



NavInfo and its R&D Projects

Dr. Alex Zhe Xiang



Mapping your way

- **About NavInfo**
- **R & D Scope**
 - Overview
 - Survey and Production of Map Data
 - Navigable Map for Intelligent Vehicles
 - Other Relative Projects
 - R & D Partners

About NavInfo

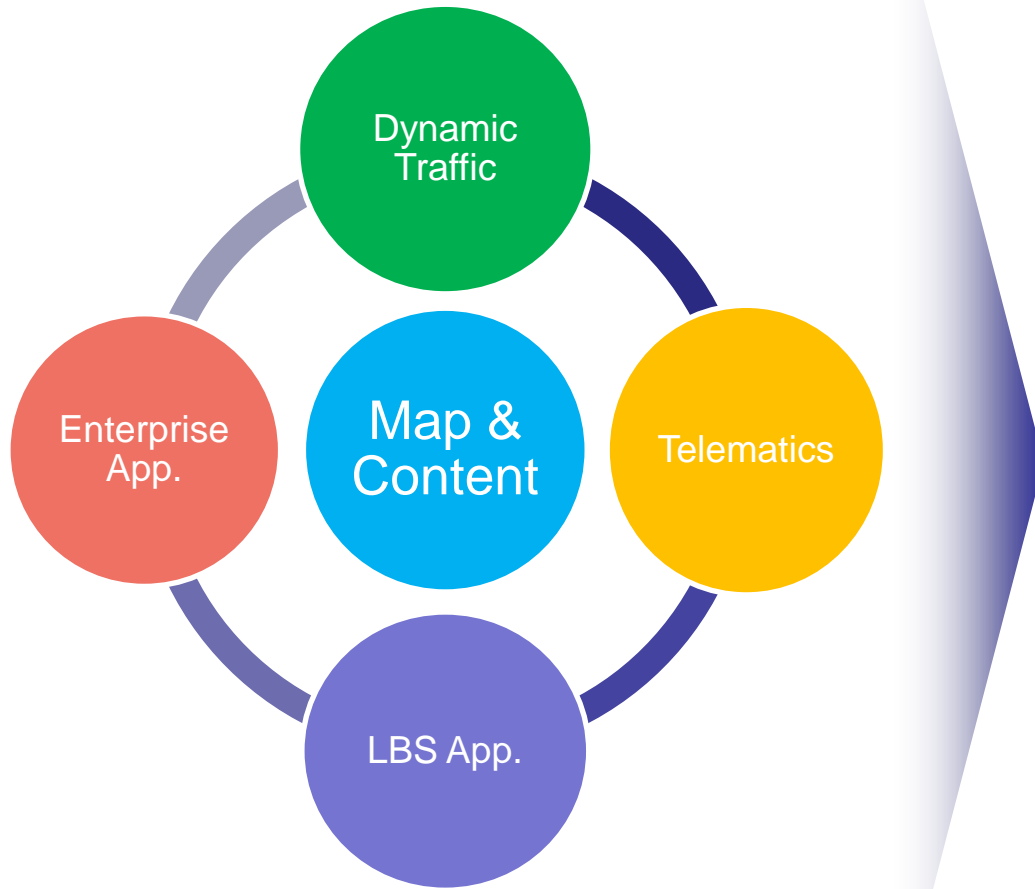
www.navinfo.com

- Leading Service Provider in China, in fields of navigable map, dynamic traffic information and automotive integrated information;
- China's largest and world's fourth-largest navigable maps provider;
- Engaged in R&D of professional China navigable map since 1997, company established in Dec, 2002, more than 2,500 employees;
- 2460 employees, including 530 software engineers and 1220 data engineers



Wide Application

www.navinfo.com



In-vehicle Navigation



51.4% market share in 2011

Portable Navigation



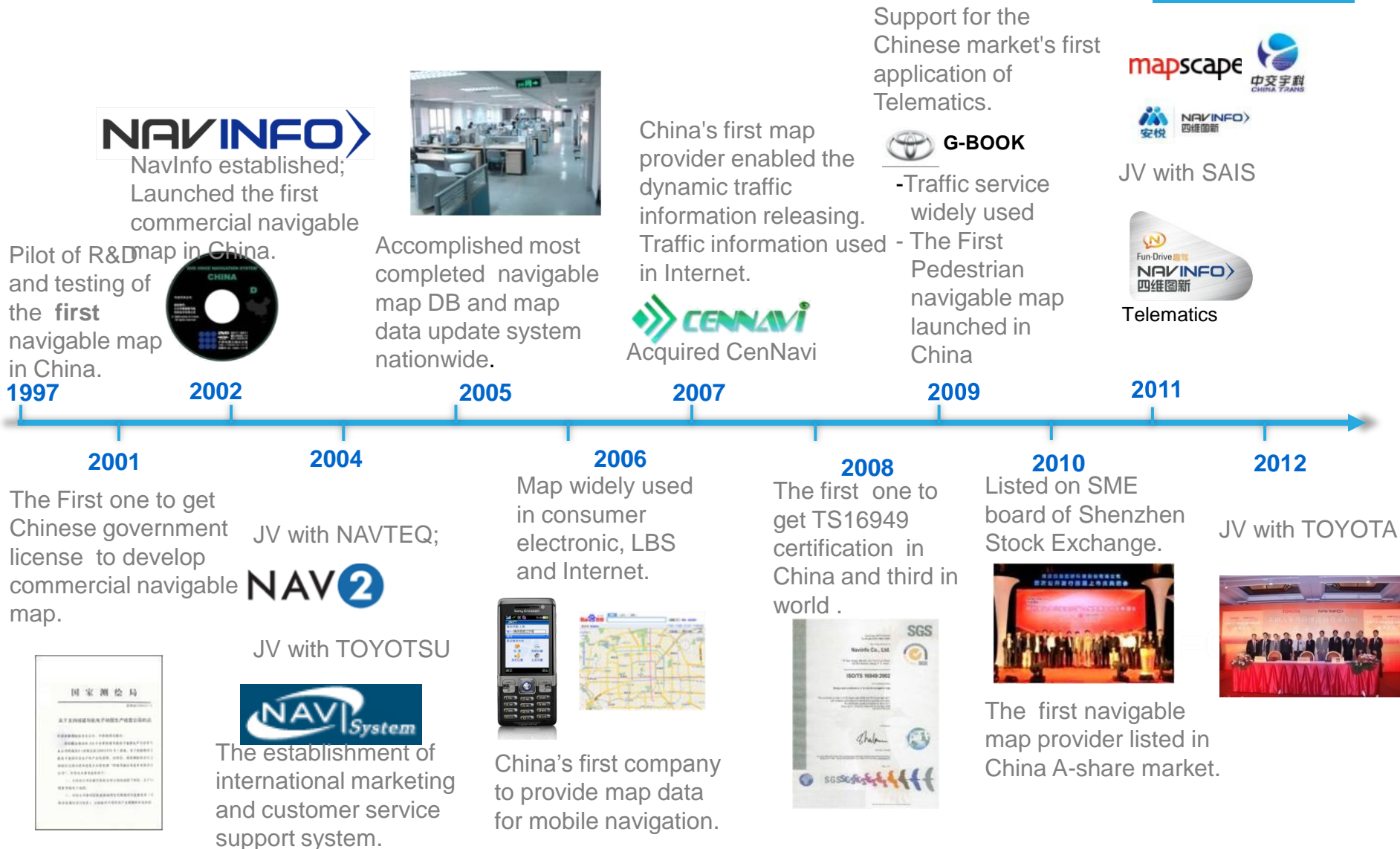
66.96% GPS phone market share in 2011 (navigation map preloaded in smart phone)

