

System for monitoring and controlling car fleets with bidirectional communication

Diploma Thesis

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PhD.**

System overview

From A simple vehicle monitoring system to an enhanced fleet control platform

- Allows real time monitoring of car position and speed
- Can provide historic data regarding geographic position and navigation data
- Provides means of bidirectional communication for dispatching assignments

System Components

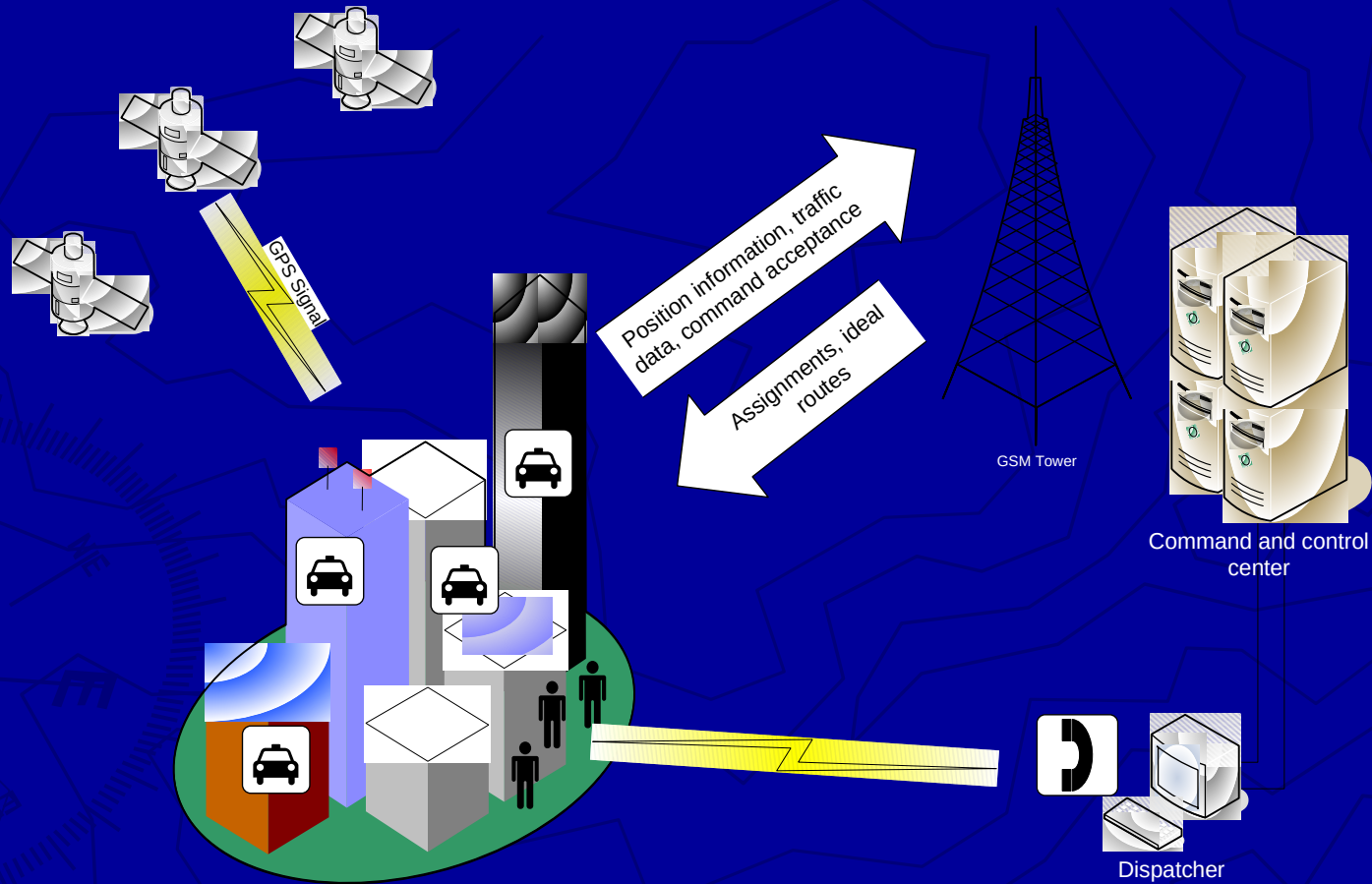
1. A Command and control center
2. A mobile equipment

Tackled problems

- ▶ Live monitoring of vehicles and assets using GPS
- ▶ Bidirectional communication using GPRS
- ▶ Improving assignment dispatching
- ▶ Optimizing routes and fleet control

