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On-Site Monitoring of Environmental Processes using Mobile Augmented Reality (HYDROSYS)



→ close gap between on-site and in-office work through usage of mobile applications

cell-phone and handheld computer

Goal



- **HYDROSYS focus**
- **System overview**
- **Mobile Augmented Reality**
 - Visualization, multi-camera framework
- **Outlook**





- **EU funded project HYDROSYS**
 - Project in the field of environmental monitoring and management using mobile devices
 - Project runs from 2008 – 2011
 - FP7 / DGINFSO 224416

Major themes: interactive visualization, mobile computing, database systems, simulation, sensor technology, robotics

HYDROSYS project in a nutshell





TU Graz

Mobile augmented reality



EPFL

Sensor Networks, deployments



WSL

Deployments, simulation



University of Cambridge

Localization, unmanned aerial vehicle



Helsinki university of Technology

Cellphone interactive visualisation, deployments



Ubisense

Localization



Luode

Deployments

Project partners





understand | communicate | share

**improve the understanding and
management of environmental
processes in the field,
complementing office-only work
activities**

Project focus



- **Improved prediction and decision-making, solution finding and checking**
 - Difficult to quantify
- **Optimized data pipeline from sensor to handheld**
 - actual access to *almost real-time* data and simulation results (pre-processed)
- **Advance interactive visualization at handheld platforms**

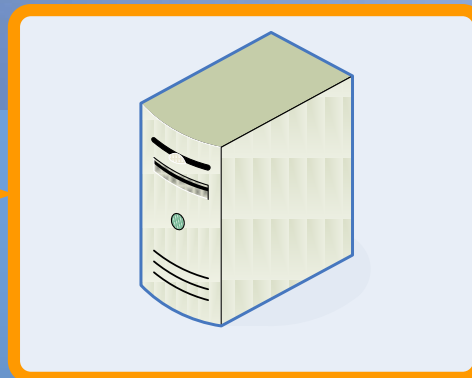
Expected outcomes





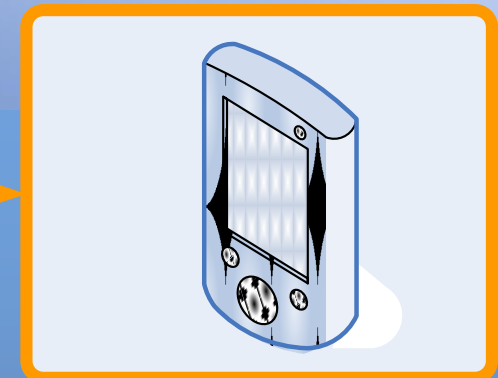
data acquisition

Gather environmental data in field, send over network



data storage and processing

Check, store and process data



data visualization and analysis

Access data in field, observe processes in quasi real-time

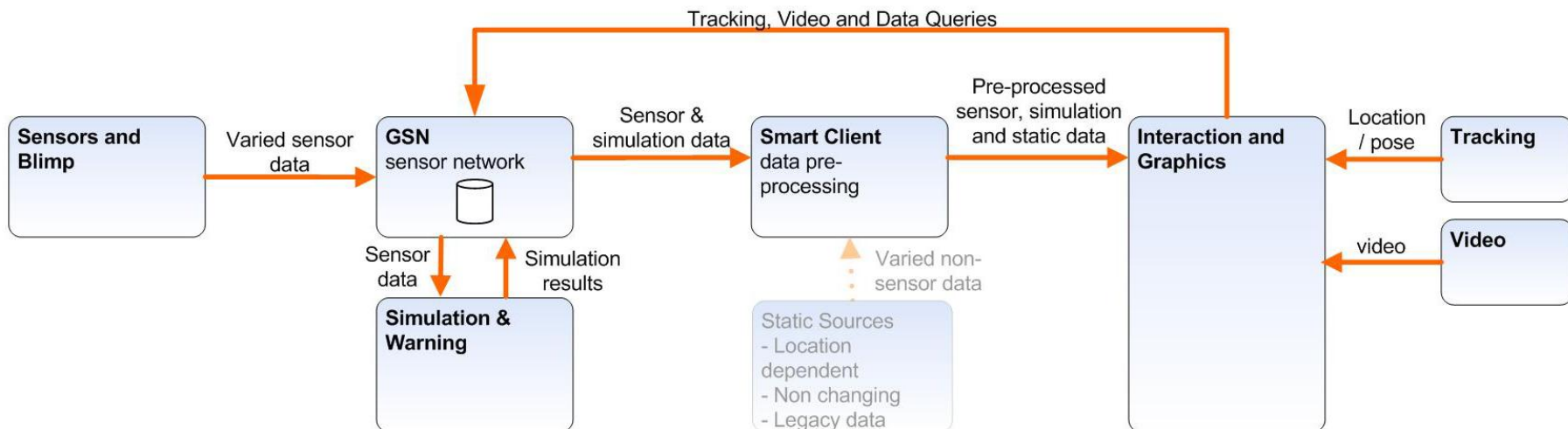
What does HYDROSYS offer?