Internet & LBS



Over 60 million users rely on NavInfo's map data per day

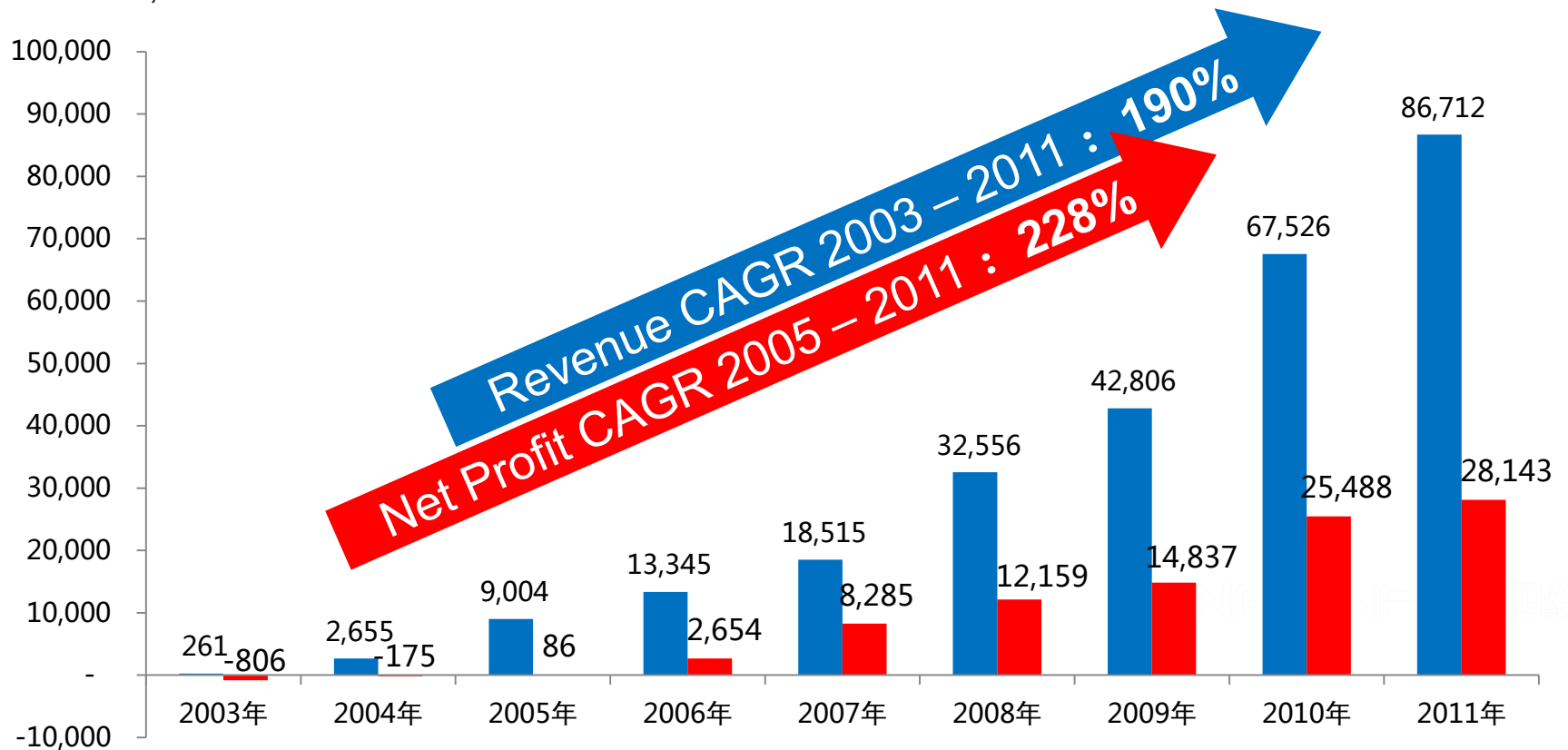
Rapid Development



Stable Growth

Revenue and net profit from 2003 to 2011

Unit: 10,000 Yuan



Data sources: NavInfo Annual Report

Major Clients

In-vehicle Navigation



Cell phone and PND



LBS & Internet



Application in other industry





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Trends of Navigation & Map

www.navinfo.com

| <u>Research Themes</u> | <u>High Freshness</u> | <u>High Richness</u> | <u>High Definition</u> | <u>High Precision</u> |
|------------------------|---|---|------------------------|-----------------------|
| Applications | | Argument Reality | | |
| Service & Platform | | Real-DB Platform for Navinfo data production China Location Cloud Platform | | |
| Infrastructure | | Cloud Platform and Virtualization | | |
| Innovation Data | | ADAS Data, 3D Data, Wireless FingerPrint Data, StreetView Data, Indoor Map | | |
| Data Production | Pattern Recognition & Image Processing UGC data mining | | | |
| Data Survey | DCS in vehicles | | | |



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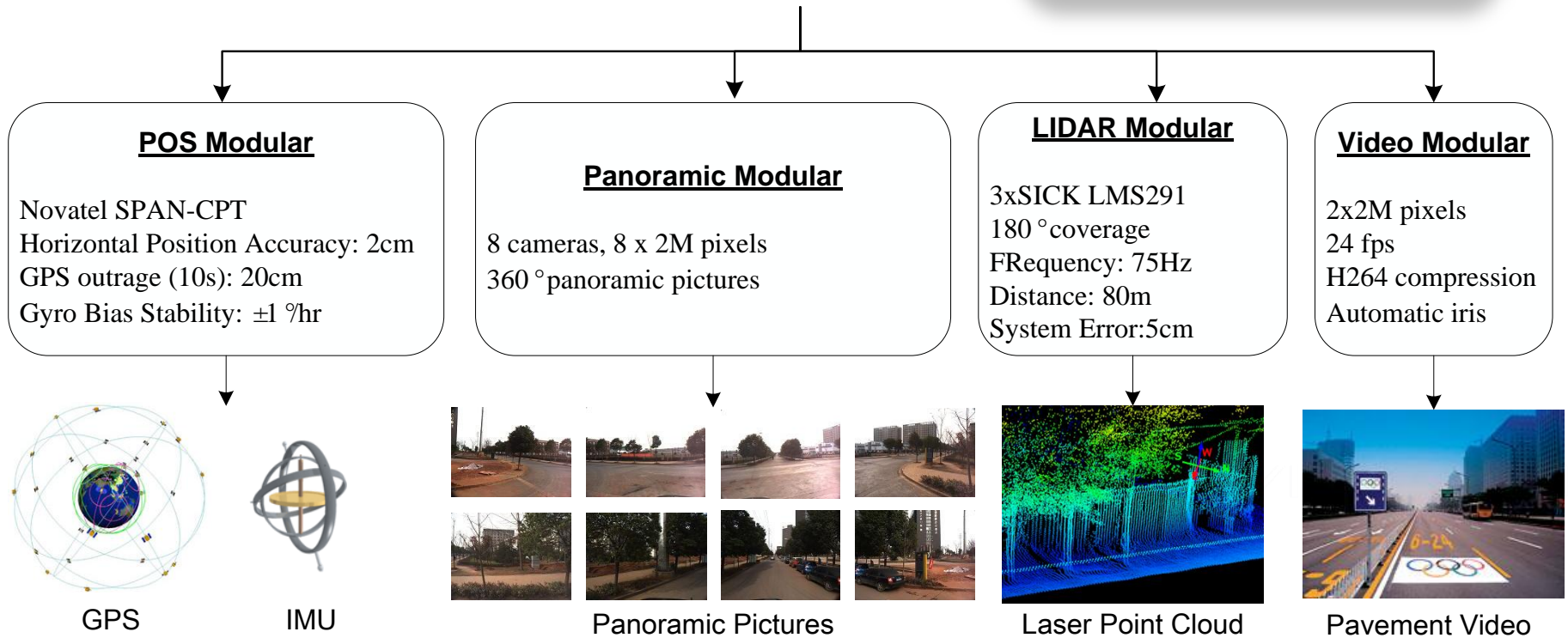
Vehicle-borne DCS V2.0

