Hybridization of E-GNSS and Wi-Fi ranging for LBS and automotive Accurate Navigation in Smart city

WEBINAR FE calls, 30th June 2022

Laura Val, ROKUBUN  laura.val@rokubun.cat
Outline

• Concept

• Key figures and Goals

• Preliminary results and market expectations

• Project Management hints
Concept
Problem

Mass-market verticals

LBS  Autonomous vehicles

GNSS excels at accuracy in benign conditions (open sky)

but suffers in not-so-benign conditions (e.g. urban → multipath, obstructions...)

Geolocation solutions needs

- Accurate
- Robust
- Ubiquitous
- Affordable
- Scalable

urban environments, most of the users
Solution: BANSHEE

BANSHEE proposes a new technology hybridizing GNSS and Wi-Fi RTT to fill the gaps of GNSS in urban harsh environments and in indoor scenarios.

BANSHEE will use Wi-Fi ranging based on Time-of-arrival (the new 802.11mc protocol), not the less accurate Received Signal Strength or Fingerprinting, being used nowadays.
What is BANSHEE?

- Is an indoor-outdoor accurate positioning technology for mass-market and IoT applications
- Combines GNSS and wireless ranging in a new positioning engine
- Is demonstrated for Location Based Services (LBS) and automotive
- Specially targeted for Smart City environments
- Leverages Galileo differentiators (E5, CS-ECA)

**Benefits**
- Ubiquity: seamless location outdoor/indoor
- Accuracy: meter level
- Scalability and portability
- Affordability
- Alternate PNT

**Product**
- User side: Software library for GNSS + Wireless navigation running in smartphones and COTS navigation devices.
- Service side: API automatically computes precise location of wireless nodes and provides them to the SDK for wireless accurate navigation.

**Technology**

- **GNSS + WIRELESS**
  - Global Navigation Satellite Systems, for outdoors navigation
  - Wireless Access Point, for indoor navigation
  - Wi-Fi, UWB (ultrawideband), Bluetooth, 5G, etc.

**Target Devices**
- High-end smartphones
- COTS (Commercial off The Shelf) navigation technologies
High Level Architecture

WIFI ranging based on 802.11mc protocol (RTT) complement GNSS

Wardriving receivers log and send GNSS+WiFi ranges to BANSHEE server

Usage of GNSS raw measurements for accurate position fix

Hardware update on Rokubun’s GNSS receiver to measure WiFi ranges

The server processes ranges to compute WAP locations and stores them in server database

The users query the BANSHEE API to know location of WAP

BANSHEE database stores WAP location, served to the end users

An SDK runs in end-user equipment to hybridize GNSS and WiFi ranges
Key figures and Goals
The Project in numbers

KO: Jan 2021
24 months
4 partners: ROKUBUN, IDNEO, MOCA, UPC
Budget: 1,4 M€
Grant: 0,99 M€
The Project in numbers

2 Papers
6 Milestones
14 Meetings
5 Events
14 Deliverables
9 Articles
>100 Posts

@BansheeGSA
banshee-navigation.eu
Accurate Navigation for Mass-Market
Preliminary results and market expectations
WAP survey campaign

• Geodetic survey campaign was taken over the closed traverse in the ROK office neighborhood in order to have centimeter error in WAP positions.

• Used equipment: Trimble M3 2” total station, mirror.

• Yellow dots represent highly accurate surveyed points and green triangles - reproduced coordinates of the WAPs.
First results on Wi-Fi indoor positioning

- **Google Pixel 4** used to collect measurements and perform indoor Wi-Fi positioning

- **True positions of WAPs** obtained from the survey (along with calibrated biases)

![Graph showing horizontal error distribution](image)

- Horizontal error for F0 and F1 points:
  - $0.51 \pm 0.23$ m
  - $1.57 \pm 0.77$ m
First results on Wi-Fi indoor positioning

The video shows the comparison of Android Location and BANSHEE location in our office premises running in a static Pixel4 smartphone.
WALS API

• WALS API deployed
• Fully working online documentation (via Swagger, link below)
• Work on API mostly completed (authentication also implemented), ready for testing phase

http://api-test.wals.rokubun.cat/docs
WALS web service

- Demonstration front-end (not initially covered in the project, but implemented for convenience)

- Currently up & running, leverages WALS API shown before

- Next steps: Authentication (using WALS API) to be added.

https://banshee.rokubun.cat/
Market expectations

Cumulative revenue by segment 2021–2031

- Consumer Solutions, Tourism & Health: 61.0%
- Road & Automotive: 29.2%
- Other: 9.8%
- Total: €3,860 bn

Installed base of GNSS devices by type

Source: EUSPA EO and GNSS Market Report 2022
Project Management hints
Hints & lessons learnt

The reporting and payment process can take a while

Use timesheets!

Keep all your invoices and proof of expenditures (and track them properly!)

Market-oriented technology in the proposal

Choose good partners:
  • The consortium must be balanced
  • the dynamics between the partners during the proposal are a preview of how smooth the project will develop
THANK YOU FOR ATTENDING!

laura.val@rokubun.cat

Llacuna 162 08018 Barcelona, Spain
www.rokubun.cat
The European Union Agency for the Space Programme is hiring!
Apply today and help shape the future of #EUSpace!

Get in touch with us

www.euspa.europa.eu