realtrac
Registered trademark
of RTL-Service JSC
http://rtlservice.com/

RealTrac™ technology overview

Alex P. Moschevikin

PhD, CSO of Nanonets LTD,
former CSO of RTL-Service JSC,
associate professor,
Petrozavodsk State University,
alexmou @ lab127.karelia.ru

GS NANOTECH
ТЕХНОПОЛИС GS
http://lab127.ru/

R&D

RealTrac™ project started in 2008.

- Hardware
- Antenna design
- Embedded software
- Communication protocol INCP
- System and network architecture
- Server-side software
- Client-side software
- Voice communication
- Localization engine

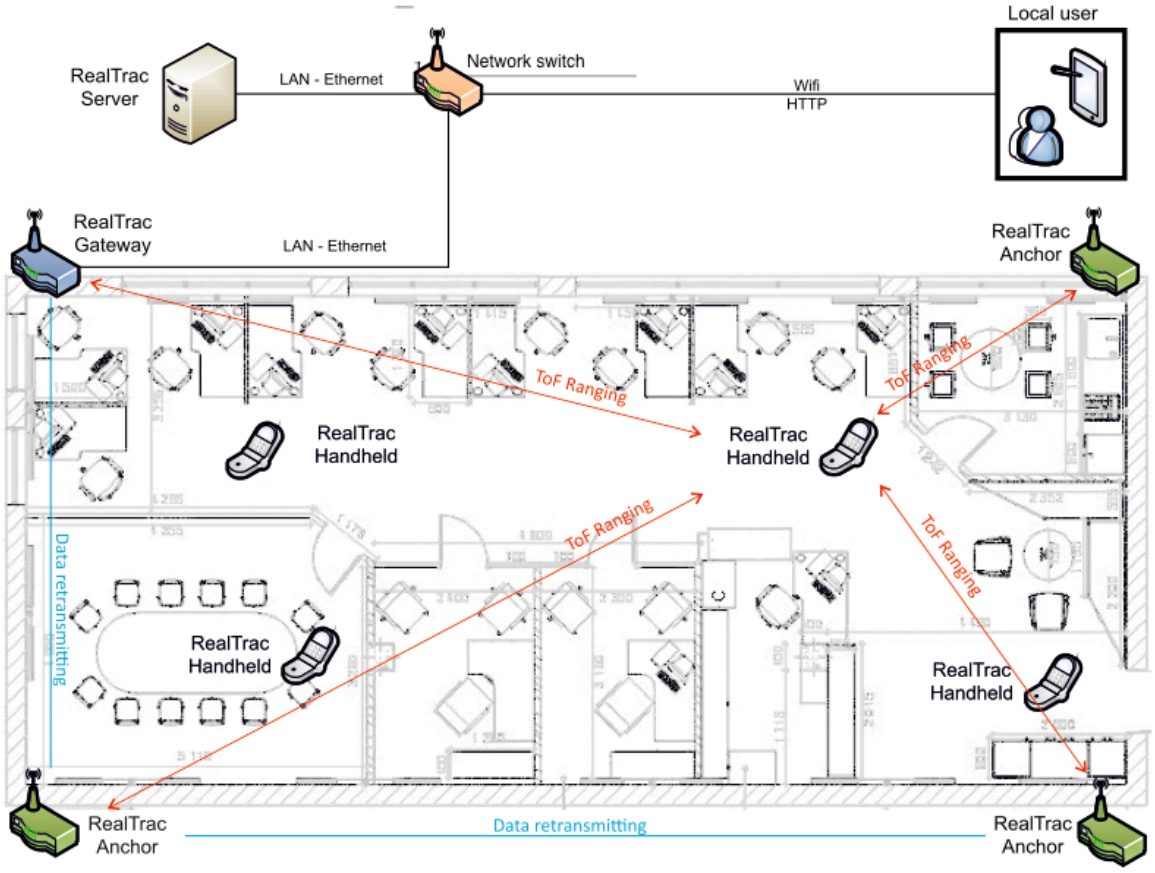
IT-park of PetrSU,
RTL-Service JSC, Nanonets LTD

25 developers (+ part-time researchers and students), including 8 PhDs.
Average age: 30 years

RealTrac™ Technology Summary

wireless & mobile	power saving
wireless sensors networks	
localization	
voice communication	

RealTrac



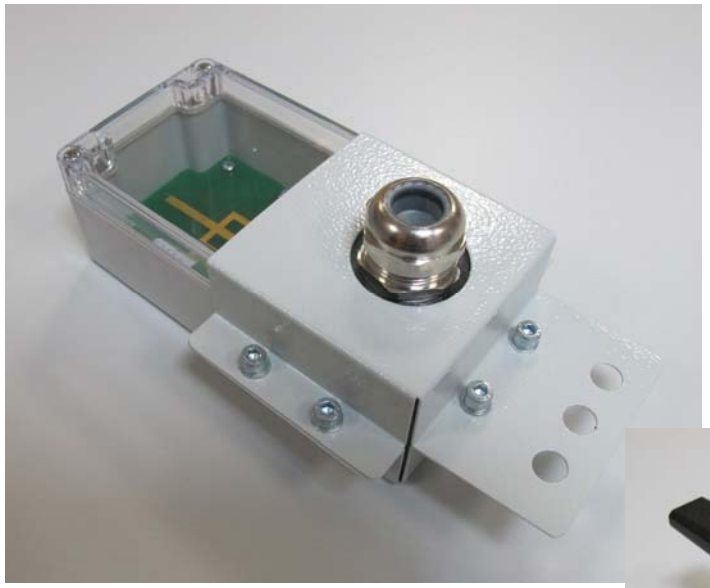
RealTrac™ devices for indoor applications

Ethernet access points

Intercom Rio

Tag

RealTrac™ devices for outdoor and industry



In partnership with "Ingortech" (Ekaterinburg, Russia)

