LIVING LAB BUS PLATFORM FOR IOT SERVICE DEVELOPMENT IN PUBLIC TRANSPORT CONTEXT

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THE GOAL

Enabling and supporting faster development of mobility services through a concrete, open test environment in a real public transport context.
OFFERING

• **Open platform for technology and service providers**
  development, testing and demonstration of new technologies and services

• **Quick prototyping and testing**
  faster commercialization and credible verification and references

• **Real context and real users**
  user acceptance, feedback and development ideas

• **Co-development ecosystem**
  new mobility service value chains, and information exchange
TECHNICAL ENVIRONMENT

Connected hardware

- TinyNode sensor hubs (w/ BT)
  - temperature
  - humidity
  - air pressure
  - CO2
- BLE Beacons
- Weather station
- Feedback device

Component case

- CAN data
- DC 24V

Hardware in component case

- 3G/4G/GPS multiband antenna

VTC 1010 in-vehicle computer

U-blox M8N GPS incl. dead reckoning

Real-time data to cloud:
- location, acceleration, gyro, compass, ...
- sensor data
- CAN data
- vehicle status

Living Lab Bus cloud

- Resource management
- APIs for developers

Real-time local data:
- GPS, bus id, sensor data

Service delivery channels

- Mobile channels
- Fleet mgmt, etc.

Displays
LLB IOT/EDGE COMPUTING
SYSTEM ARCHITECTURE

LLB CLOUD

Services
- LLB portal
- Vehicle Landing Page
- Apps & Services

Data abstraction
- LLB Developer API
- Azure IOT Platform Analytics

Data accumulation
- LLB Real-time Data Hub
- Azure IOT Platform Storage

Edge computing
- Local software execution env.

Connectivity
- Local sensor API
- Local vehicle API
- V2C, Internet Gateway (Wi-fi)
- V2I Gateway
- V2V Gateway

Shared resources
- Sensors
- Vehicle system data API
- Displays
- Video cameras
- HW modules

LLB Vehicle Platform

Back end system
- Driver UI
- Internet connection
- On-Board system
- Vehicle system

SDK
Design guidelines
Resource Registry
System security
BUSES AS MOBILE SENSOR PLATFORMS
OFFERING FOR DEVELOPERS

- Electric busses as a **hardware platform**
  - electricity and cabinet space
- **Edge computing environment**
  - hosting of software
  - 4G communication and
  - information distribution channels (shared public displays inside the bus)
- **Open APIs and toolset for new service development via developer portal** for utilizing transportation and environment related sensor data collected by various IoT devices
- **Means of collecting passenger service ideas and feedback** of offered new services either by application/service inbuilt channels or via specific feedback devices
CONCLUDING REMARKS

• Expected **benefits** of LLB approach are:
  • to increase product and service **quality**
  • **reduce** market-based **risks** and
  • increase the rate of **market diffusion**

• IoT/Edge **architecture approach** allows:
  • **elasticity of the system** allowing distribution of processing and resource use
  • **modularity and extendibility** of the system allowing new sensor devices, data sources and actuators to the system in a flexible way
  • optimization, and thus, **efficiency of data traffic**
  • **reliability and quality** of applications and services.