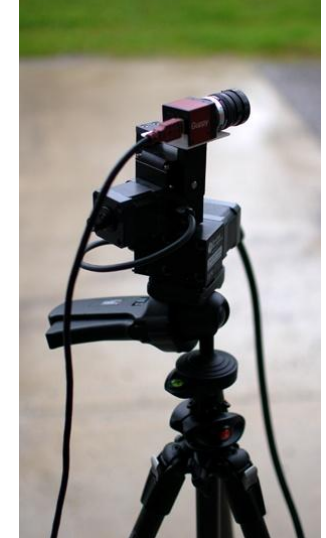
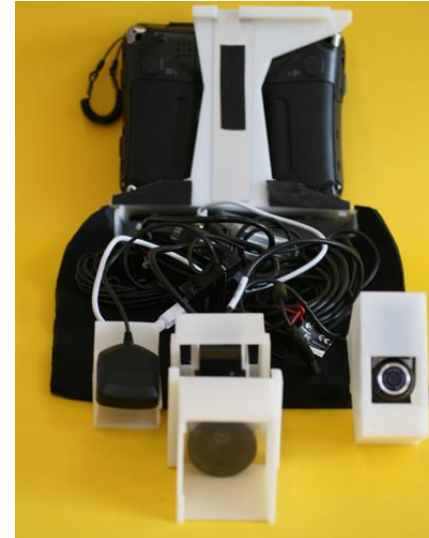
DATA ACQUISITION

DATA STORAGE AND PROCESSING

DATA VISUALIZATION AND ANALYSIS



system design



- Observe site from multiple perspectives by „browsing“ camera footage
 - Cognitively demanding!

Multi-camera framework

- **Select and view various types of visualization**
 - Live update of sensor data
- **View site from various perspectives**
 - Multi-camera framework
- **Annotate / collaborate**
- **Manual sensing**

Handheld functionality



Planning and performance in *campaigns*

- **Site setup (office)**
 - “GIS stage”: site selection, problem identification, data gathering, conversion, geo-referencing
- **Campaign planning (office)**
 - Select and setup data sources (sensors), upload data, configure user communication, prepare simulations
- **On-site campaigns (in the field)**
 - Communication possible with in-office workers

Associated work process





- **Environmental data types**
 - ~25 data types
 - „normal“ weather data
 - Specialized sensors
- **Stationary and mobile sensors**
- **Temporal aspects**
 - Data update anywhere between ~60 minutes and ~minute
- **Typical site size**
 - Couple of hunderd meters riverbed up to 12km²
 - Typically covered by 5 – 15 sensor(stations)

Sensors in use



- **Sensor data is stored in GSN**
 - Various integrated simulation engines
 - Select simulation process through web front-end
- **Simulation results need to be pre-processed**
 - Semi-automated step using visual front-end
- **Data communicated over WiFi bridges**

