



# What is Global Positioning System (GPS) technology, and what can it do for people with dual sensory impairment?



6<sup>th</sup> European Seminar of the Acquired Deafblindness Network 2006

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Øystein Dale, BA, M.H. Sc.

NAV National Center for Assistive Information Technology (NAV SIKTE)

The Labour and Welfare Service, Norway



## Aims and objectives:

- After this presentation - hopefully you will:
  - know what GPS is and understand how it works
  - have a better understanding how it can be used in orientation and mobility (O&M)
  - appreciate some of the limitations of GPS
  - have a better understanding of the special considerations one needs to make when using GPS with persons with dual sensory impairment (DSI)
  - If you disagree – I will buy you a drink tonight



## My background

- National Center for Assistive Information Technology (NAV SIKTE) – a national resource center and advisory body
- Occupational therapist – information technology - development and research – “GPS enthusiast”
- Work with adaptive technology – develop and modify hi-tech aids for different handicap groups
- Work directly with clients all over Norway
- Ultimate goal: Ensure distribution of high quality adaptive technology



## Orientation and mobility (O&M)

- Why talk about GPS?
- Safe O&M – important in most areas of life
- Decreased O&M ability can affect:
  - Safety – personal and safety of others
  - Independence
  - Participation in society
  - Social activities
  - Educational & vocational opportunities
- Ultimately – it may lead to reduced quality of life
- Can GPS be of assistance?



# Global positioning system technology

- Satellite based navigation system based on radio waves ([webpage](#))
- Originally based on American military satellite system
- With the system you can with great accuracy decide where you are anywhere in the world
- GPS helps you to find out:
  - Where am I? E.g. Which street, address or intersection
  - How do I get to my destination? E.g. from home to work
  - What is in my surroundings? E.g. a bank, a park or a dangerous street crossing (need to be programmed)



# Global positioning system technology

- Increasingly popular
- “GPS” – 281 mill. hits on Google – 3.69 mill. for “Global positioning system”
- Optimal accuracy – professional systems – centimetres
- Most consumer GPS-units 5 m accuracy
- Typically in Oslo +/- 10-30 m
- To use system - need a GPS-receiver – many different models – cars, boats or hand held units
- Most GPS receivers use electronic maps