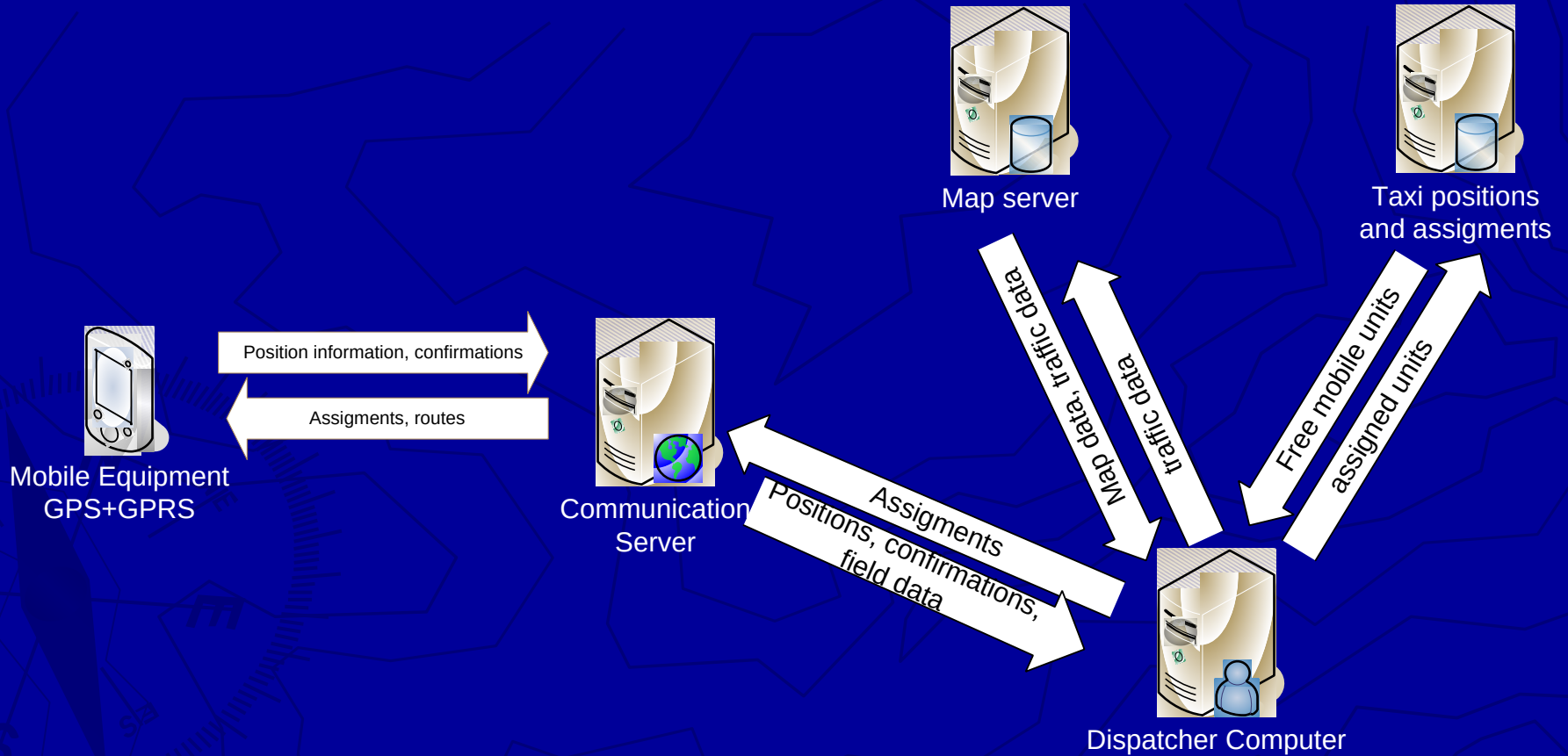
Solution overview

System architecture

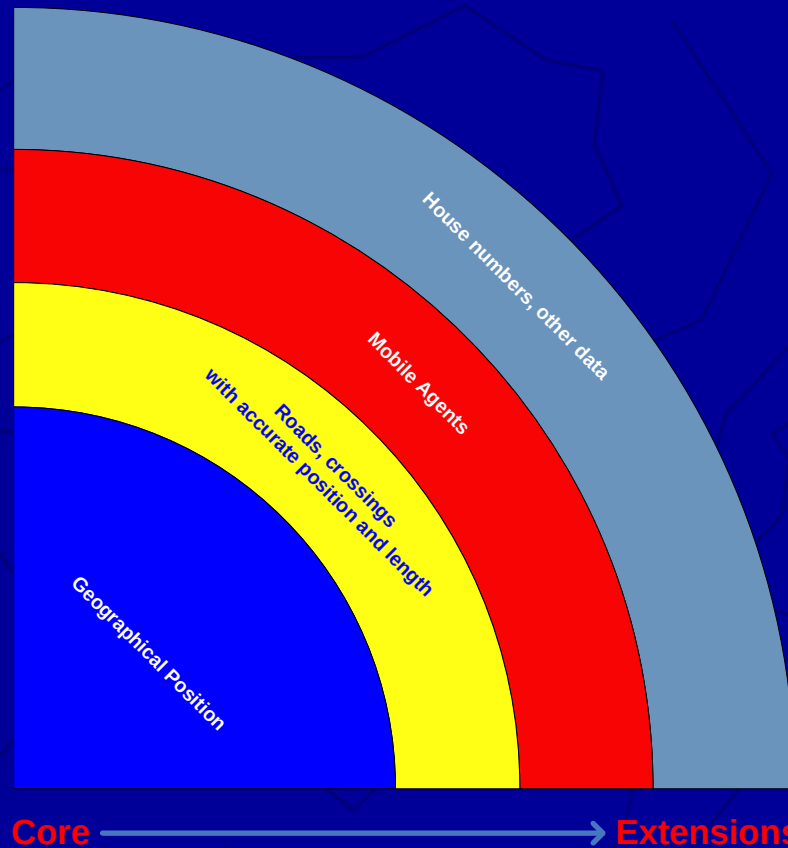


Solution Overview

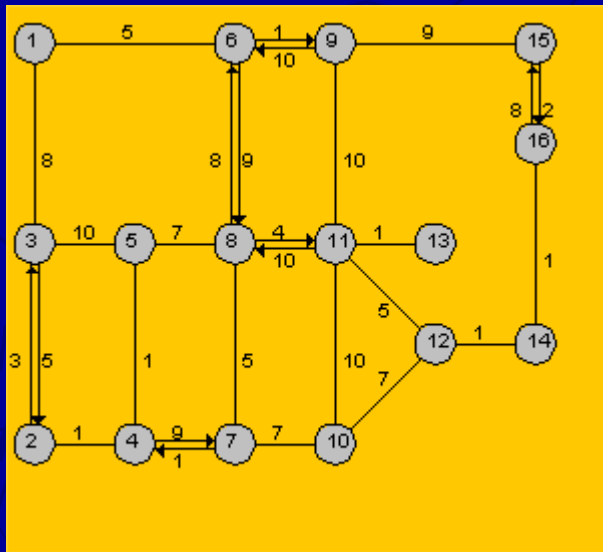
Command and Control Center



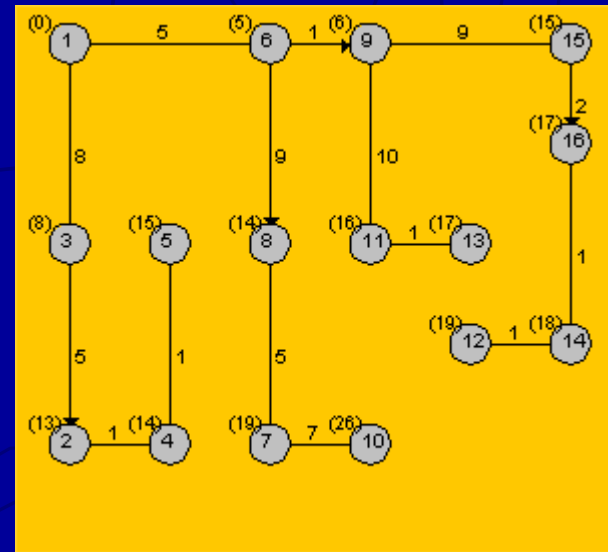
Minimal implementation of a GIS System



GIS System Layers



Memory Street Map



Shortest Path Solution

GIS System Database Structure

edge	
ID	INTEGER(10)
ID_FromNode	INTEGER(10)
ID_ToNode	INTEGER(10)
BoxXMin	DOUBLE
BoxXMax	DOUBLE
BoxYMin	DOUBLE
BoxYMax	DOUBLE

lineshapepoints	
ID	INTEGER(10)
Latitude	DOUBLE
Longitude	DOUBLE
Ord	TINYINT(3)
ID_Edge	INTEGER(10)

agent	
ID	INTEGER(10)
Name	VARCHAR(45)
Suraname	VARCHAR(45)
ID_RoadElement	INTEGER(10)
Latitude	DOUBLE
Longitude	DOUBLE

node	
ID	INTEGER(10)
Latitude	DOUBLE
Longitude	DOUBLE

roadelement	
ID	INTEGER(10)