Embedded sensors

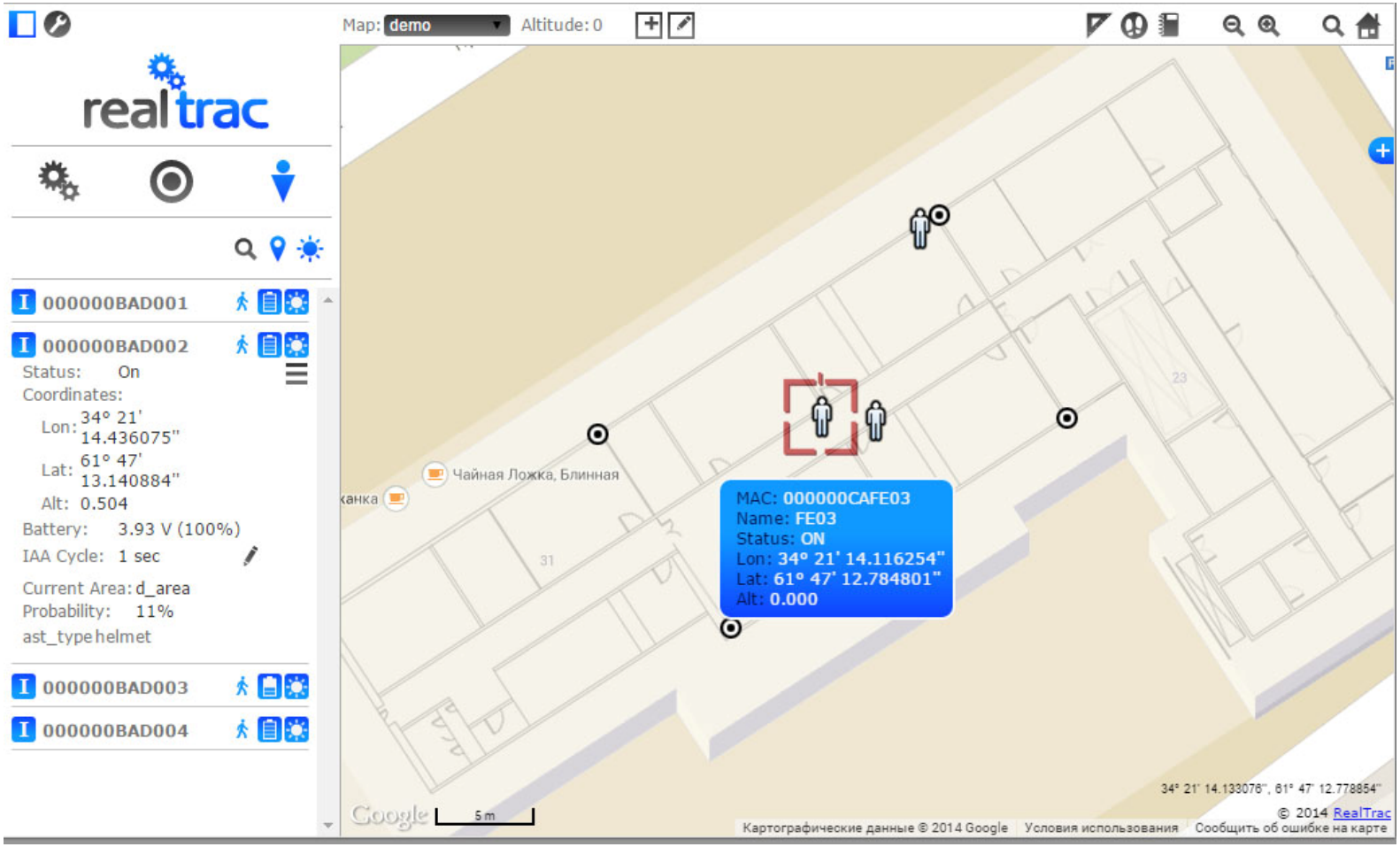
Mobile nodes

- Pressure
- Temperature
- Received signal strength
- 3D accelerometer
- 3D gyroscope
- 3D magnetometer
- RFID proximity tag