# Handheld GPS unit



Photo used with kind permission from Belanor AS



# GPS unit for car



Photo used with kind permission from Belanor AS



# GPS watch



Photo used with kind permission from Belanor AS



# Handheld computer GPS unit



Photo used with kind permission from Belanor AS

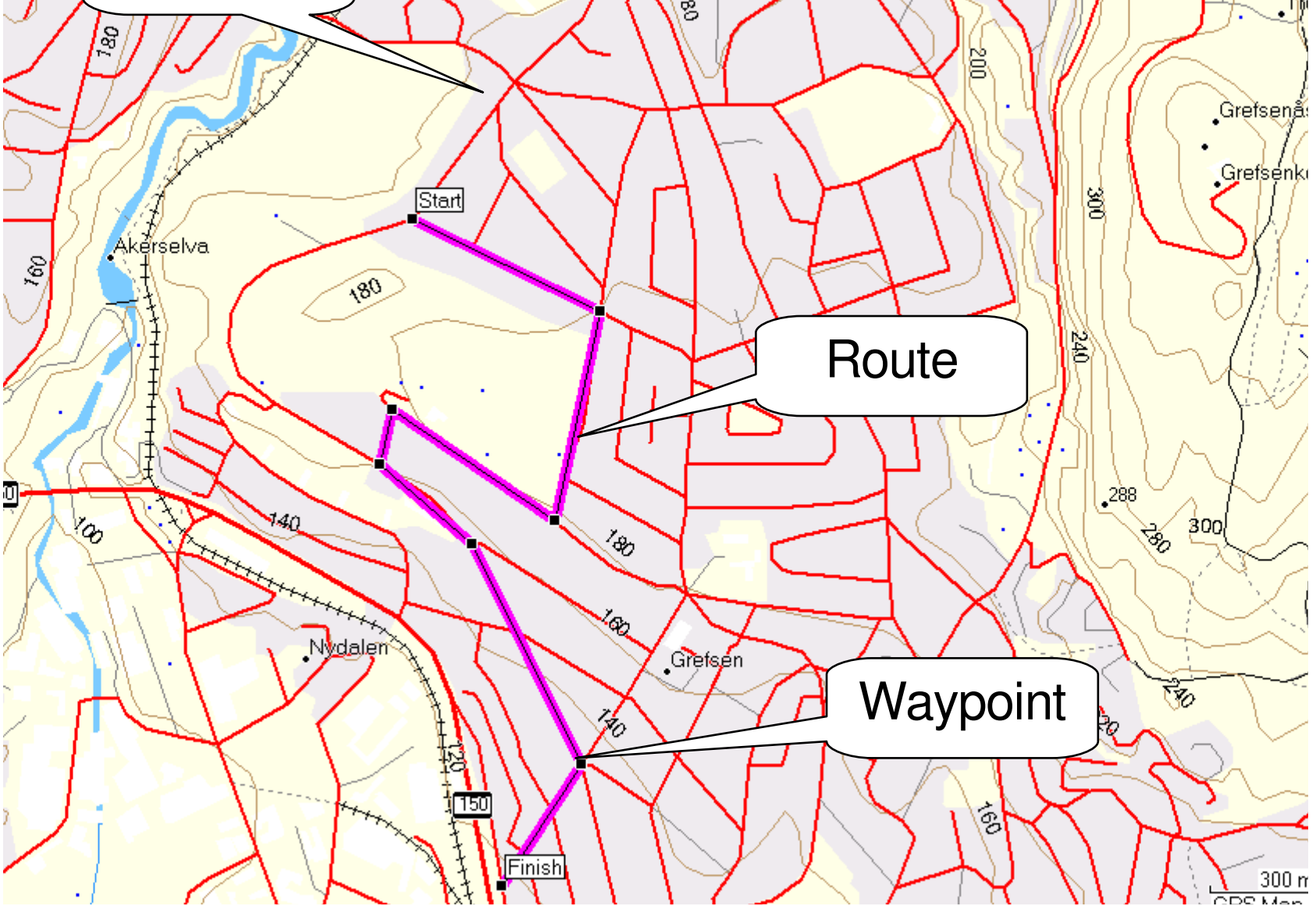


## Additional information about GPS

- Besides telling you where you are, e.g. “Groningen train station” – it can also help you to navigate
- Make a route between two places
- Can make route manually or type in two addresses and the route is automatically generated by the GPS
- It is possible to make a route and practice before going outside – a very popular function
- As you walk the GPS tells you where to turn, e.g. “turn left at next intersection” - visually or with voice
- Example of making a route (on PC or GPS-unit)