Sensors and simulation

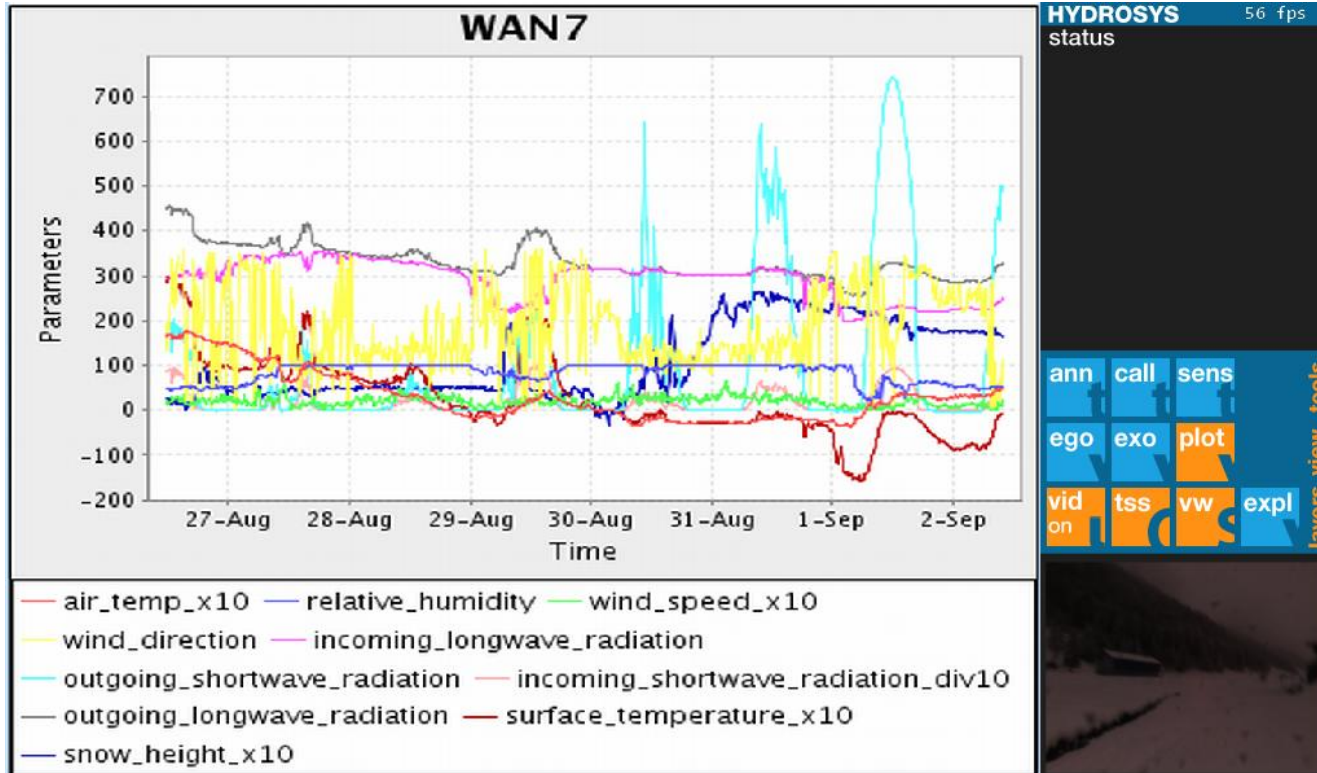


The screenshot displays the HYDROSYS software interface. The main window shows a list of sensor data under the heading "wind_direction". The data is organized into two columns:

Variable	Value	Variable	Value
baslerchopf_bel	= null	baslerchopf_mid	= null
baslerchopf_top	= null	baslerchopf_tre	= null
biochange_arell	= null	biochange_chlar	= 347.059
biochange_eichw	= 263.310	biochange_lusch	= null
biochange_purcs	= null	chaiseren	= 280.8
dorfberg_sensor	= 62.8442	dorfberg_sensor	= null
dorfberg_sensor	= null	grossalp	= 248.5
jakobshorn_ex_r	= null	jakobshorn_jatz	= null
rufiberg_sensor	= 28.3163	stillberg_face_	= 287.876
stillberg_lower	= null	stillberg_tree1	= null
strelapass_sens	= null	teufi_sensorsco	= null
teufi_upper_sen	= 283.717		