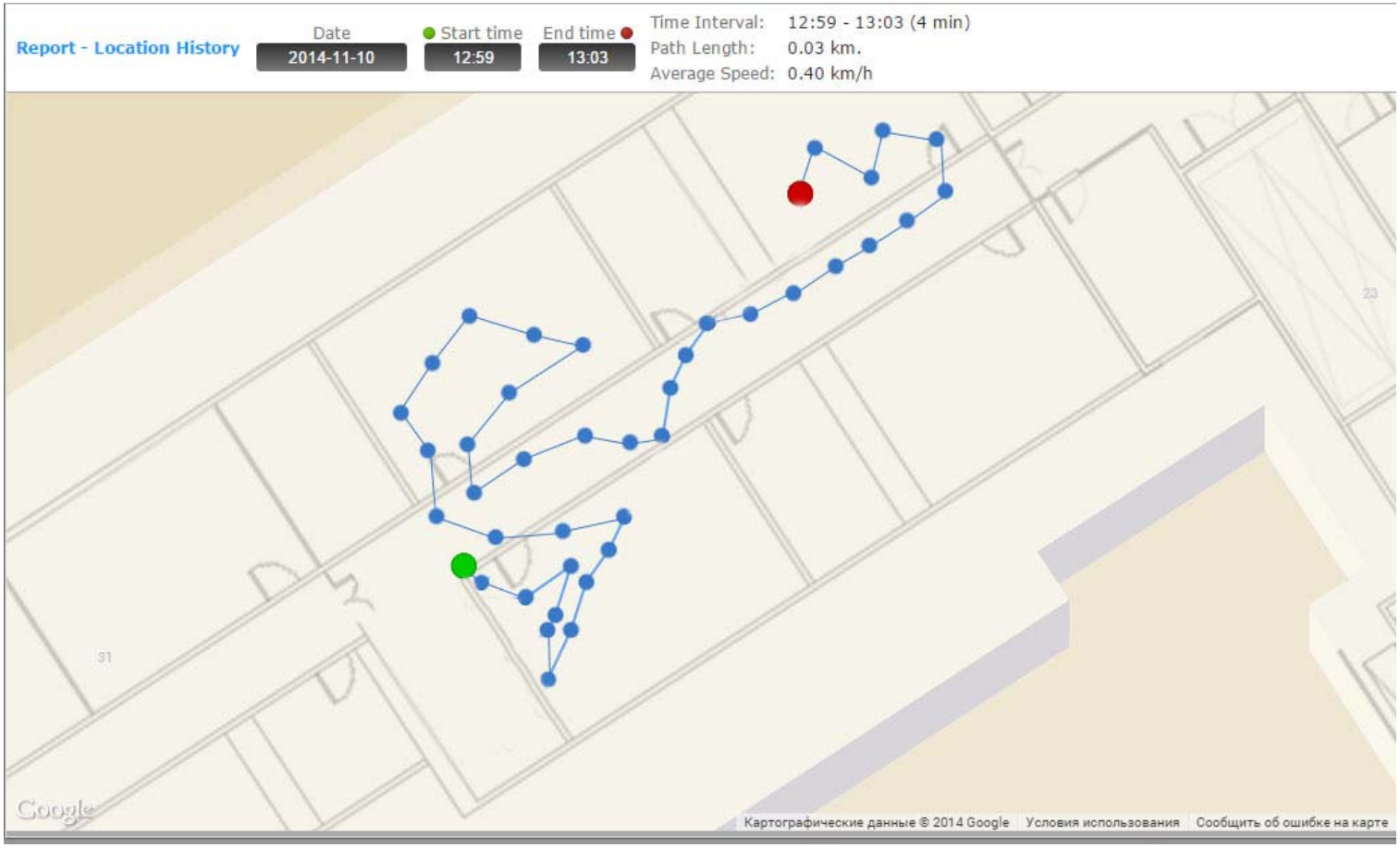
Access points

- Pressure
- Temperature
- Received signal strength

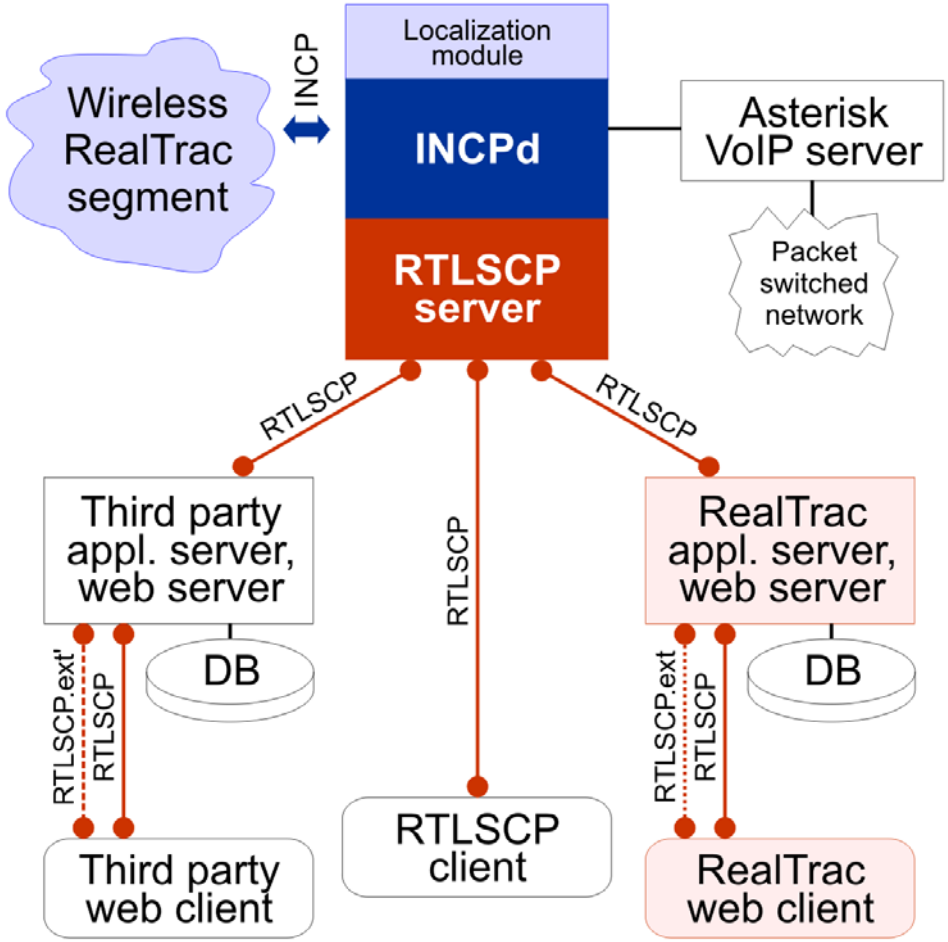
Client software (web browser)



Movement history



RealTrac™ Technology Architecture



RealTrac™ voice communications

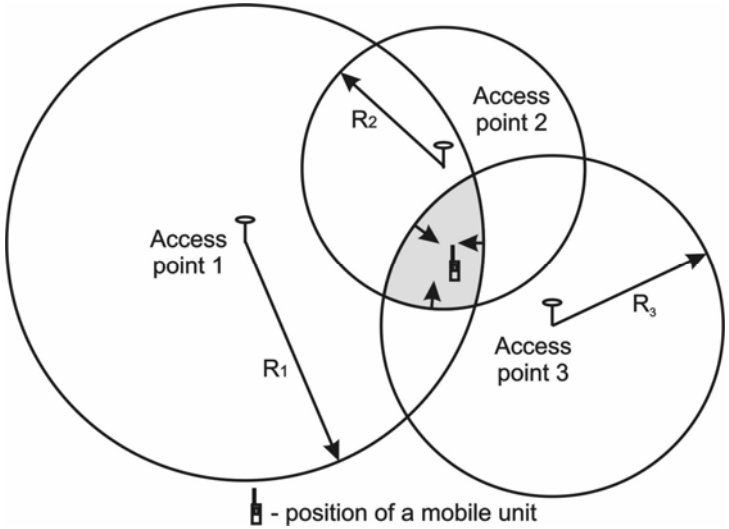
- Asterisk software PBX
- 16 bit, 8 kHz, G.729A, ≈8kbit/s, adaptive (up to 5 times) redundancy
- Duplex sessions (peer-to-peer, phone calls)
- Half-duplex radio (one-to-all, voice broadcasting)

NanoLOC wireless standard

RealTrac™ is based on **nanoLOC™** RF standard (IEEE 802.15.4a).