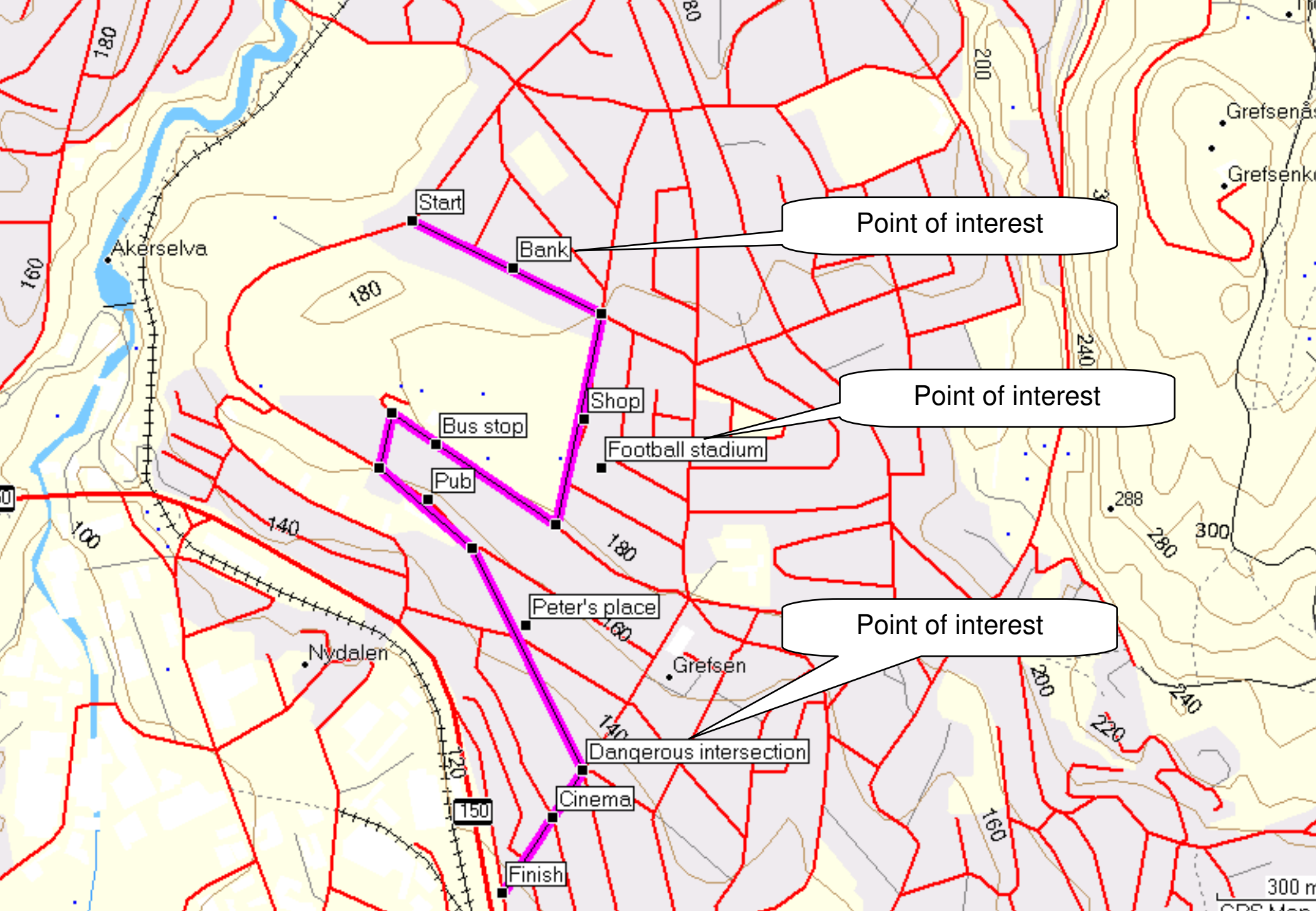
GPS map



Route

Waypoint

300 m  
GPS Map



Start

Bank

Point of interest

Shop

Point of interest

Bus stop

Football stadium

Pub

Peter's place

Point of interest

Dangerous intersection

Cinema

Finish

300 m  
GPS Map



## GPS - challenges

- Challenges:
  - Accuracy may be poor due to reduced GPS reception
    - Vegetation, buildings and other physical barriers
    - positioning of GPS on body
    - Consequence: You get the wrong position!
  - NB! Does not work indoors!
  - NB! The GPS does not alert you to immediate obstacles, e.g. a hole in the ground or a parked car
  - Technical malfunction and flat batteries
  - Requires some technical knowledge to operate
- As a consequence - can not rely on a GPS as the only orientation aid



## Adapted GPS-solutions for sensory impairment

- Several different models available
- Output or interface - speech or Braille display
- They all require:
  - hearing and/or
  - ability to read Braille
- Two examples – Maestro Trekker and Braille Note GPS



# Example Maestro Trekker



Photo used with kind permission from Bojo AS

<http://www.adaptivetechnet/products/trekker.htm>



## New technology - alternatives



Photos used with kind permission from Idedata AS (left and centre) and Handytech Norge AS

