!
  - first 30 minutes (in case of daily, 3-days ticket), first 45 minutes (in case of pass) are free + + after that rising fees
  - docking: no space -> extra 15 minutes to search another station – need to record on terminal
  - one user can rent only one bike

3. generation – Vélib', Paris (2007) http://en.velib.paris.fr/

- 23.600 bikes, 1800 stations; 0-24

- operator: JCDecaux advertising agency – in exchange the agency gets advertising opportunities throughout the city; income is provided to city

- access:
    - online registry, no deposit / ad-hoc ticket buying in terminal with 150 EUR deposit
    - PIN code in terminal + ID of bike
    - first 30 minutes is free + after that rising penalty fees
    - docking: no space -> extra 15 minutes to search another station - need to record on terminal
    - one user can rent only one bike

- tariff system:
    - daily ticket: 1,7 EUR
    - weekly ticket: 8 EUR
    - annual pass: 29 EUR free first 30 minutes, or 39 EUR free first 45 minutes
    - student discounts

- webpage/mobile application + terminal display

- bike sharing for children (5 location in parks)

3. genaration – BikeMi, Milan (2008) https://www.bikemi.com

- first integrated bike sharing system

- 3650 traditional bikes + 1000 e-bikes (pedelec),

- 260 stations; 7 am – 1 am (some station is temporary)

- operator: Clear Chanel (advertising agency)

- access

  – registration in advance (on internet, via phone, on terminals (not in the stations) -> code is provided via e-mail or SMS

  – card in case of annual pass within 15 days by post

  – user's account is debit in every month

- different tariff system

  – daily ticket: 4,5 EUR

  – weekly ticket: 9 EUR

  – annual pass: 36 EUR

  – traditional: free first 30 minutes, after that 0,5 EUR/30 minutes

  – pedelec: 0,25 EUR/first 30 minutes + rising tariff

- webpage/mobile application

3. generation – Next Bike Berlin (2007) http://www.nextbike.de/en/berlin/

- 300 bikes, 53 station; 0-24, winter break

- operator: Next bike profit oriented company

- access:

  – registration in advance (on internet, via phone, on terminal)

  – identification via mobile application or calling dispatcher -> with individual code

  – docking: record via application or calling dispatcher

  – or smart card (+2 EUR)

  – one user can rent 4 bikes

- tariff system:

  - occasional user: 1 EUR/30 minuets; 9 EUR/24 hours

  - ordinary user: 48 EUR (free first 30 minutes) + 9 EUR deposit

- every bike sharing system operated by Next Bike can be used in the same smart card
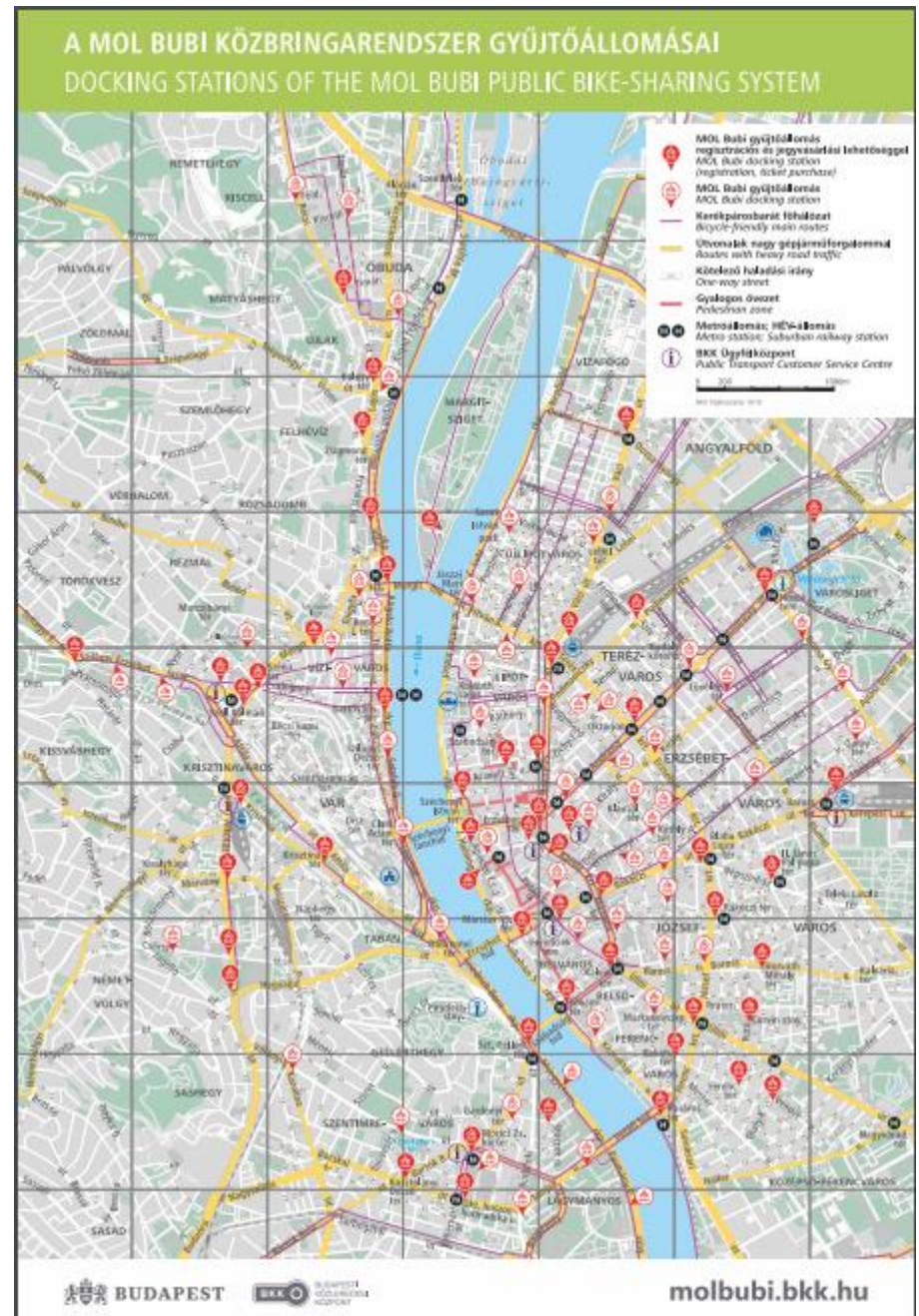
- webpage/mobile application

3(-4). generation – MOL BuBi Budapest (2014) http://molbubi.bkk.hu/

- 1100 bikes, 76 stations (2014); 0-24

- current: 1286 bikes, 112 station

- operator: BKK/MOL/(Next Bike)

- access:

  – ad-hoc + deposit (25.000 HUF) / registration in advance + agreement (only personally in customer service)

  – with smartphone (application + QR code, smart card, phone number + PIN code)

  – one user can rent 4 bikes

  – first 30 minutes are free, rising penalty fees

  – docking: no space -> using extra racks with locker of bike

- tariff system:

  – daily ticket: 500 HUF

  – 3-days ticket: 1000 HUF

  – weekly ticket: 2000 HUF

  – trimestral, half year, annual pass (12.000 HUF)

  – student discount, cheaper with annual pass of PT, ‚launching' promotion

- webpage/mobile application

3. generation – MOL BuBi Budapest

- station distance 300-500 m

- estimated daily trips: 7332

- estimated average riding distance: 2,21 km;

- average riding time: 18 minutes

based on date from September 2015:

- 22.000 user, 815.000 renting

- most busy: Friday, Saturday evenings, nights

- minor accidents

- strong commuter, work motivated traffic – occupancy of docking stations

- income: September 2014 –June 2015: 67 million HUF

- sponsor income: 122 million HUF

- annual operating cost: 244 million HUF

A MOL BUBI KÖZBRINGARENDSZER GYŰJTŐÁLLOMÁSAI
DOCKING STATIONS OF THE MOL BUBI PUBLIC BIKE-SHARING SYSTEM

BUDAPEST   molbubi.bkk.hu

4. generation

Copenhagen (Denmark, 2014) - http://bycyklen.dk/en/

- pedelec bikes

    – charged battery: 25-45 km long distance

    – electro motor supports rider to 22 km/h

    – active supporter (need to pedel, stich off by breaking

    – three level: turn off, urban, hill

    – hidraulic seat

- smart devices (tablet) in each bike

    – proving value-aded, real-time information (e.g. PT connections, POI)

    – navigation

    – searching free docking station

    – route planning in advance at home, displlaying route on the display after sign in

    – contionus data connection (10s)

4. generation

Copenhagen (Denmark, 2014) - http://bycyklen.dk/en/
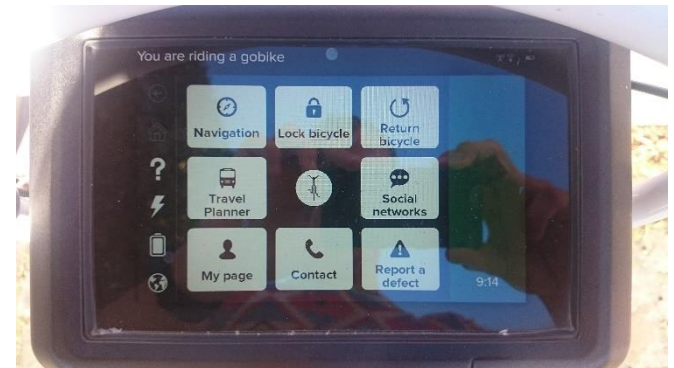
- 1000 bikes, 58 station (September 2015)

- operator: municipally + DSB (rail company)

- extension plan: 1850 bikes, 100 stations

- access:

    – registration in advance on internet + deposit

    – e-mail address + PIN code

- tariff system:

    – every case deposit: 200 DKK = 26,8 EUR

    – occasional user: 30 DKK/1h = 4 EUR/1h;
      300 DKK/10h (after that 0.5 DKK/min)

    – ordinary user: 70 DKK/month = 10,35 EUR/month (140
      min free riding, after that 0.35 DKK/min, parking 0.15
      DKK/min,)

- reservation 30 minutes before riding

- one user can rent only 1 bike

- 0-24 h
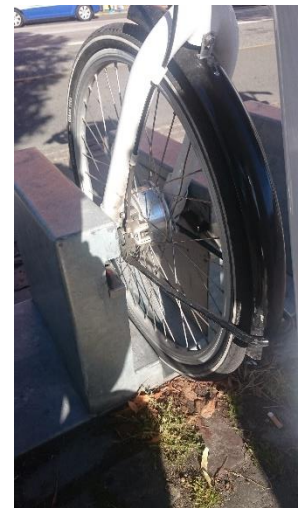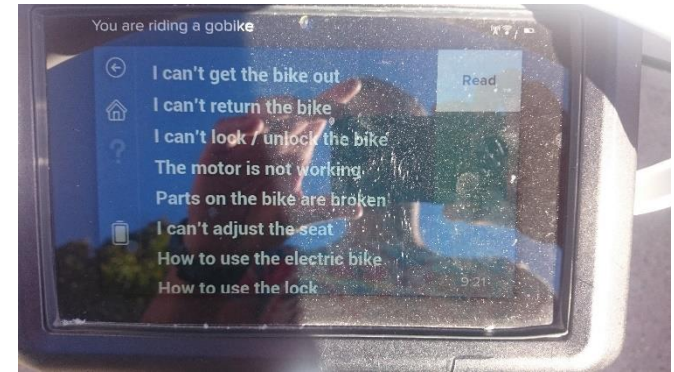
Thank you for your kind attention

Dávid Földes

e-mail: foldes.david@mail.bme.hu