ID_Edge	INTEGER(10)
ID_FromJunction	INTEGER(10)
ID_ToJunction	INTEGER(10)
ID_Street	INTEGER(10)
Name	VARCHAR(45)
RoadClass	TINYINT(1)
Direction	TINYINT(1)
AverageSpeed	TINYINT(3)
BlockedPassage	TINYINT(1)
DividerType	TINYINT(1)
Length	DOUBLE
RoadCondition	TINYINT(1)
SpeedRestriction	TINYINT(3)
Width	SMALLINT(5)
ID_HouseNumber	INTEGER(10)
NrOfLanes	TINYINT(1)
TrafficJamSensitivity	TINYINT(2)

prohibitedmanoeuvre	
ID	INTEGER(10)
ID_FromRoadElement	INTEGER(10)
ID_ViaJunction	INTEGER(10)
ID_ToRoadElement	INTEGER(10)

junction	
ID	INTEGER(10)
ID_Node	INTEGER(10)
Name	VARCHAR(45)

housenrange	
ID	INTEGER(10)
HouseNrStructure	TINYINT(1)
FirstNrLeft	VARCHAR(45)
LastNrLeft	VARCHAR(45)
FirstNrRight	VARCHAR(45)
LastNrRight	VARCHAR(45)

street	
ID	INTEGER(10)
BoxXMin	DOUBLE
BoxXMax	DOUBLE
BoxYMin	DOUBLE
BoxYMax	DOUBLE
Name	VARCHAR(45)