NanoLOC™ features:

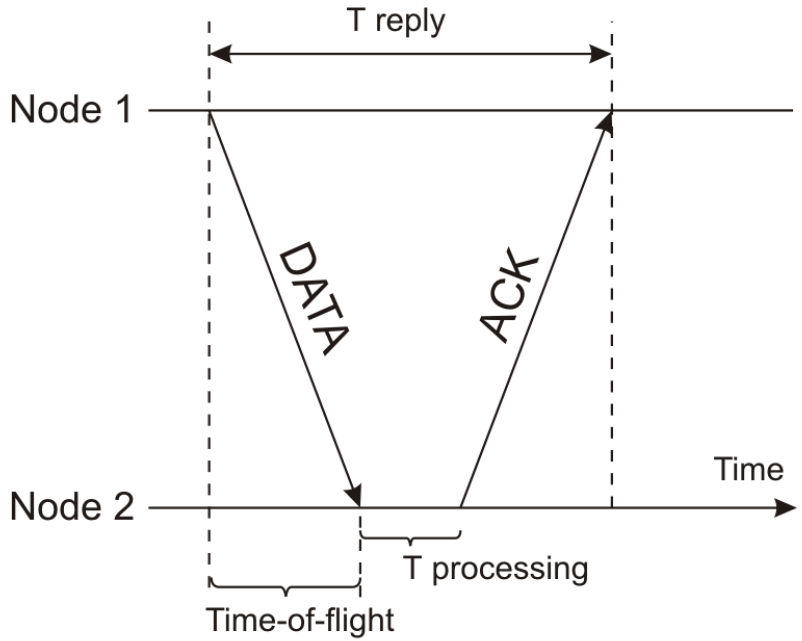
- developed by Nanotron Technologies GmbH (Germany)
- license free ISM band 2.4 GHz
- chirp modulation
- low power consumption
- **receive signal strength measurements (RSS)**
- **time-of-flight ranging (ToF)**



ToF ranging basics, RTT scheme

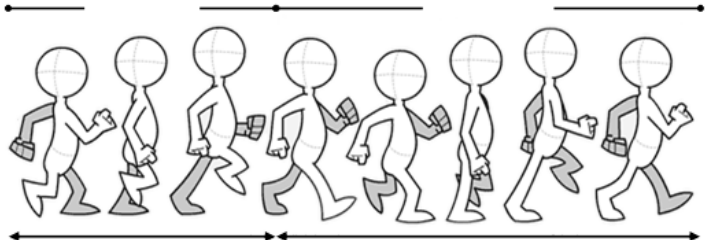
$$d = c * \Delta t$$

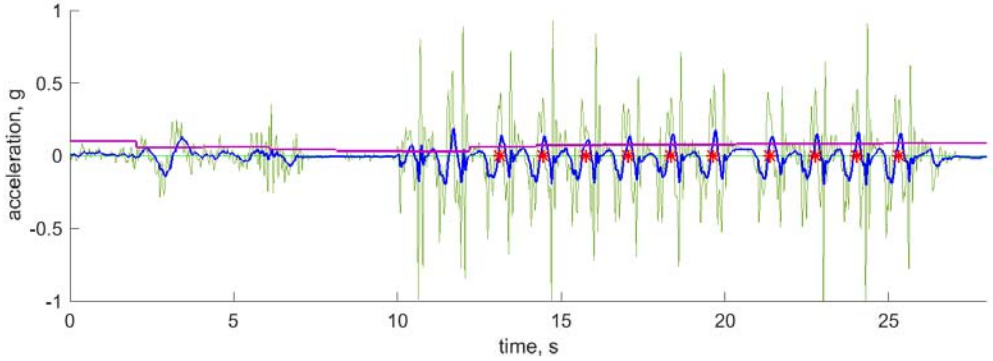
d = distance
c = speed of light
Δt = time-of-flight



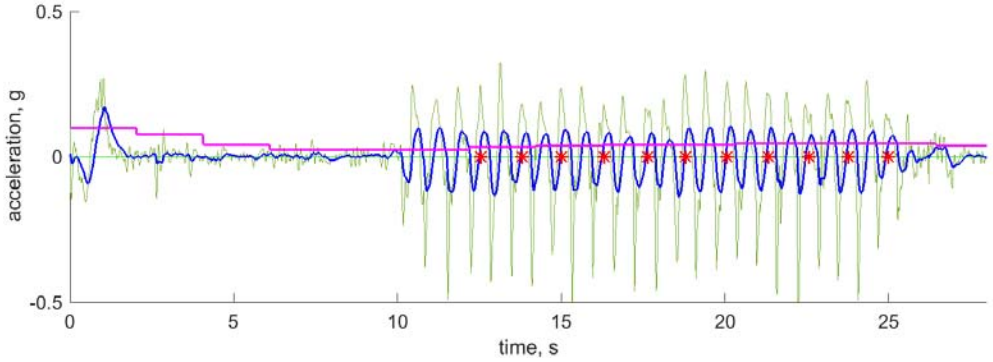
$$\Delta t = (T_{reply} - T_{proc}) / 2$$

Inertial Measurement Unit (walking pattern)