- High Precision
- Real World Details
- Measurable



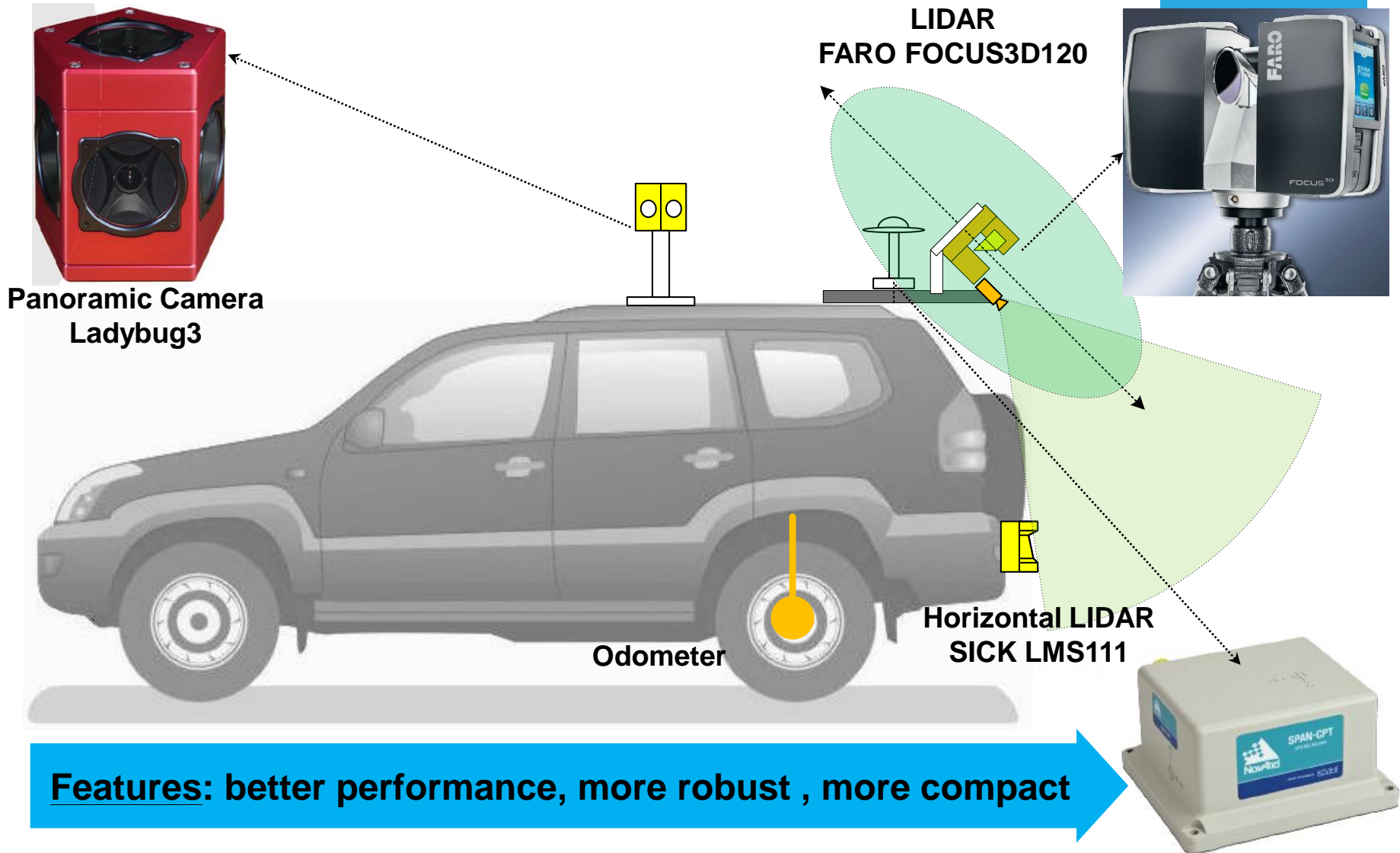
ADAS Data

- *Height, slope*
- *Curvature*
- ...



Vehicle-borne DCS - V2.1

www.navinfo.com



Vehicle-borne DCS V2.0 vs. V2.1



| Items | Vehicle-borne DCS V2.0 | Vehicle-borne DCS V2.1 |
|---------------|---|--|
| POS | <u>SPAN-CPT</u> | <u>SPAN-CPT</u> |
| LIDAR | <u>SICK LMS 291</u> <ul style="list-style-type: none"> •Coverage: 180° •Frequency: 75Hz •Distance: 80m •System error: 5cm | <u>FARO FOCUS3D 120</u> <ul style="list-style-type: none"> •Coverage: 305° •Frequency: 97Hz •Distance: 120m •System error: 0.1cm |
| PANO | <u>In-house development</u> <ul style="list-style-type: none"> •Software compression •2 fps | <u>Pointgrey Ladybug3</u> <ul style="list-style-type: none"> •Hardware compression •16 fps |
| VIDEO | <u>AV2105</u> <ul style="list-style-type: none"> •2 x 2M pixels | <u>AV5105</u> <ul style="list-style-type: none"> •2 x 5M pixels |
| Working Speed | <ul style="list-style-type: none"> • 40km/hr | <ul style="list-style-type: none"> • 60km/hr |