- Drawbacks:
  - Not necessarily suitable for those with sensory impairment – made for cars or sighted pedestrians
  - Requires greater technical expertise to use
  - Limited support system for people with special needs



## NAV SIKTEs GPS project - background

- Wanted to find out if GPS could be suitable as an orientation aid for persons with deafblindness?
- "Talk is cheap" – make our own prototype
- Initiated project with deafblind client consultants and Cognita AS
- The prototype:
  - How to make a unit suitable for DSI?
  - Main target group – people with acquired deafblindness
  - Our goal – no sight, hearing or ability to read Braille required

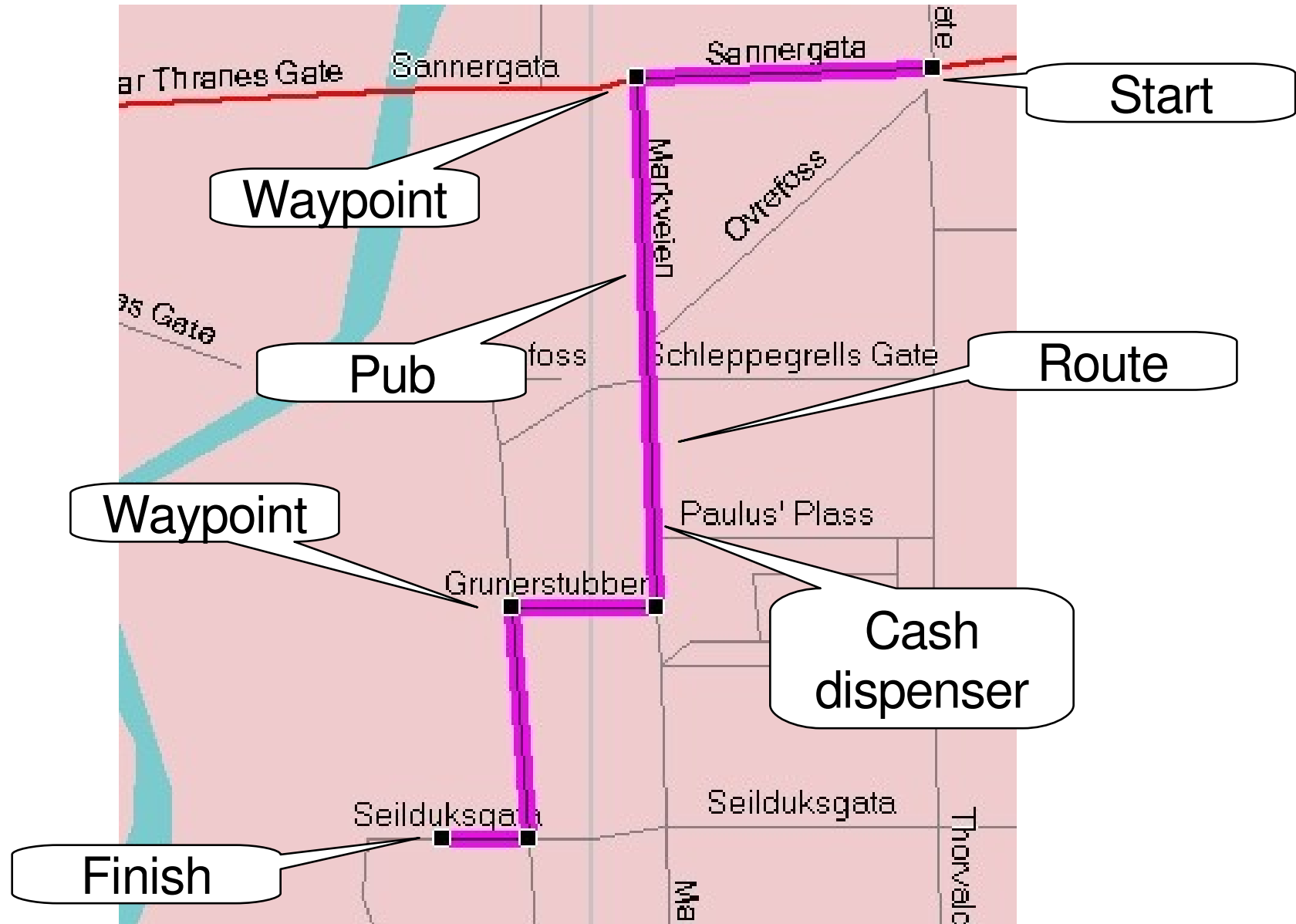


## The prototype II

- Challenges:
  - how much information to convey
  - how to make the GPS information understandable for the user?
- Decided to use vibrotactile stimulation – vibrating units
- Code the vibrations – e.g. different codes for “go left”, “go right”, “stop”, “u-turn etc. = a type of “Morse” code
- Designed not to distract residual sight and hearing, and to keep hands free
- An orientation aid – to be used in addition to mobility cane, guide dog or sighted guide