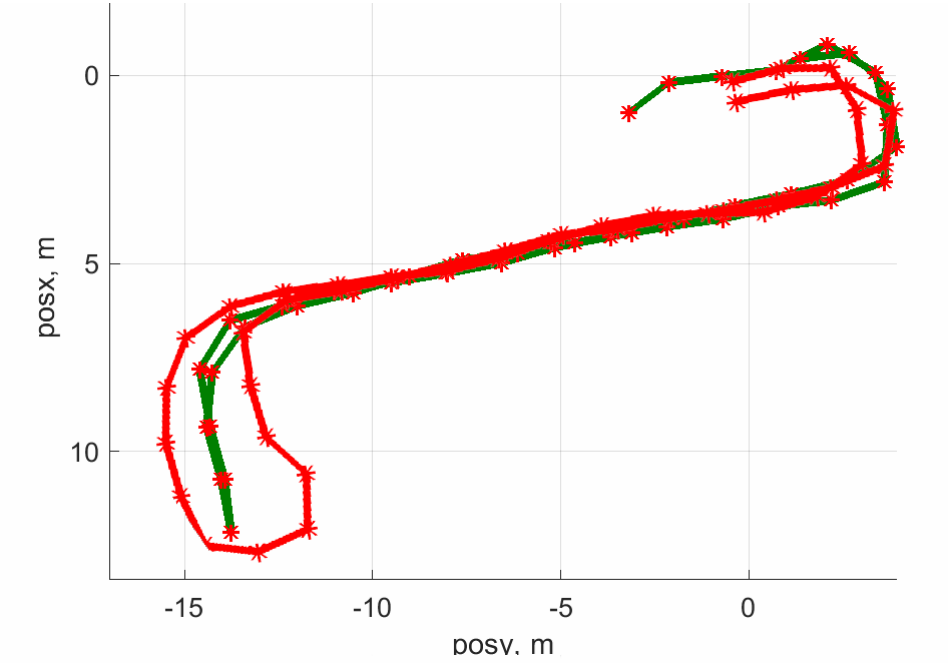
device in hanging hand



device near head

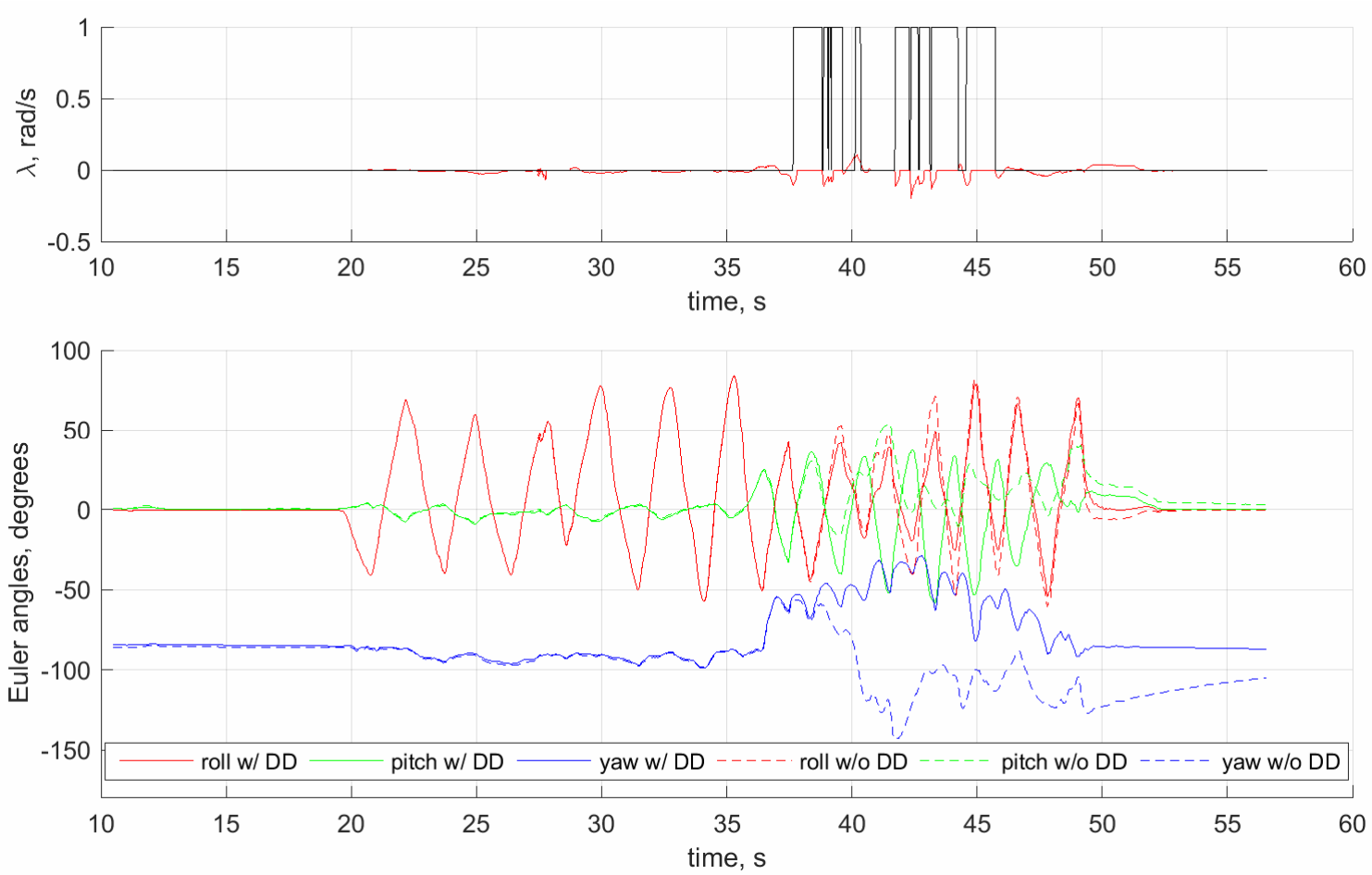
Inertial Measurement Unit (trajectory)

accelerometer
+
gyroscope
+
magnetometer
=
trajectory



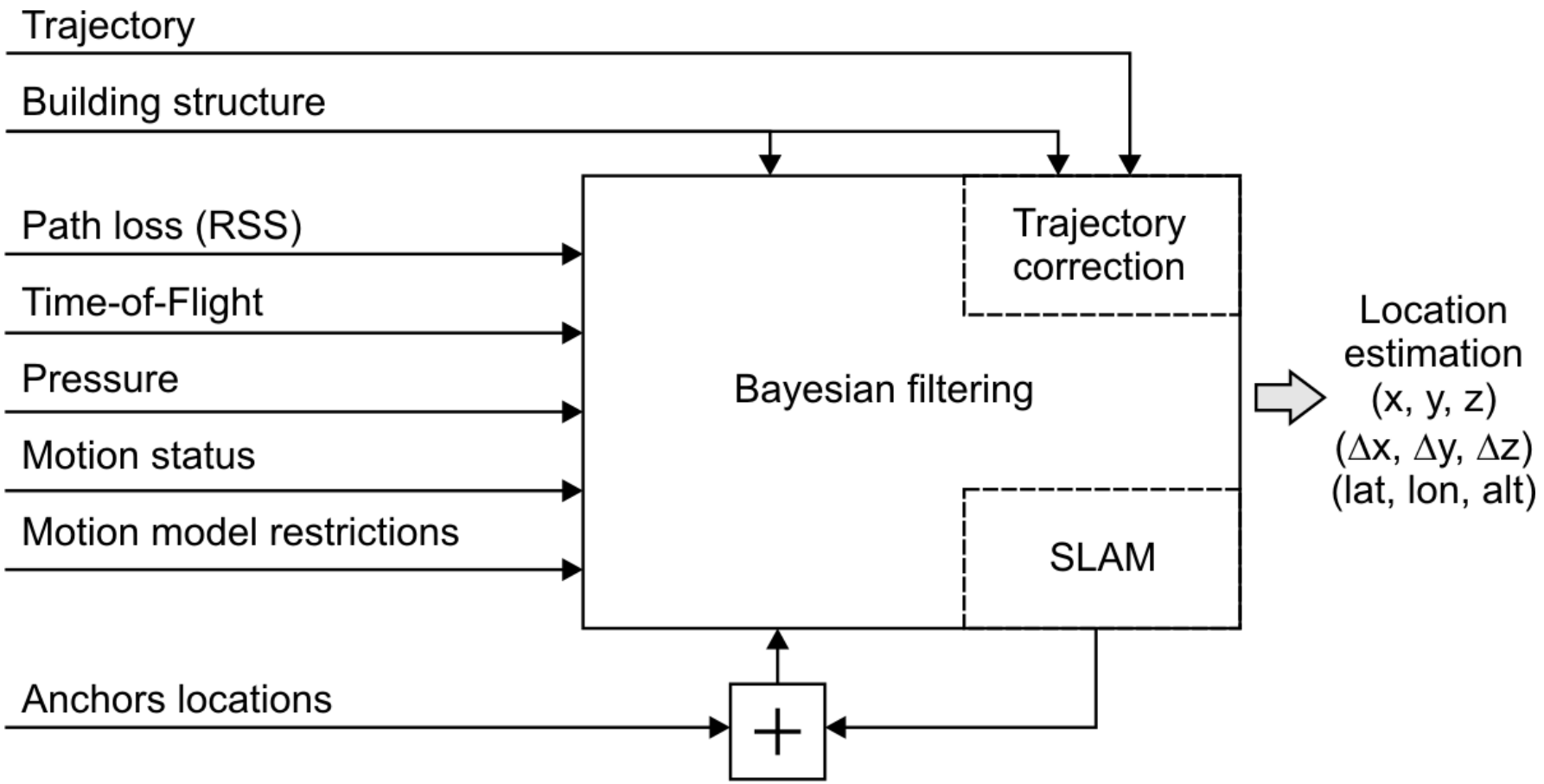
step length, step direction, step number