Goal: more detail, higher accuracy, more efficiency

Vehicle-borne DCS V2.1



Vehicle-borne DCS V2.1



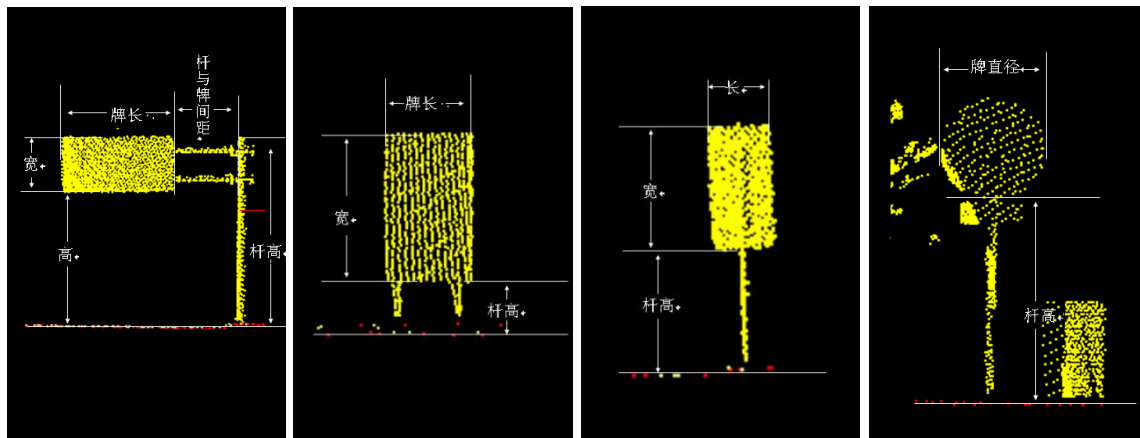
Vehicle-borne DCS V2.1



Vehicle-borne DCS V2.1



Traffic Signboard Detection based on Laser Point Cloud



Signboard for Navigation

- Positions
- Types: *Warning*, *Note*, *Guidance*, *Forbidden*

Traffic Signboard Detection and Classification based on Image



Warning



Note



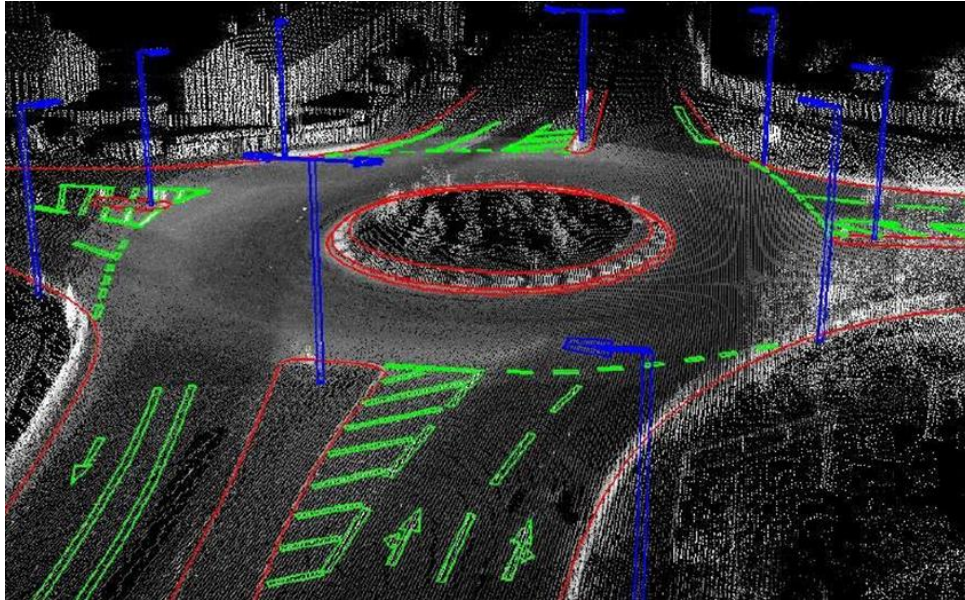
Guidance



Forbidden

Pattern Recognition

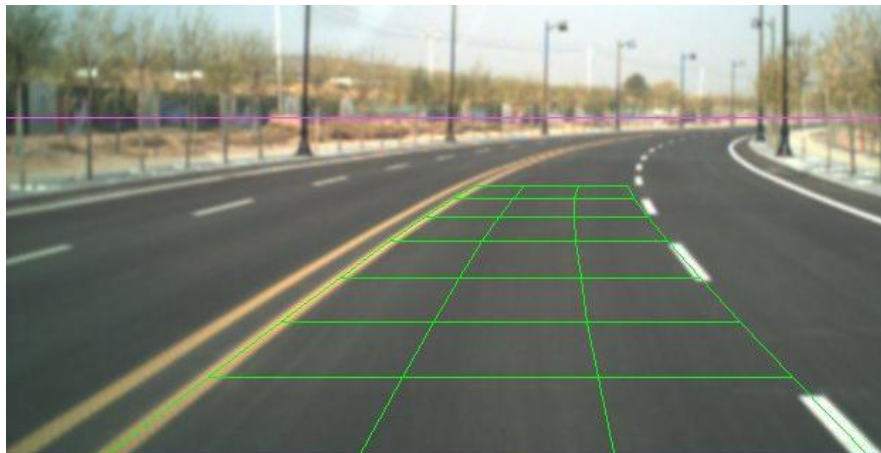
Lane & Mark Detection and Recognition based on Laser Point Cloud



Lane & Mark for Navigation

- Positions
- Road width / Lane width
- Number of lanes
- Types of lanes and marks

Lane & Mark Detection and Recognition based on Image



Face and License Plate Detection

Privacy Data Processing

- Face Detection
- License Plate Detection



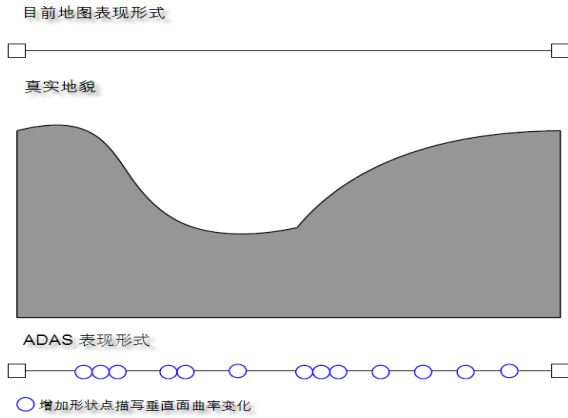


Mapping your way

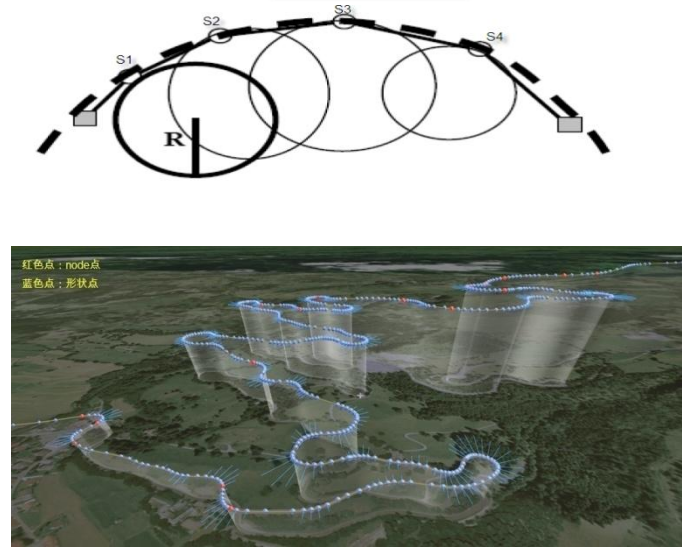
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Advanced Navigation Data: ADAS