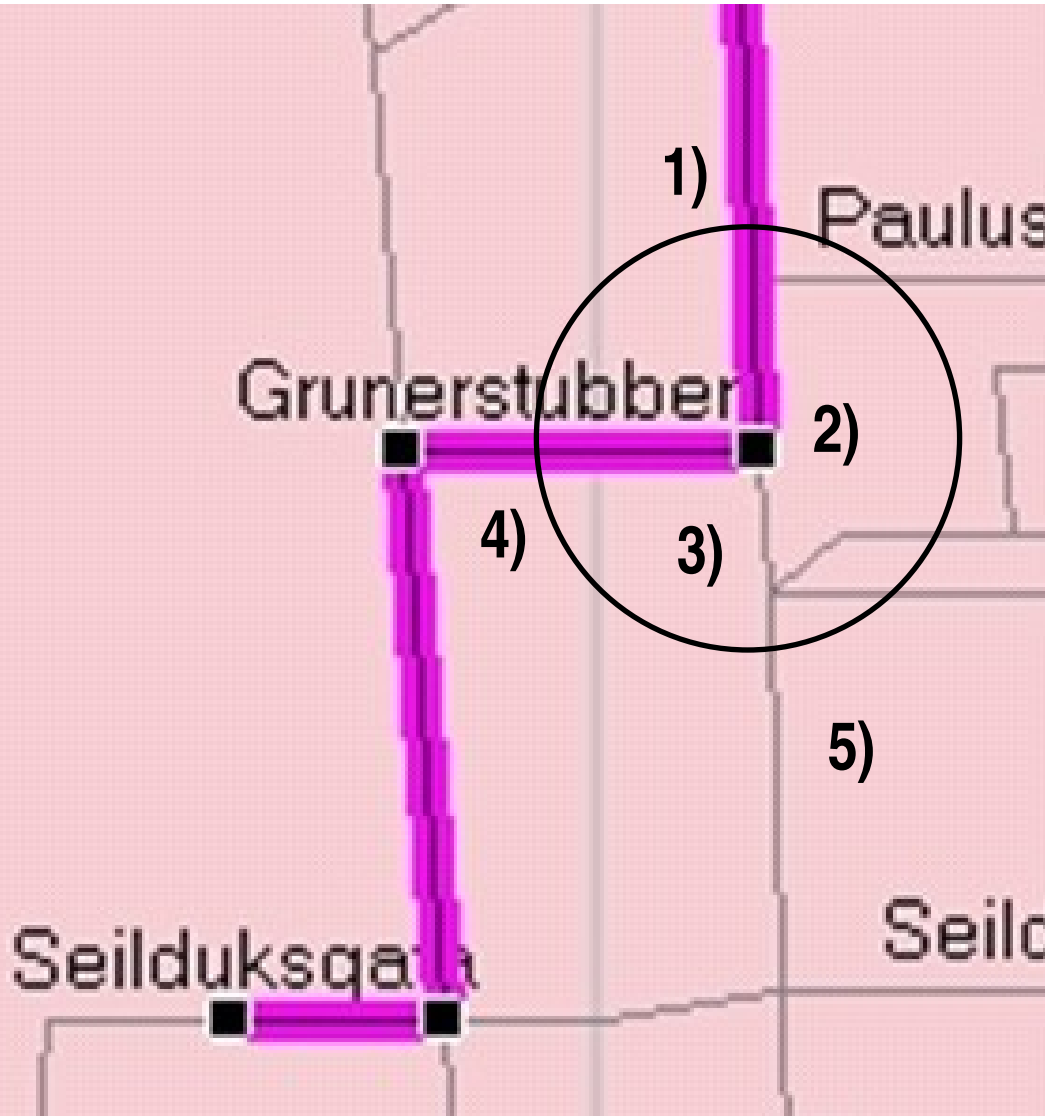


# How does it all work?





## How does it all work II



- 1) In 20 meters turn right
- 2) You have reached waypoint - turn
- 3) 66 steps until next waypoint
- 4) You are walking in the correct direction
- 5) Wrong direction – U-turn



## Two words about vibrations & the coding

- Why vibrations – why not visual, auditory or Braille?
  - Parallel information channel
  - NB! Can still use residual hearing and vision
  - The hands are free – mobility cane/guide dog
  - + practical problem in Norway during winter
- Great potential – we have only chosen a simple solution – future – maybe use standardized haptic communication



# Using GPS with DSI

- GPS has many uses:
  - Active use in O & M process
  - As an information tool – collecting information about one's surroundings – very important
- For active use - user must be reasonable proficient at independent O & M
- Only use GPS as part of bigger O & M strategy
- GPS is **only an orientation aid**
- GPS - an addition to O & M cane, guide dog or sighted guide
- Comprehensive training & support - essential!
- GPS needs to be easy to use – for user and helper(s)



## Using GPS with DSI II

- Challenge find suitable interface (output method)
  - Visual
  - Auditive
  - Braille
  - Vibrotactile?
- Depends on individual preferences
- Ability to use vibrotactile – depends on residual vision and hearing
- Important – must allow for use of residual vision and hearing and other O & M aids
- Technical competence and maintenance issues



## Related positioning technology

- Take over and assist where there is poor or no GPS reception
  1. Stationary correctional “ground stations” – send information to GPS
    - Radio frequency identification
    - Talking lights
  2. Handheld navigation units – many devices in one - step counter, compass, altitude meter etc. - 90% accuracy