Inertial Measurement Unit (corrections)



Navigation: Gyroscope vs Magnetometer

RealTrac™ localization engine



RealTrac™ ranging scheme

The main principle of RealTrac™ system –
to provide voice communication and localization services with effective radio bandwidth utilization.

1. Intercoms perform ranging to neighboring anchors/repeaters.
2. Ranging results (if any) are sent by Intercom in IAA packet.
3. IAA packets are received by gateways and then redirected to a server.
4. The server may issue commands to several gateways to perform additional ranging to intercoms if needed.

Data and events (RTLS CP)

Obtained data

- Position XYZ in geo-coordinates
- Trajectory (IMU) in local coords.
- Step counter (IMU)
- Battery voltage
- Alive cycle duration
- Pressure
- Temperature
- Received signal strength

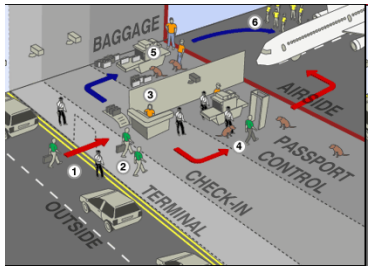
Generated events

- Distance to object
- Location based events
- Voice calls
- Temperature monitor
- Battery level
- RFID proximity event
- Activity trigger
- Man-down event
- Gesture recognition (?)

Data and events are available through RTLS Communication Protocol.

Applications

Case: Safety, security and control



Where is a lost passenger?

I need RealTrac Technology!

Help me!

Where are my kids?

Case: Hotel

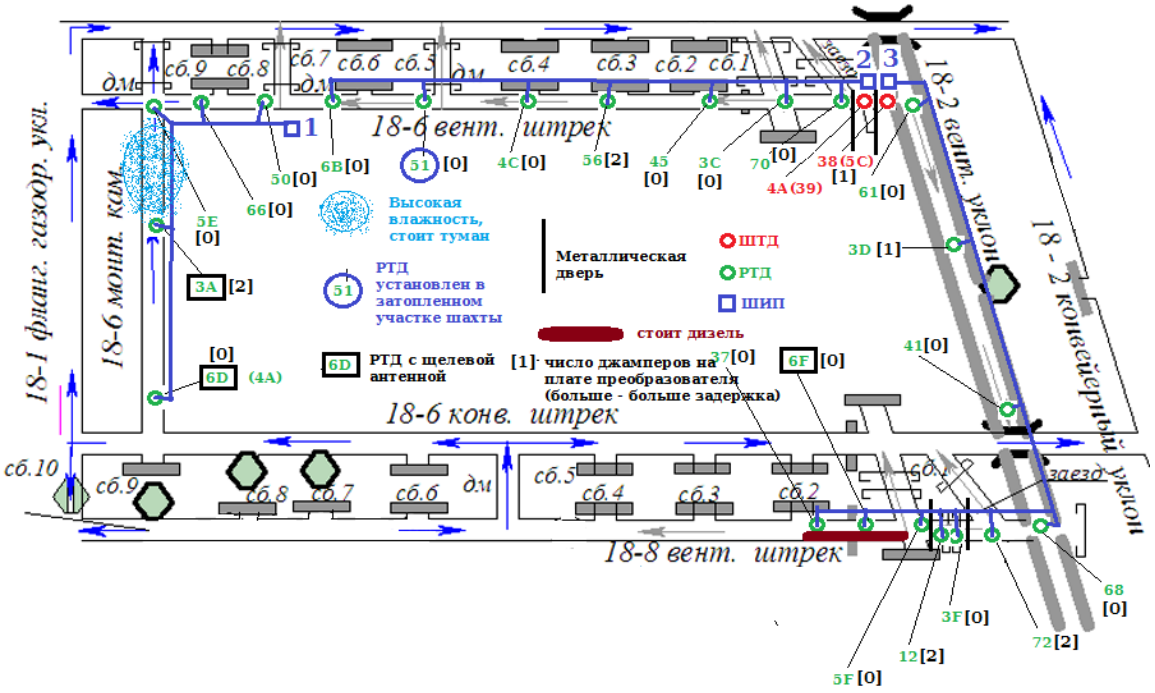
Juice, please!

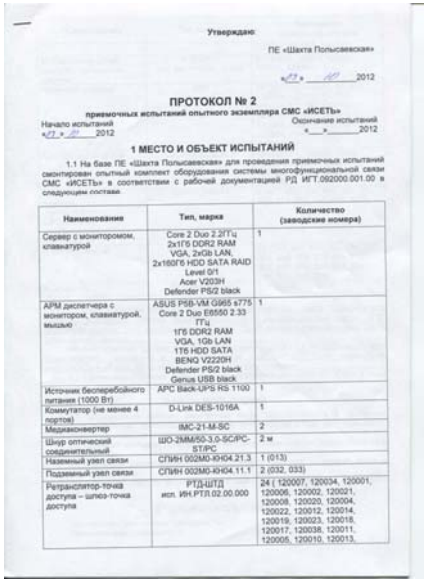
Juice, please!