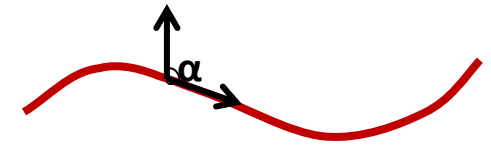
Slope



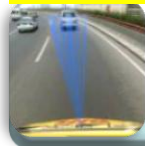
Curvature



Heading



Applications



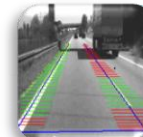
adaptive
cruise system



Fuel-efficient
system



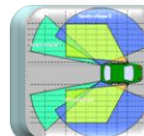
Lane-changing
auxiliary system



Lane-deviating
warning system



Bend warning
system



Blind spot
detecting &
reminding



Self-adjusting
headlights system



Traffic sign
detecting

NavInfo ADAS Status and Roadmap

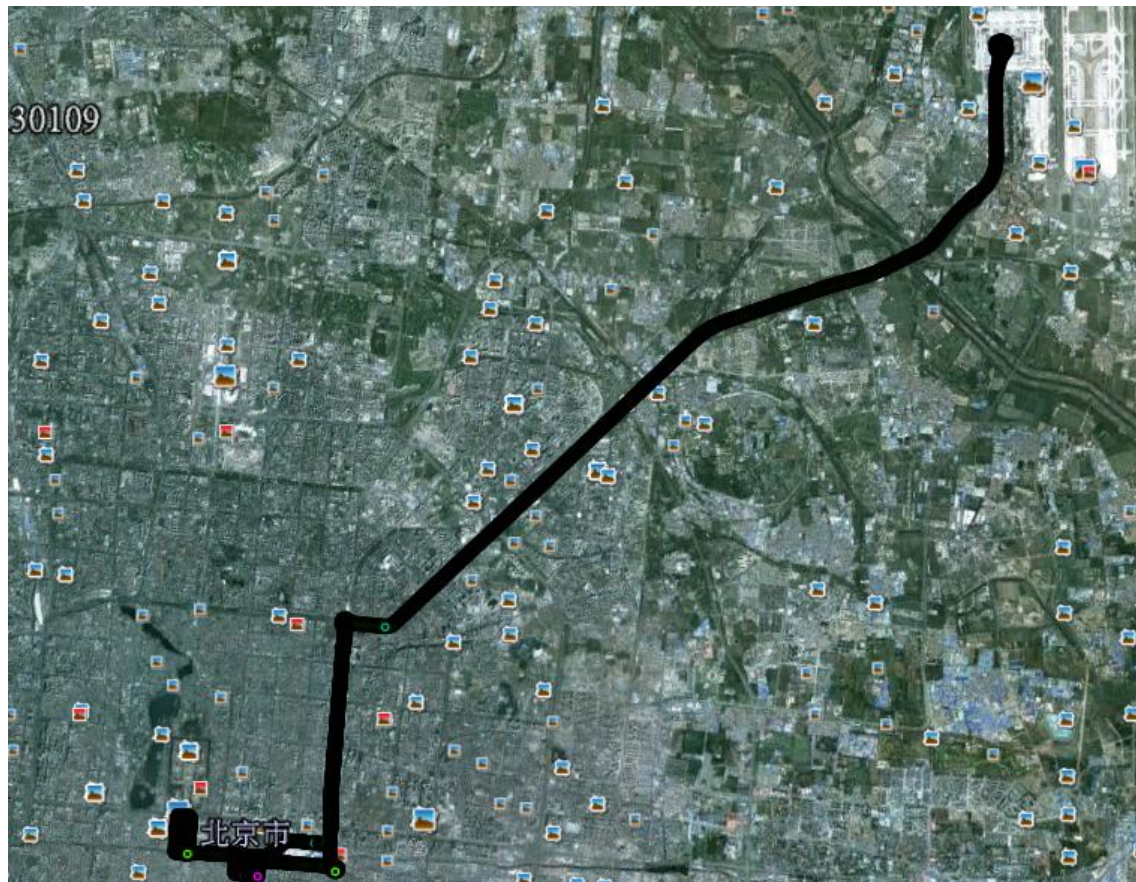
www.navinfo.com

| Content | Category | 2011 | 2012 | 2013 | 2014 | 2015 |
|----------------------|-----------------------------|---|--------------------|--|-----------------------|-----------------------|
| Core Features | High-accuracy road geometry | Beijing: 2 nd ,3 rd ,4 th , 5 th ring road | Beijing: FC1-2 | Beijing/ Shanghai/ Guangzhou/ Chongqing/ HK: FC1-4 | Major cities:FC1-4 | Major cities:FC1-4 |
| | Slope | | | | | |
| | Curvature | | | | | |
| | Heading | | | | | |
| | Slope(low-accuracy) | All China | | | | |
| | Curvature(low-accuracy) | | | | | |
| | Heading (low-accuracy) | | | | | |
| Advanced Speed Limit | Speed category | All China FC1-2 | All China FC1-4 | | | |
| | Speed limit | | | | | |
| | Speed limit condition | NA | All China FC1-4 | | | |

HD Map Data for 2013 China Autonomous Vehicles Competition

www.navinfo.com

- 2013 China Autonomous Vehicles Competition
- Time: 2013 Summer in Beijing
- Road: from Tian'anmen Square to Beijing International Airport, ~30km



HD Map Data

- Road links
- Road lanes
- Traffic signs
- Road marks
- Traffic lights
- Toll gates
- Service Zone
- Gas stations
- Road lights
- Road Cross
- Road Side
- Restriction



Traffic lights



Road mark



Gas station



Note



Guidance



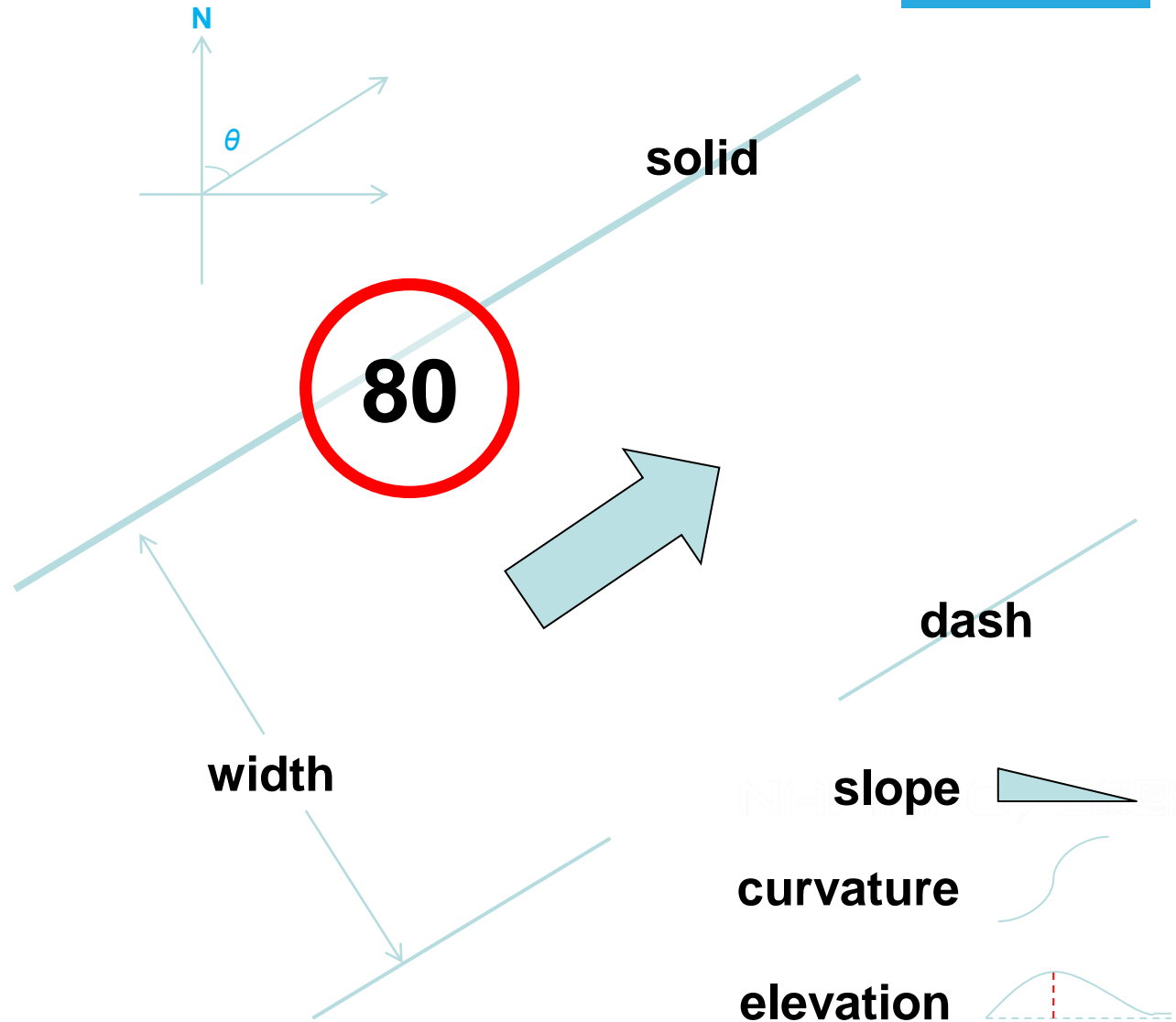
Forbidden



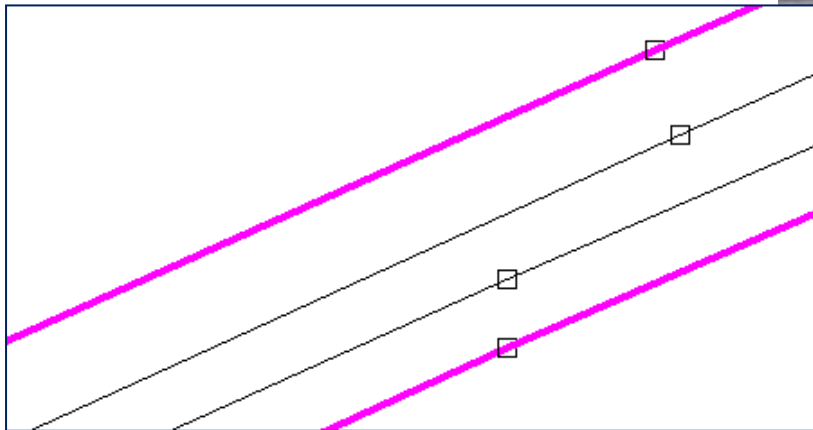
Toll gate

Specification of Road Data

- Road lanes
 - Sequence
 - Type
 - Direction
 - Width
 - Elevation
 - Curvature
 - Slope
 - Arrow
 - Mark
 - Restriction



Data Accuracy: Lane's Geometry (50cm)