On the right side, there is a "HYDROSYS status" panel with a "59 fps" indicator. Below it is a "layers view tools" panel with buttons for "ann", "call", "sens", "ego", "exo", "plot", "vid on", "dtm off", "dw", and "expl". At the bottom right, there is a small terminal window showing a list of variables and their values, including "baslerchopf_bel", "baslerchopf_top", "biochange_arell", "biochange_eichw", "biochange_purcs", "dorfberg_sensor", "dorfberg_sensor", "jakobshorn_ex_r", "rufiberg_sensor", "stillberg_lower", "strelapass_sens", "teufi_upper_sen", "baslerchopf_mid", "baslerchopf_tre", "biochange_chlar", "biochange_lusch", "chaiseren", "grossalp", "jakobshorn_jatz", "stillberg_face_", "stillberg_tree1", and "teufi_sensorsco".

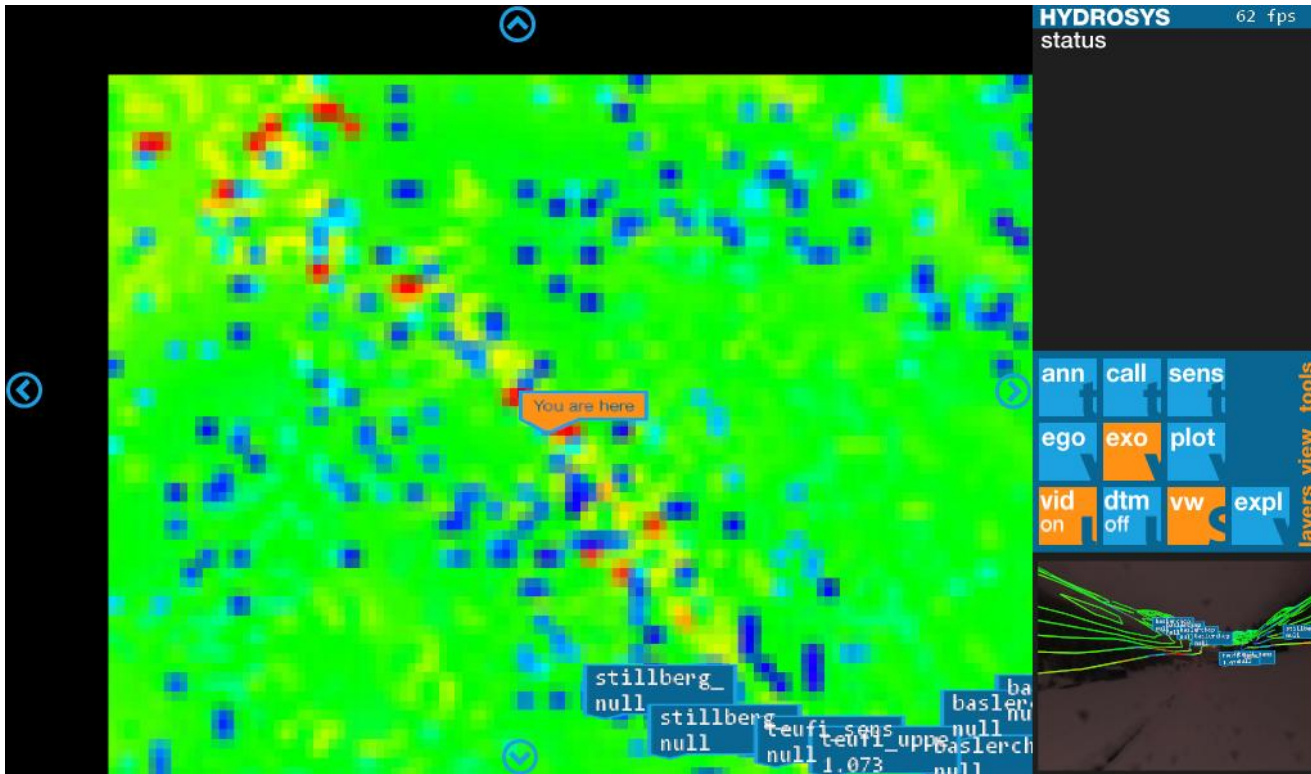
sensor data (numeric)