No need to explain where you are,

the service finds you!

Coal mines, Ingortech (since 2011)

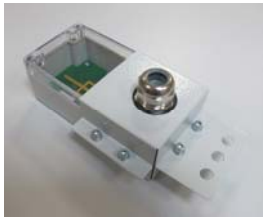


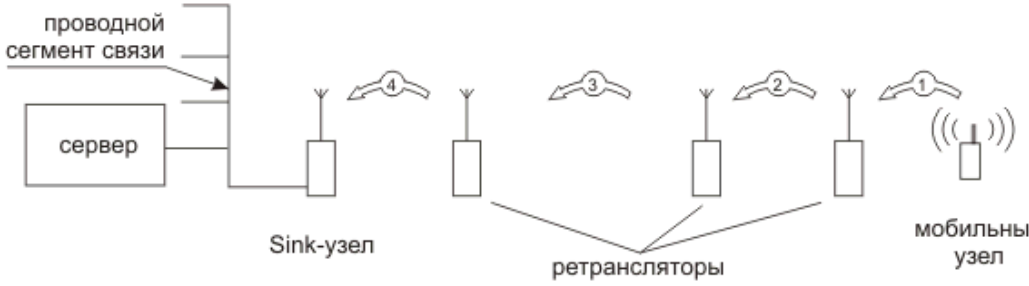


ПРОТОКОЛ № 2
приемочных испытаний опытного экземпляра СМС «ИСЕТЬ»

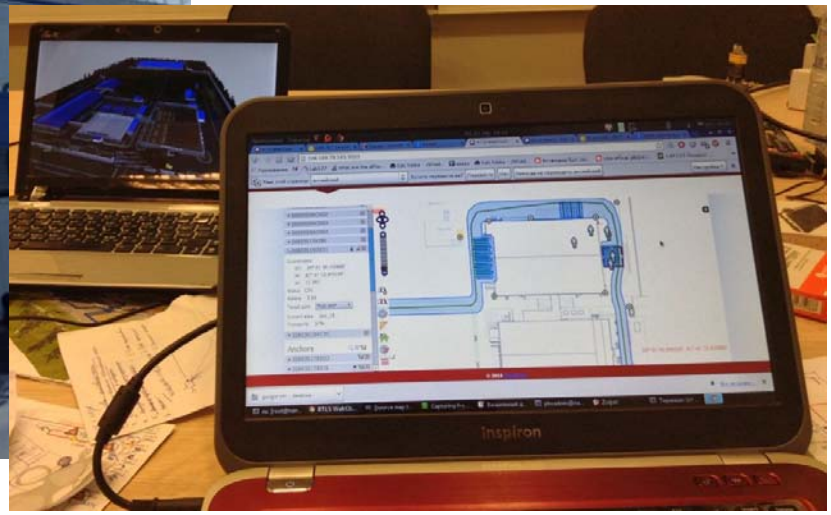
1 МЕСТО И ОБЪЕКТ ИСПЫТАНИЙ

Наименование	Тип, марка	Количество (заводские номера)
Сервер с монитором, клавиатурой	Core 2 Duo 2.2ГГц 2x1Гб DDR2 RAM VGA, 2xGb LAN, 2x160Гб HDD SATA RAID Level 0/1 Acer V203H Defender PS/2 black	1
АРМ диспетчера с монитором, клавиатурой, мышью	ASUS P5B-VM GI965 s775 Core 2 Duo E6550 2.33 ГГц 1Гб DDR2 RAM VGA, 1Gb LAN 1Тб HDD SATA BENQ V2220H Defender PS/2 black Genius USB black	1
Источник бесперебойного питания (1000 Вт)	APC Back-UPS HS 1100	1
Коммутатор (не менее 4 портов)	D-Link DES-1016A	1
Медиаконвертер	IMC-21-M-SC	2
Шнур оптический соединительный	ШО-2ММ/50-3,0-SC/PC-ST/PC	2 м
Наземный узел связи	СПИН 002МО-ЮН04.21.3	1 (013)
Подземный узел связи	СПИН 002МО-ЮН04.11.1	2 (032, 033)
Ретранслятор-точка доступа – шлюз-точка доступа	РТД-ШТД исп. ИН.РТЛ.02.00.000	24 (120007, 120034, 120001, 120006, 120002, 120021, 120008, 120020, 120004, 120022, 120012, 120014, 120019, 120023, 120018, 120017, 120038, 120011, 120005, 120010, 120013,