Building Maps

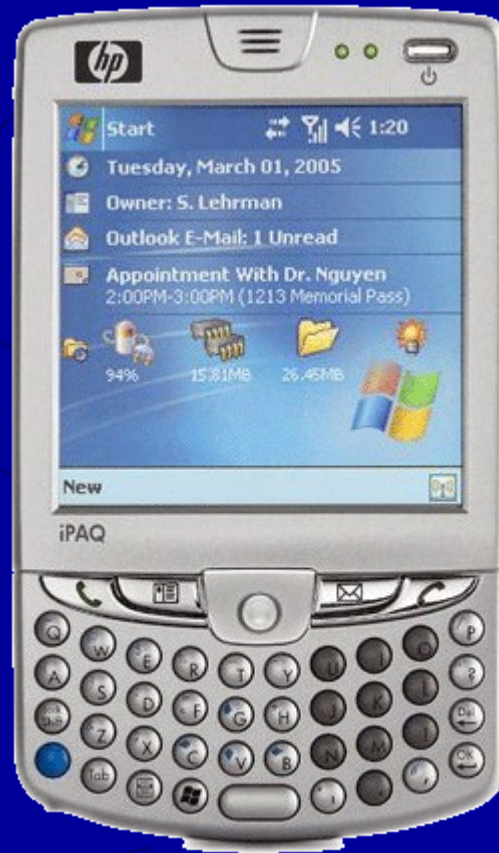


Mobile equipment

GPS Data from Satellites

Requests from Control Center

User Input

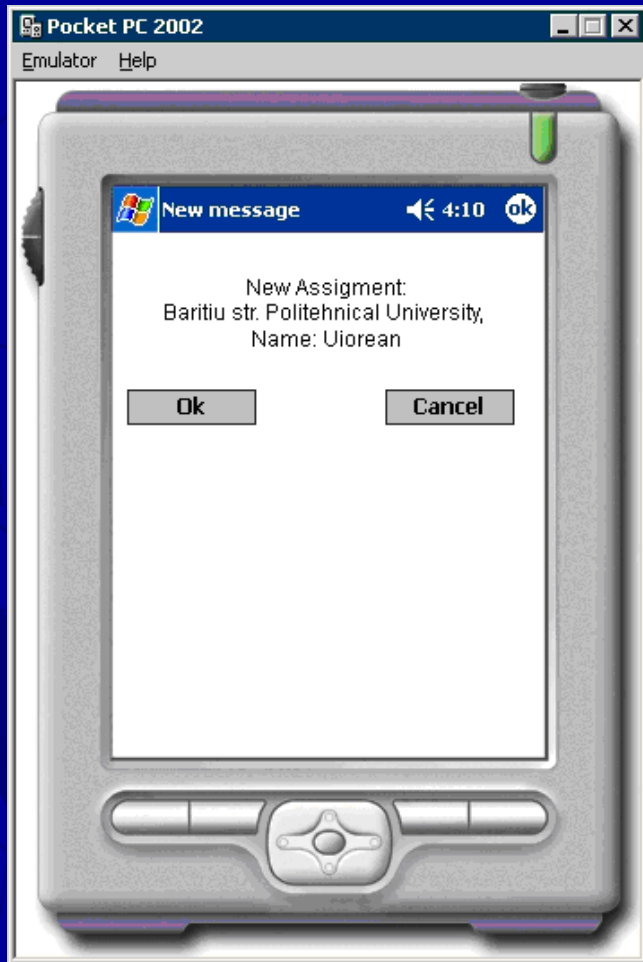


Position Data to Control Center

User Actions

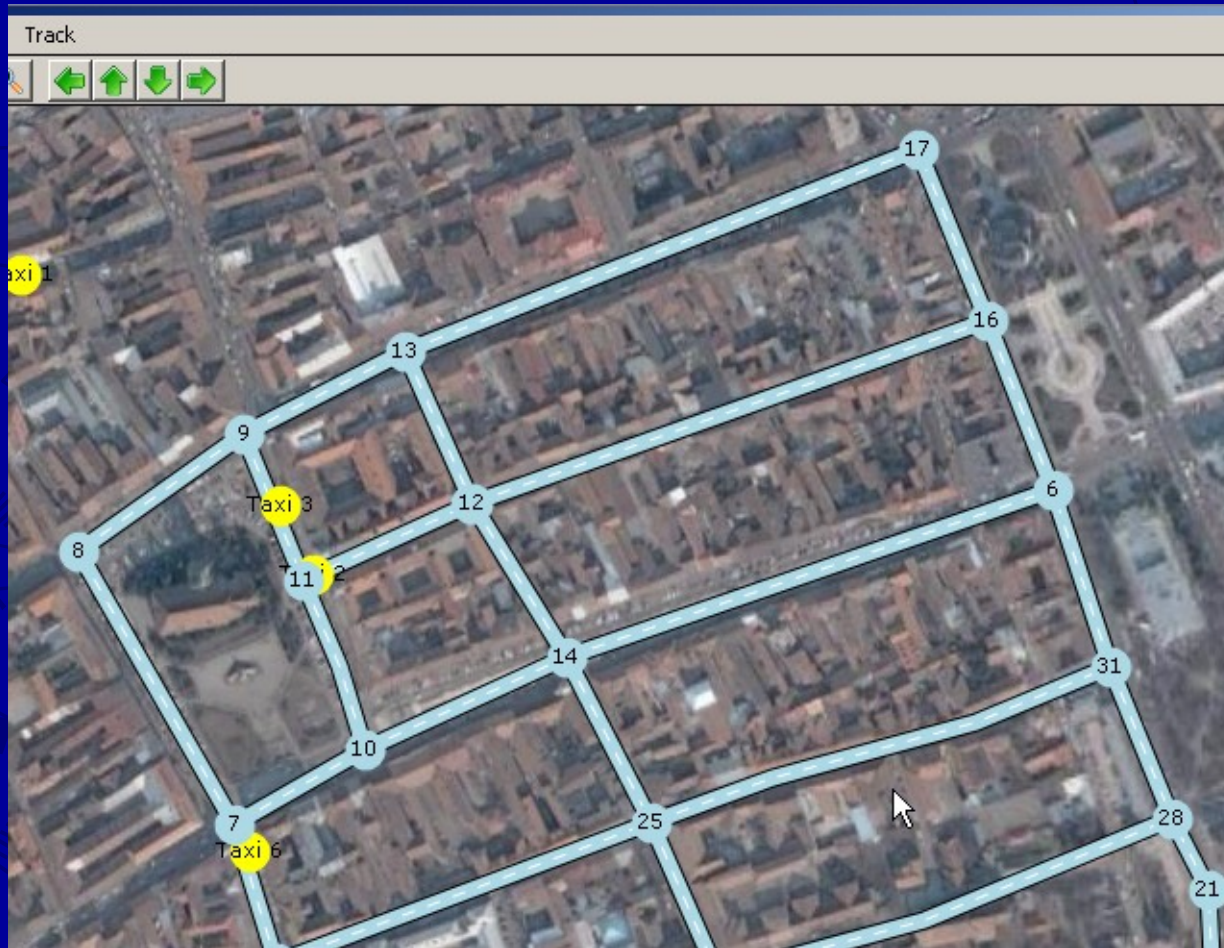
Additional Data

Mobile equipment



```
1: while(true)
2:     Currentposition=GetPositionfromGPS(0);
3:     If DistanceinMeters(OldPosition, Currentposition) > 20 OR
CurrentTime-LastMessageTime > 5
4:         RTCMCorrection=RequestRTCM()
5:         Currentposition=
GetPositionfromGPS(RTCMCorrection)
6:         SendMessagetoCCCenter(MyId, Currentposition)
7:         Oldposition=Currentposition
8:         LastMessageTime=Now()
9:     end if
10:    WaitforTasks()
11:    if TaskAvailable()
12:        Display(TaskName, TaskPosition)
13:        WaitForOk()
14:        If TaskAccepted()
15:            confirm =
SendMessagetoCCCenter(MyID, TaskID)
16:            If confirm
17:                Details =
GetDetails(TaskID)
18:                Display(Details)
19:            End if
20:        End If
21:    End If
22: End While
```