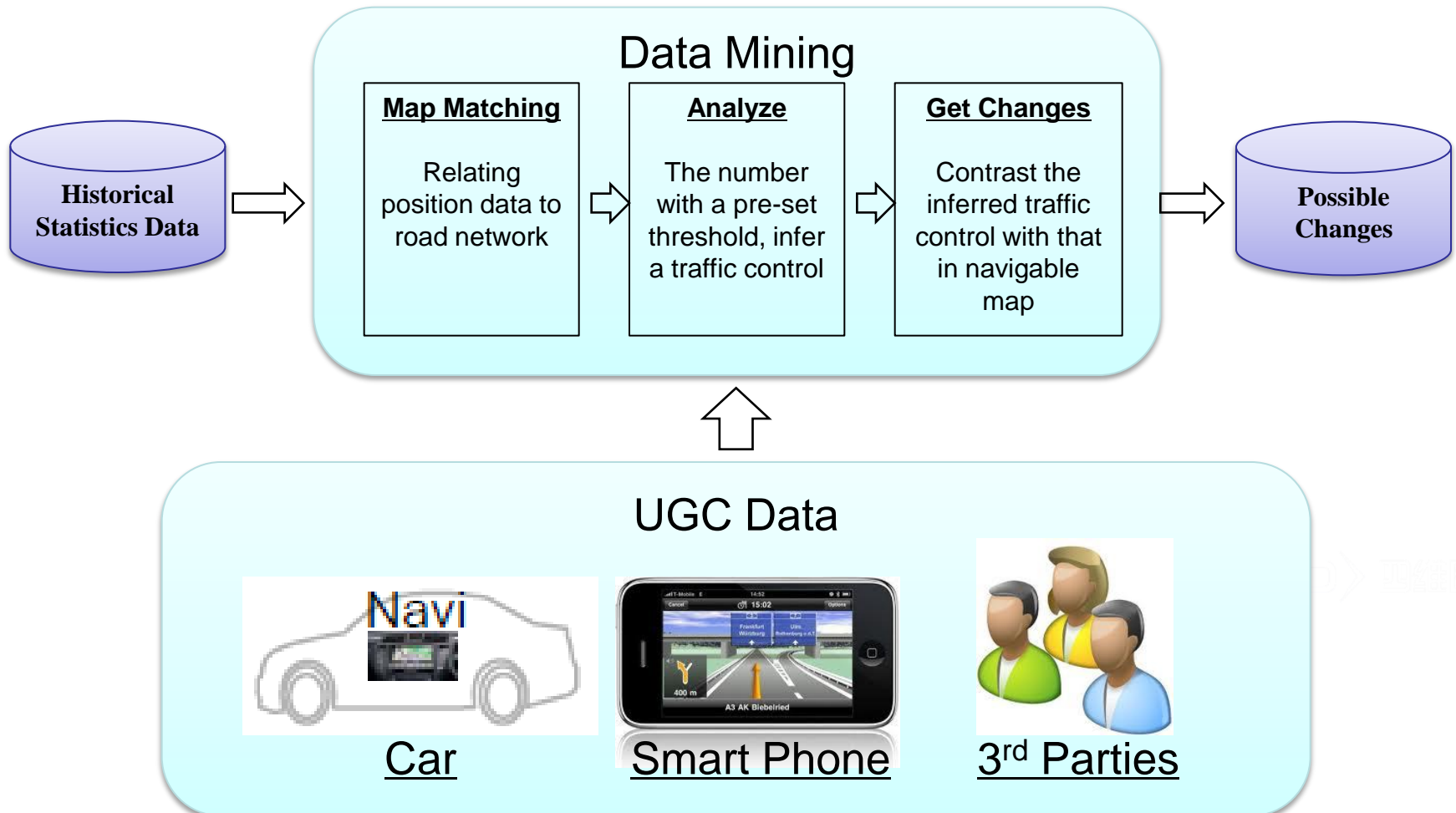




Mapping your way

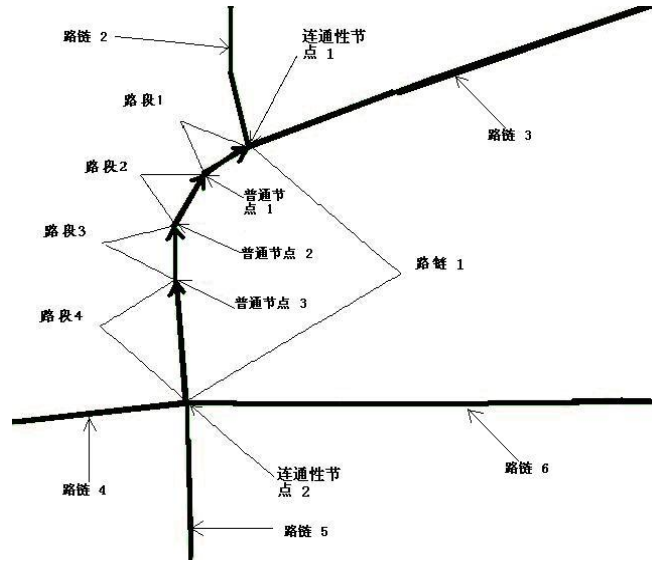
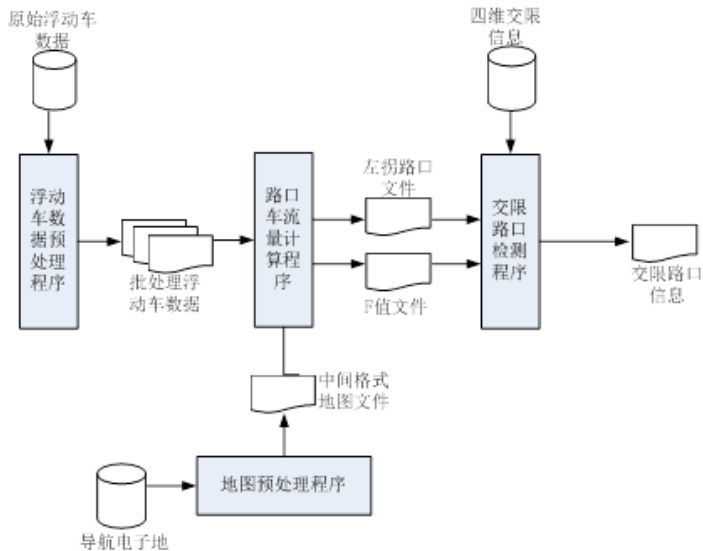
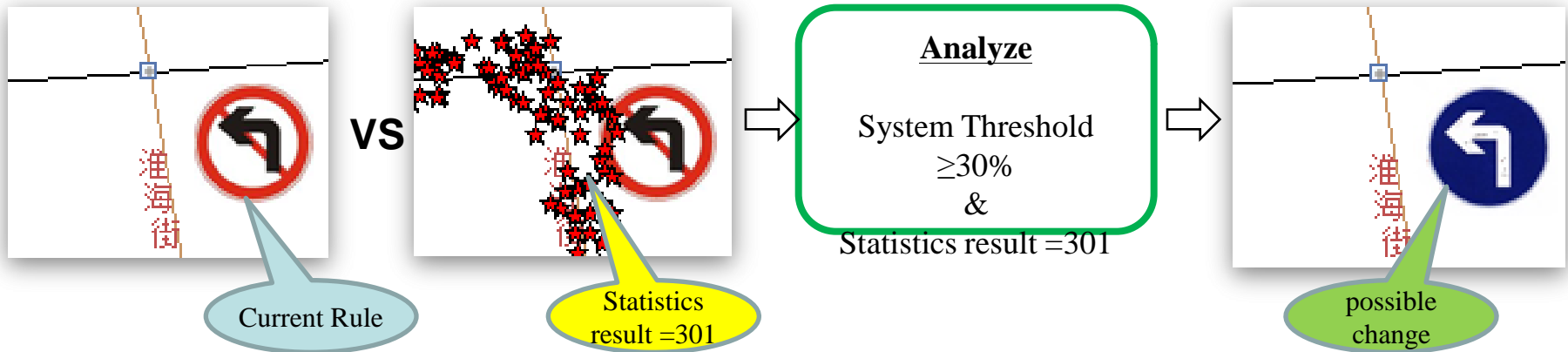
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Detecting changes based on various sensors