  3. Wireless computer and mobile phone networks – 0.5 - 50m accuracy
- Ideally – the sum of all these technologies allows you to move freely including indoors using different technologies that work together – you will always know where you are



## The future...

- We are only in the infancy of positioning technology
- Will soon have ultra portable and reliable units that will work anywhere – outside and indoors
- Based on many different technologies – work smoothly with each other
- Use of big wireless networks allowing for two way communication
- Will benefit many user groups for whom O&M is a challenge
- For people with DSI – the interface is a challenge – how do we convey the O & M information to the user – this is where the research and development need to be focused



## Concluding remarks

- Can GPS technology be used an orientation aid for people with dual sensory loss? Short answer - Yes!
- But only in addition to traditional O & M, and not suitable for all with DSI
- Challenges – GPS accuracy & reception, suitable interface, cost and requires technical expertise
- New technology will address accuracy, but for people with DSI interface remains greatest challenge
- Many point out the shortcomings of GPS – my suggestion – do not focus on what GPS technology is lacking, but on what it has got to offer now
- “Something is better than nothing”....



**Many thanks to:**

Erik Nilsen & Trine Næss, Client consultants

Håvar Falck-Andersen and the team from Cognita AS

All “test pilots” with DSI

Michael Cyrus and my other colleagues at NAV SIKTE

**Thank you for your attention!**



**For further information:**

**Please, collect my business card**

**[www.nav.no/sikte](http://www.nav.no/sikte)**

**[oystein.dale@nav.no](mailto:oystein.dale@nav.no)**