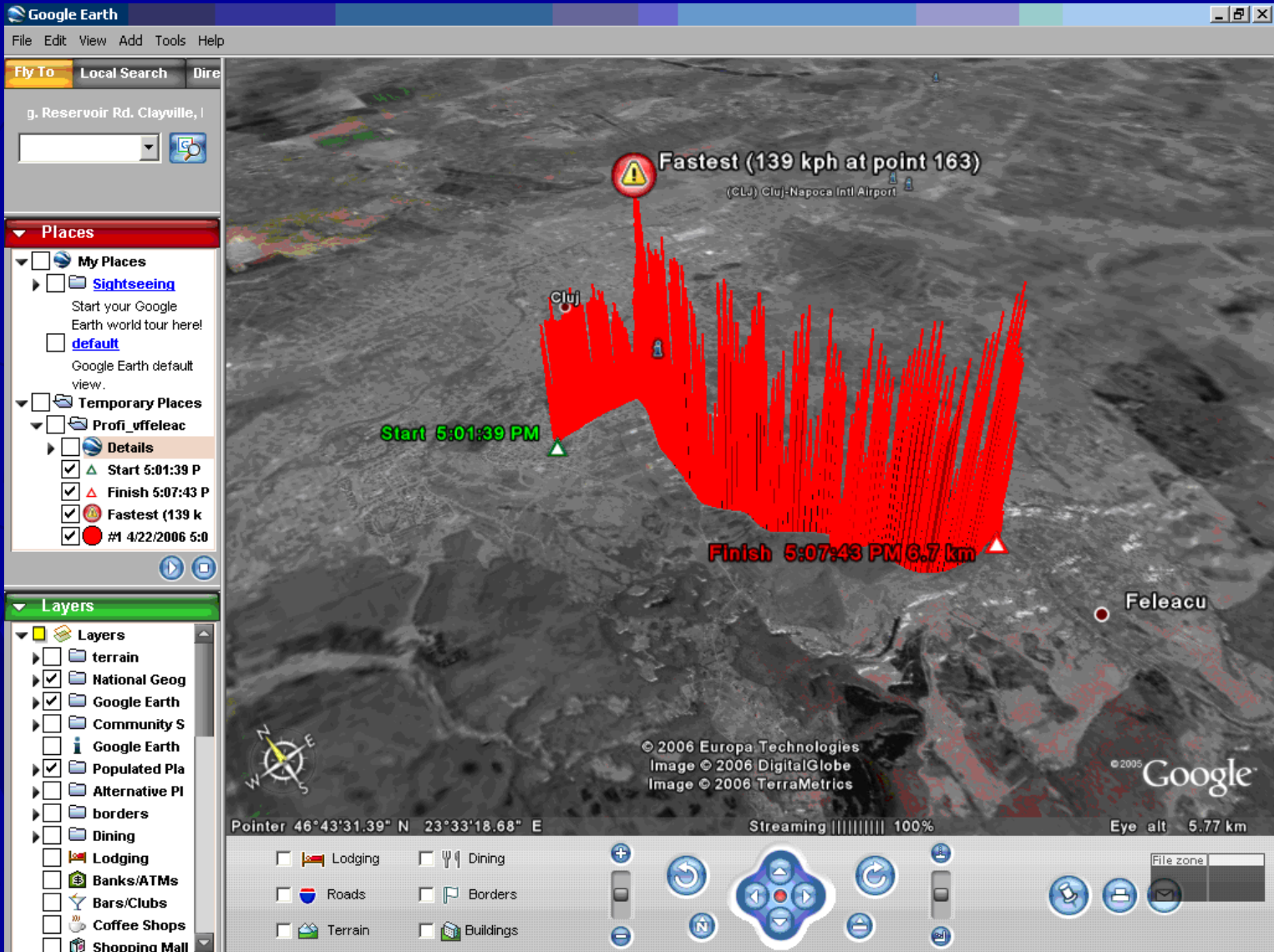
Testing: Taxi Fleet Control



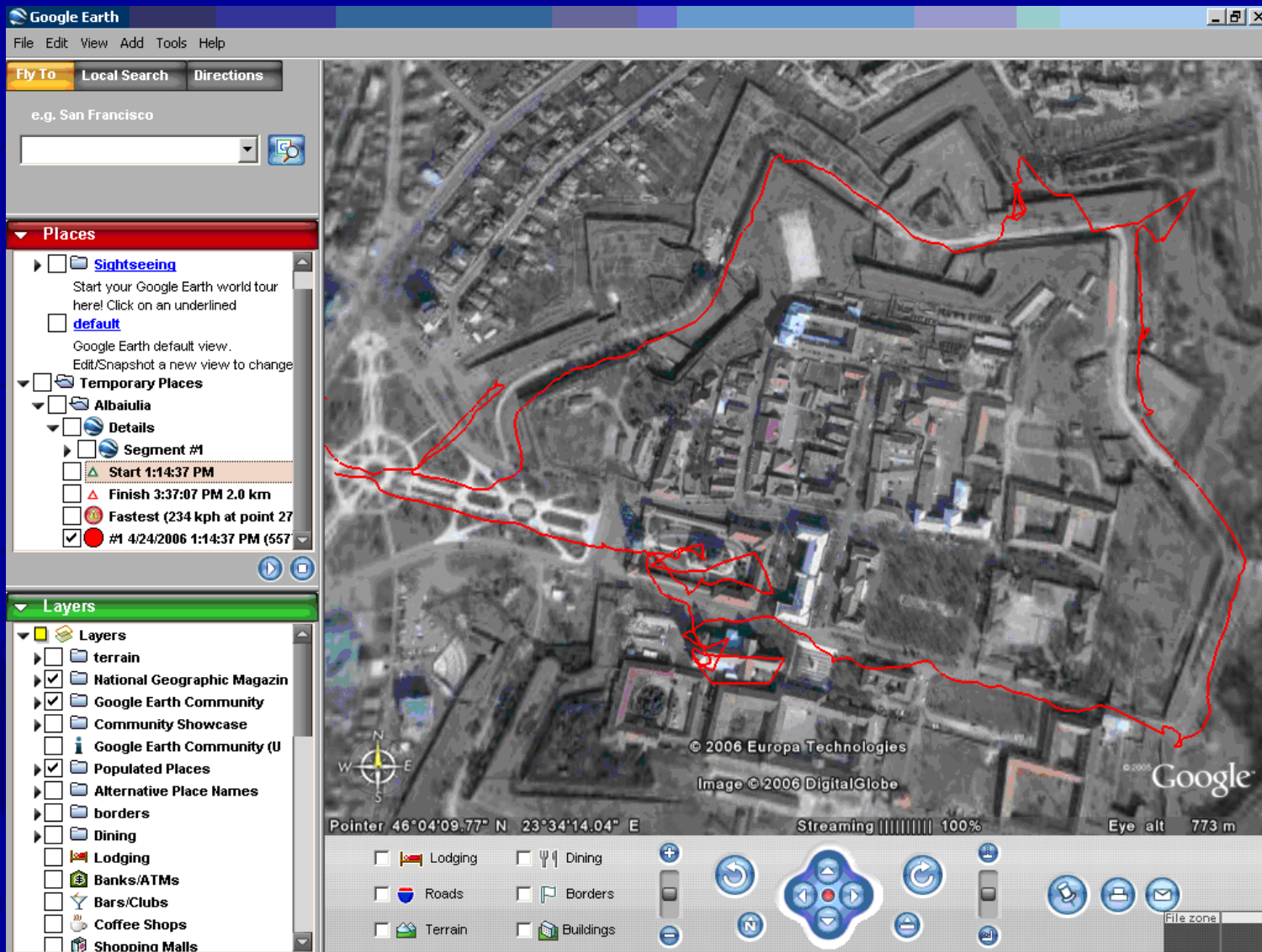
Testing: Live Monitoring



Testing: Navigation Analysis



Testing: Navigation Analysis

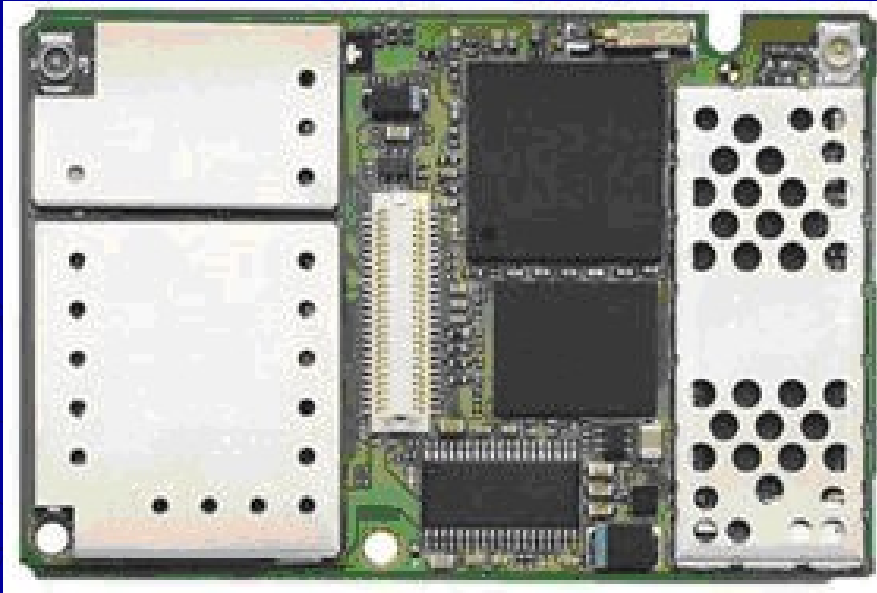


Further developments

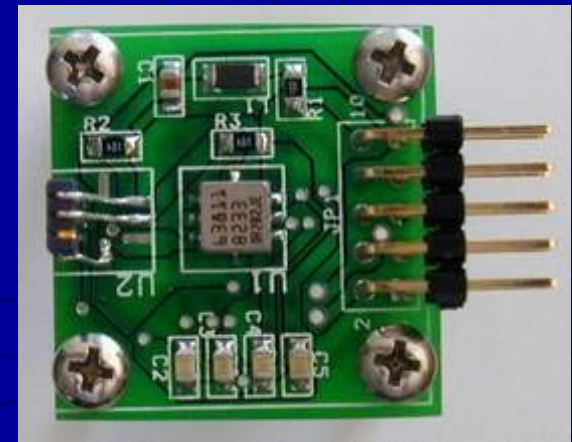
- ▶ Developing a custom platform based on Siemens XT55 Module (GPS+GPRS)
- ▶ Implementing GPS Corrections
- ▶ Analyzing traffic data and developing optimization techniques
- ▶ Obtaining EU funding for implementation of a complete taxi control solution
- ▶ Developing Quality of life sensors