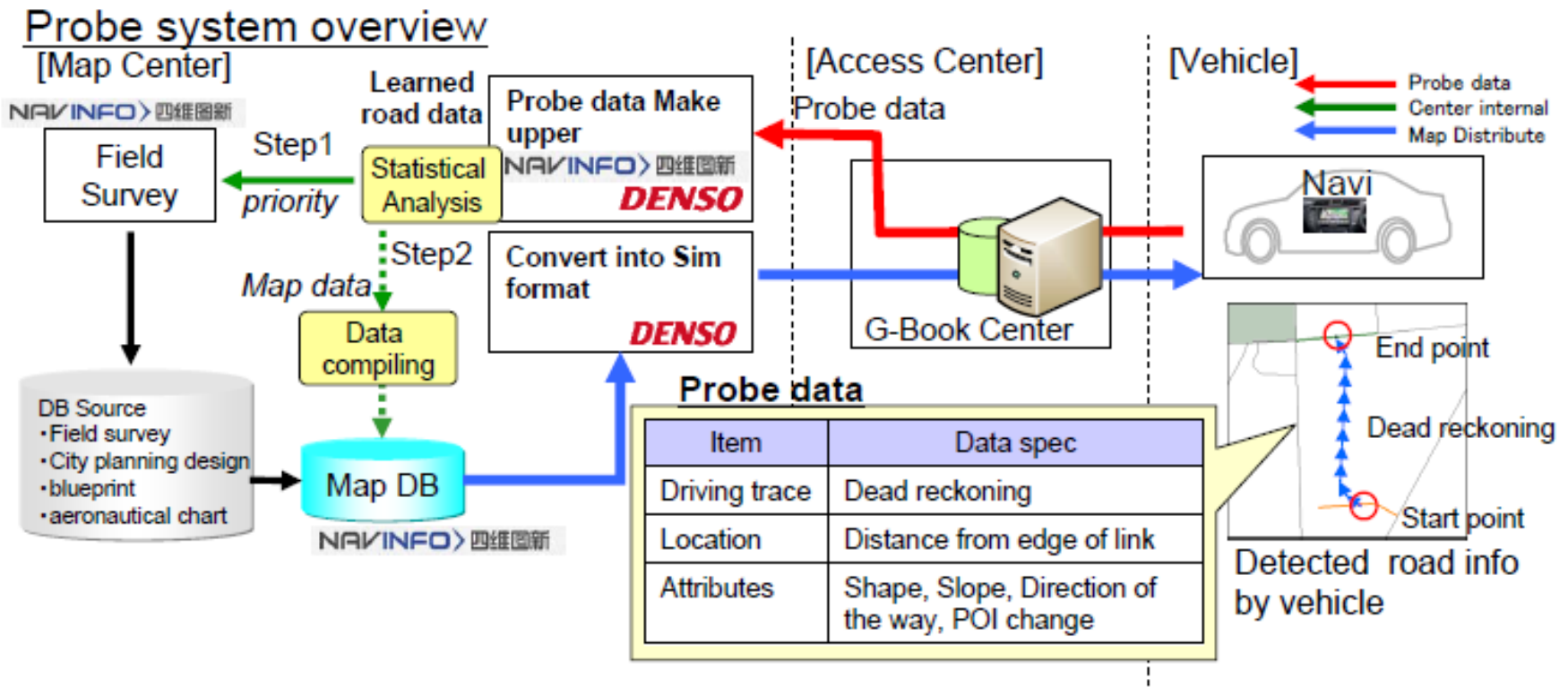


UGC Data Mining

Detecting changes of traffic rules, road shape (or new roads), speed limitation

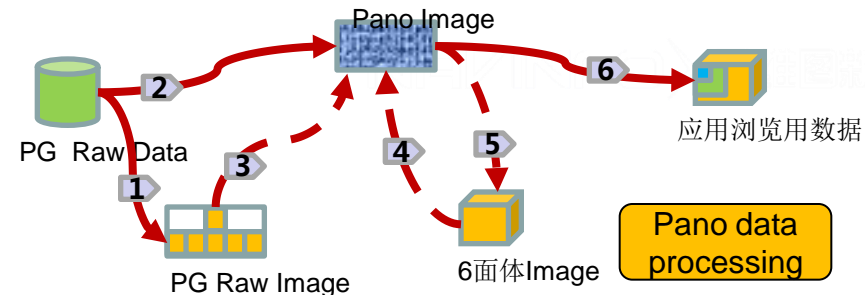
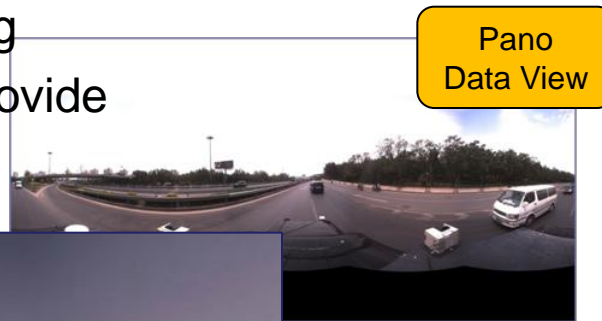
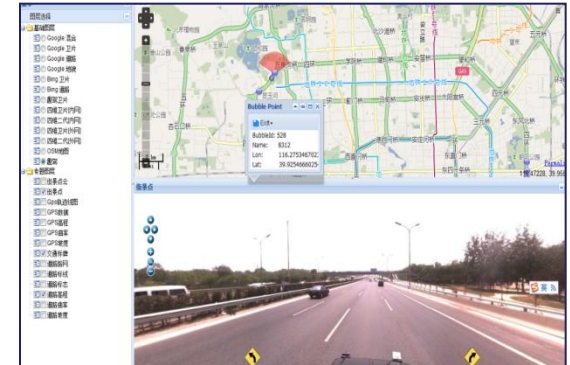


Cooperation with Denso on Probe project



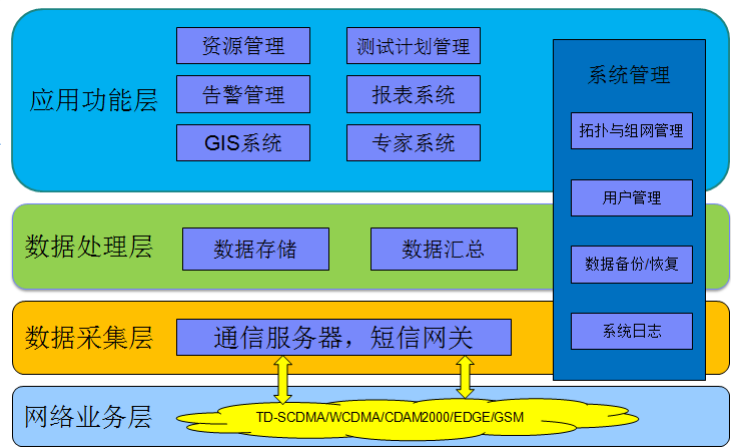
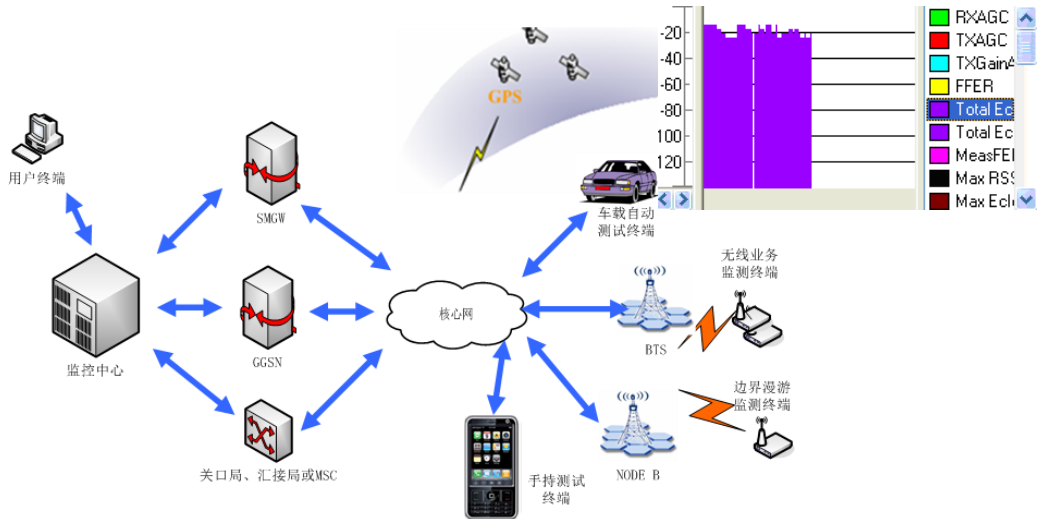
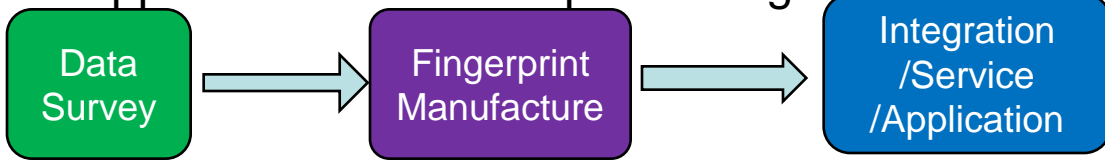
StreetView / Panoramic Data