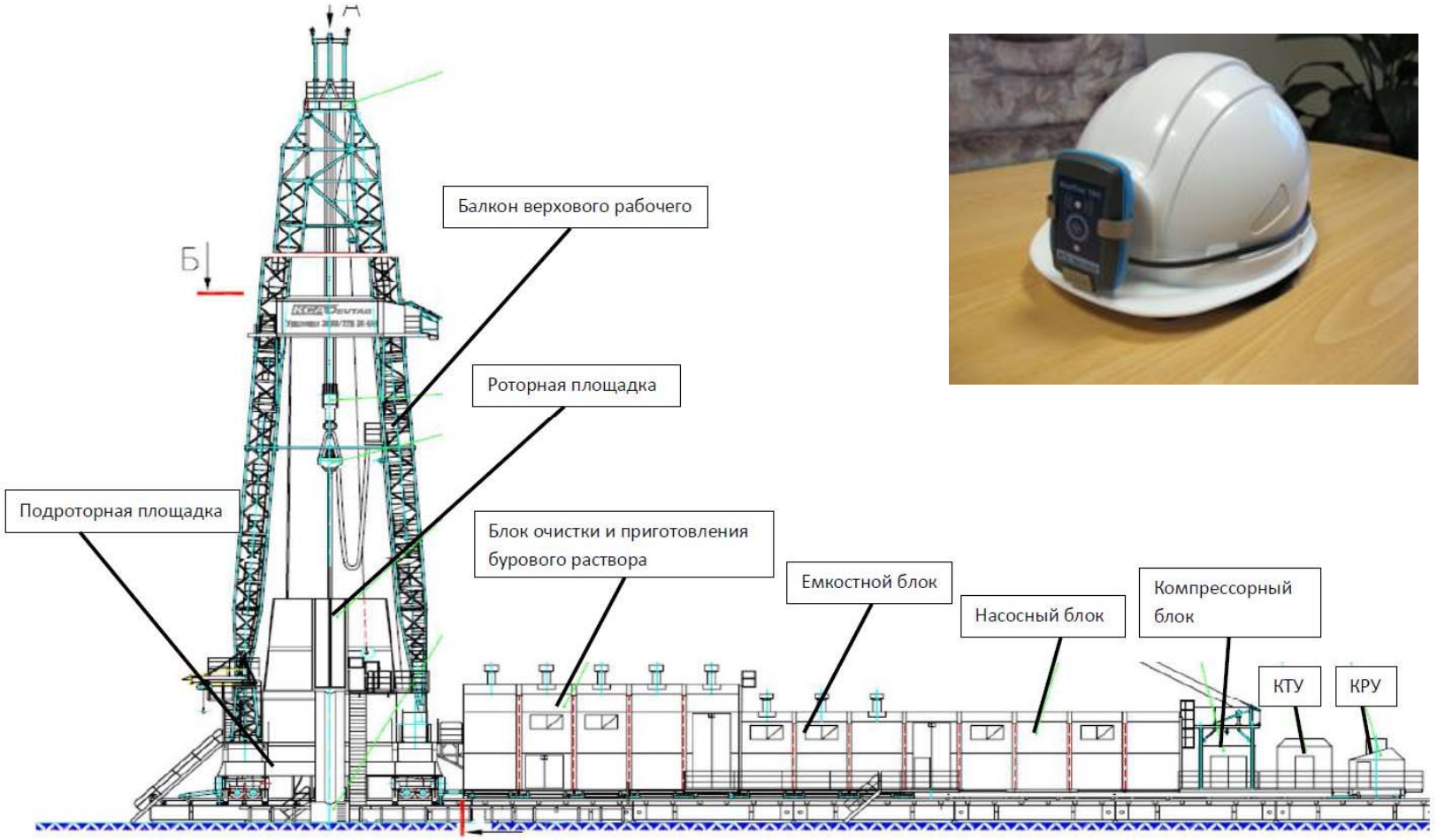




Logistics at Samsung, Kaluga (2014-2015)



Gas and oil industry, Vankor (2014)



RTL and voice communication, Australia (2014)

Awards

- Winner of the localization competition **EVAAL-2013** (http://evaal.aaloa.org)
- More than 20 diplomas and awards
- International experience of technology using

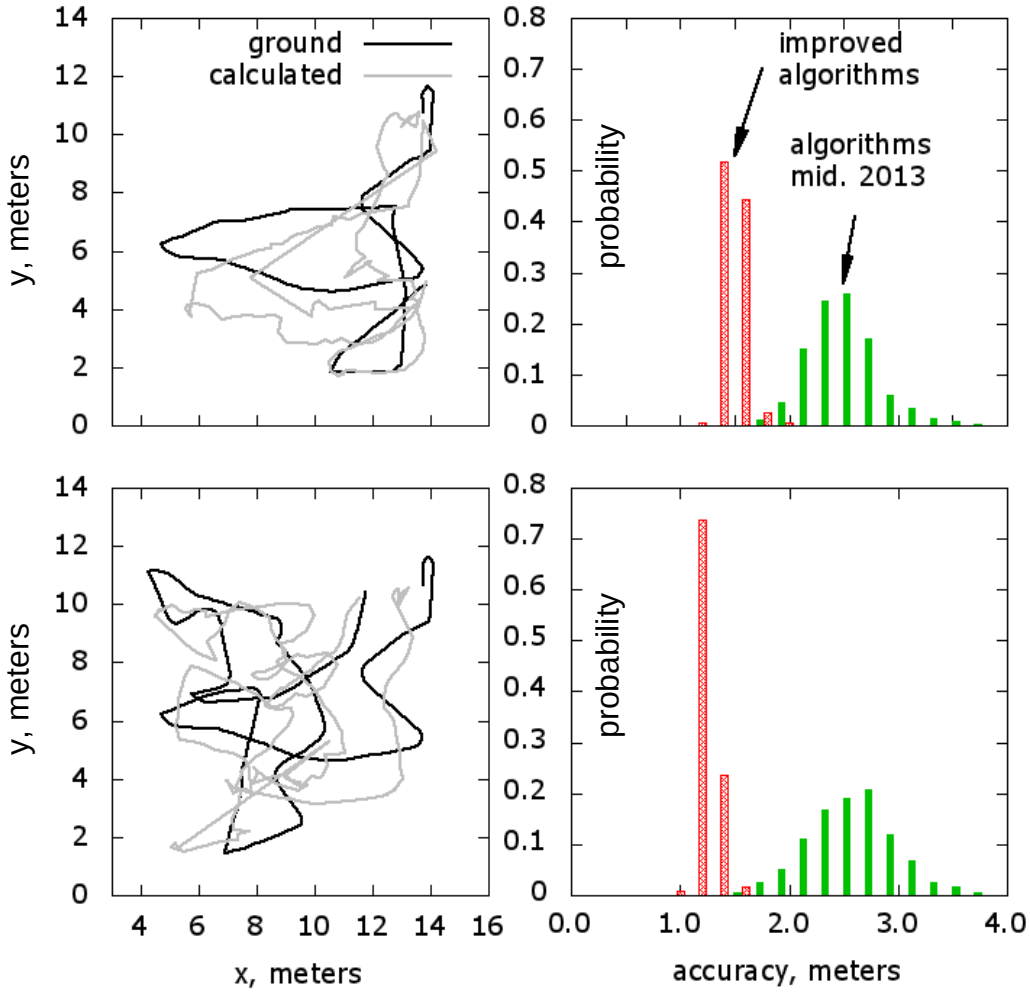

Awards

In 2013 "Nanonets LTD" won the regional contest in the nomination "The best start-up" and was one of the winners in the nomination "The best SME in Republic of Karelia".

Awards

The RealTrac™ local positioning technology won the 1st place in International competition "Evaluating AAL Systems through Competitive Benchmarking, EvAAL-2013" (http://evaal.aaloa.org/).

Localization accuracy (EvAAL-2013)



Ongoing and future research

- Ultra Wide Band
- Inertial navigation
- Pressure sensor networks
- Magnetic field maps
- Data fusion: IMU, radio and video localization subsystems

Research works are partly financed
by the Ministry of Education and Science of Russian Federation
(contract 14.574.21.0059, ID RFMFIBBB14X0164)

Industrial partners:
2014-2015: RTL-Service JSC
2016: GS-Nanotech

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