Further developments

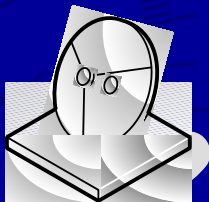
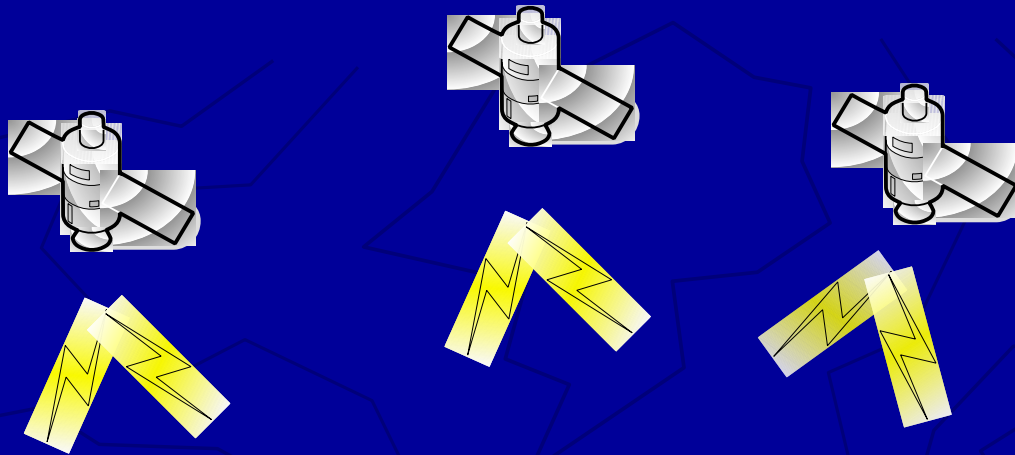
Siemens XT55 (GPS+GPRS Module)



Accelerometer



GPS Corrections

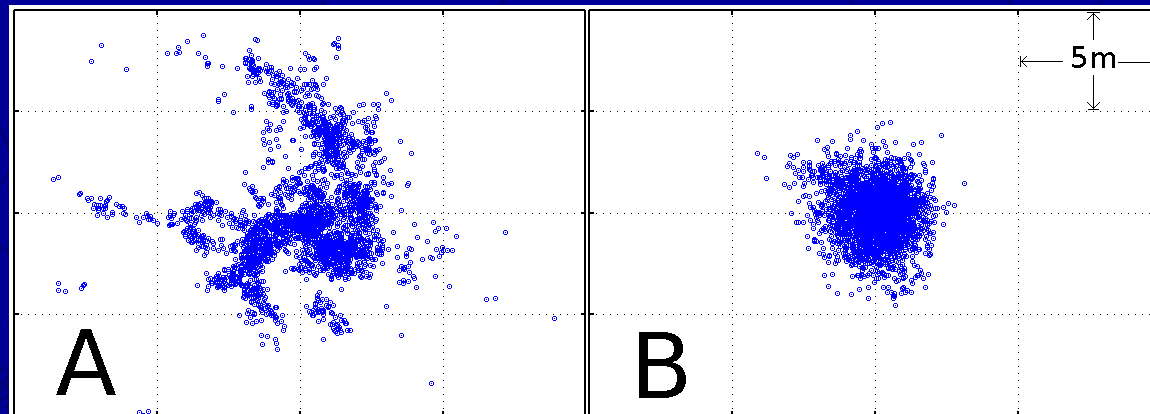


Fixed ground station
with known position



Vehicle with GPS
receiver
and data link

GPS System



Without (A) and with (B) Corrections

Taxi Fleet Control center

GPSTaxi Control Center - [Preluare comenzi]

Fisier Gestione Comenzi Ferestre Ajutor

Cauta strada

11 Octombrie
13 Septembrie
16 Februarie
Abrudului
Actorului
Ady Endre
Agriculatorilor
Agronomilor
Aiudului
Al. Davilla
Al. Sahie
Alba Iulia
Albac
Albert Einstein
Albiei
Aleea Valeni
Aleea Azuga
Aleea Baisoara
Aleea Baita
Aleea Balea
Aleea Barsei
Aleea Bizusa
Aleea Borsa
Aleea Borsec
Aleea Brates
Aleea Bucura
Aleea Castanilor
Aleea Cioplea
Aleea Ciucas
Aleea Clabucet
Aleea Detunata
Aleea Firiza
Aleea Garbau
Aleea Godeanu
Aleea Gurghiu
Aleea Herculane
Aleea Iezer
Aleea Meses
Aleea Mestecenilor
Aleea Meziad
Aleea Micus
Aleea Moldoveanu
Aleea Muscel
Aleea Negoiu
Aleea Padin
Aleea Padis

Linia 1 Linia 2 Linia 3 Linia 4 Linia 5 Linia 6

Linia1

Raspunde Reinitializare

Numar tel: Nume:

Strada 11 Octombrie Nr: Mentiiuni: Noaptea

Top adrese:

Strada	Nr	Mentiiuni
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Lista asocienilor

StartNr	StopNr	Mentiiuni
0	0	
0	0	case
1	3	

Trimite Aici apare indicativul care a accep Accepta

Inchide

Thank You

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Supervisor: Lecturer Eng. Daniel MOGA, PhD.