- China market requirements
 - Google Street View as the sample
 - China Internet companies are interested to provide street view services, i.e., Tencent, Baidu
- Navinfo Ability
 - Pano Data collection
 - Pano Data processing
 - Pano Data service provide

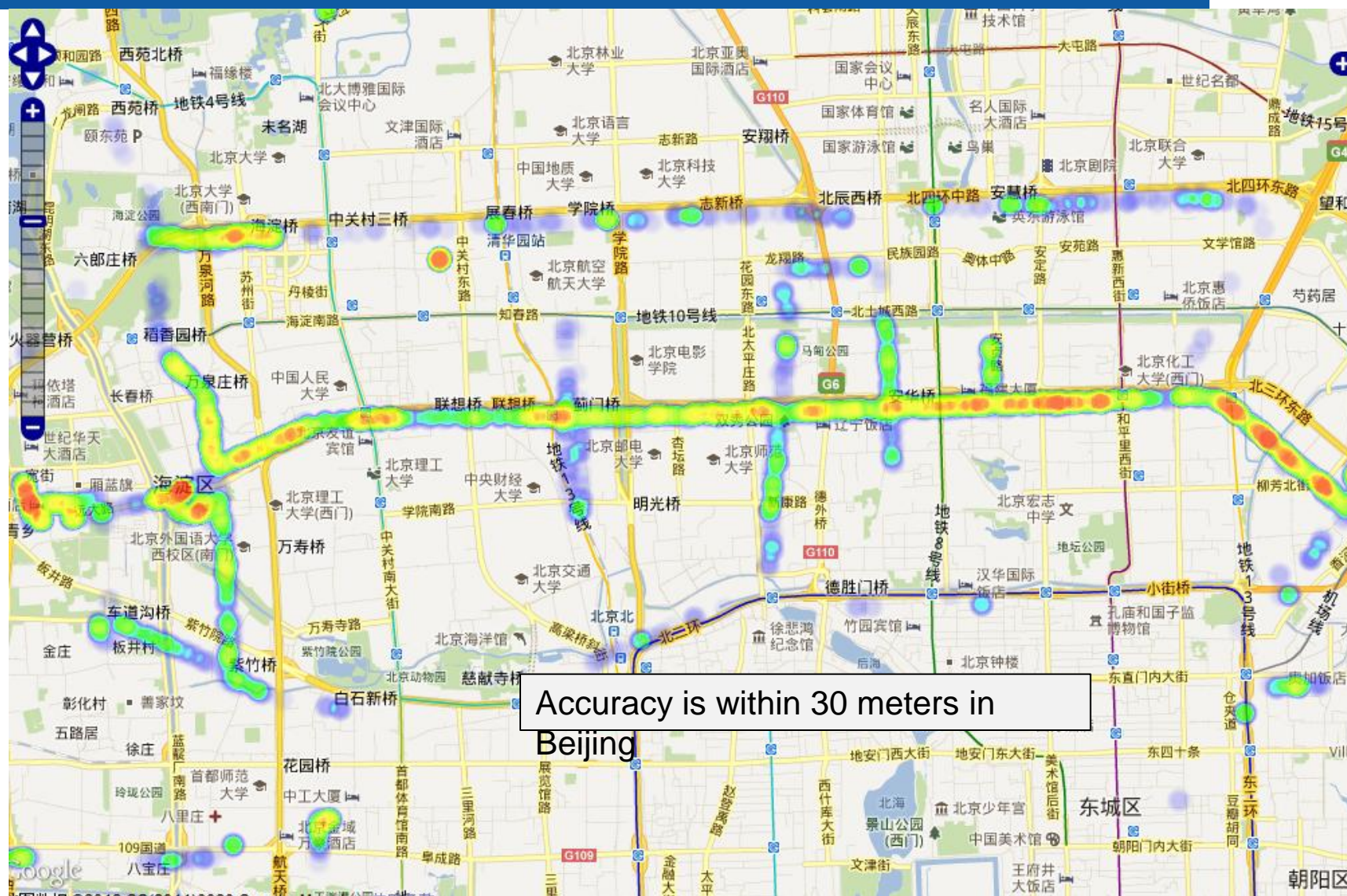


Wireless FingerPrint for Telecom Base Station and WIFI

- Survey wireless signals from telecom base station and WiFi in the city (including indoor environment)
- Build Wireless FingerPrint database
- Support fast and indoor positioning



Positioning Accuracy of WiFi Finger Print in Beijing



ScreenShot: Wireless Finger Print

指纹采集

- 采集WIFI
- 采集基站

日志内容：
GsmSignalStrength:99
GsmSignalStrength:7
getGpsState:true
打开Wifi
10s Wifi
20s cell

FingerPrint Signal Survey

数据导入

任务号： 2

文件： D:\采集数据\北三环沿线\wifi_info.sqlite 选择文件

解密： 是否解密坐标

导入

开始导入
导入结束，共导入1009条基站信息，0条wifi信息
开始导入
导入结束，共导入0条基站信息，2070条wifi信息

Data management

HelloMap

WIFI定位 基站定位

Map showing locations like Wangjing Bridge, Shaoyaoju Bridge, And Taiyuan, Sanyuan West Bridge, Sanyuan Bridge, Xiaojie Bridge, and Xiangheyuan. Includes labels for line-10 and line-13.

Wireless FingerPrint assistant positioning on mobile device

Map showing locations like 和平东桥, 北三环东路, 龙顺园, 汉庭快捷酒店, 光熙门站, 西出口, 东出口, 天津宾馆, 和平街十二区, 成泰美食屋, 北京化工研究, 安时捷, 雾雨轩茶楼, 和平街文化中心小学, 北京精诚文化学校, 淇影创意, 川府美食, 地图数据 ©2013 NavInfo Mapabc- 使用条款

Wireless FingerPrint Data processing platform

任务列表 (前10条)

| 任务号 | 任务类别 |
|-----|------|
| 2 | WIFI |
| 1 | 基站 |

基站:任务1 共1009条记录未清洗
当前处理: 1-200 [处理完毕](#)



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R & D Partners



武汉大学

WUHAN UNIVERSITY



中国科学院地理科学与资源研究所

Institute of Geographic Sciences and Natural Resources Research, CAS

- Natural Language Processing Technology: Extended POI information
- Word of geographic information technology research



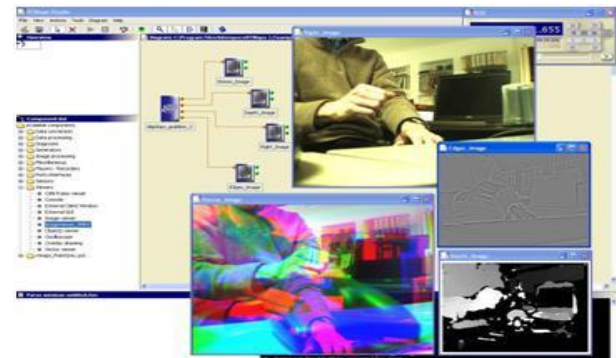
北京航空航天大学
BEIHANG UNIVERSITY

- "Hegaoji" special program: Non-structured data management system



上海交通大学
SHANGHAI JIAO TONG UNIVERSITY

- Refined image-based detection and identification of road information (Innovative Research Fund)



SuperMap®



北京大学
PEKING UNIVERSITY

- Grid GIS
- Dynamic traffic flow forecasting



Mapping your way



NAVINFO > 四维图新

Thanks!

THANKS!

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