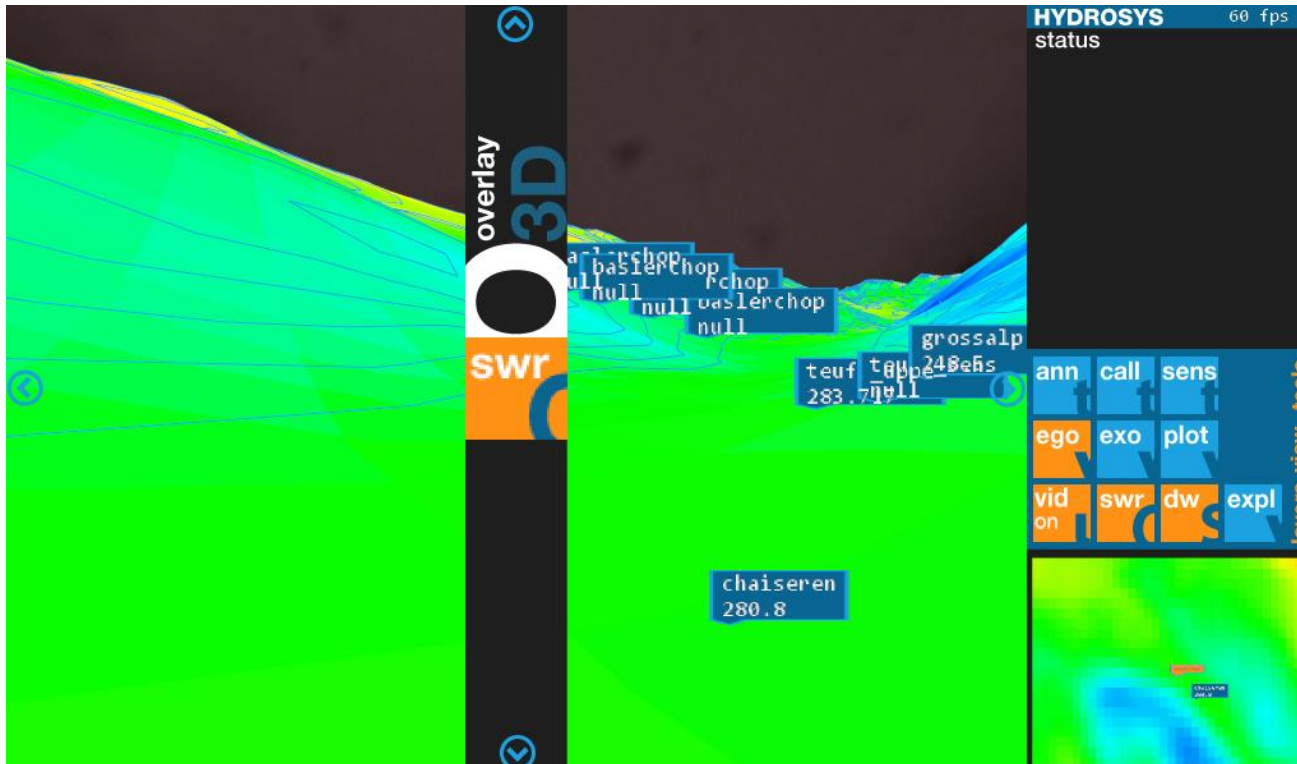
sensor data plots



**sensor data type labels
(numeric) / isophotes**



exocentric mode



3D overlays

- **Integrate various modules into one system**
 - Visualization system available, annotate + multi-camera integration proceeding
- **Promote system**
 - Open source!
 - www.hydrosysonline.eu

Acknowledgements: FP7/DGINFSO 224416

Outlook and conclude

