

# ERCIM NEWS

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Special theme:

# Mobile Computing

## Also in this issue:

### *Keynote*

*Strategies of the European ICST  
Public Research Organisations  
towards Horizon2020  
by Domenico Laforenza*

### *Joint ERCIM Actions*

*University of Southampton joins  
ERCIM*

### *Research and Innovation*

*VMC: A Tool for the Analysis of  
Variability in Software Product Lines*

## KEYNOTE

- 3 Strategies of the European ICST Public Research Organisations towards Horizon 2020**  
by Domenico Laforenza

## JOINT ERCIM ACTIONS

- 6 Cor Baayen Award 2013 Call for Nominations**
- 6 ERCIM Postdoc Fellowship Programme: Last Round of the Co-funded “ABCDE” Project**
- 7 University of Southampton joins ERCIM**  
by Inés Teresa-Palacio

## SPECIAL THEME

The special theme section “Mobile Computing” has been coordinated by Edgar Weippl, SBA Research, AARIT, Austria and Pietro Manzoni, Universitat Politècnica de València, SpARCIM

- 8 Introduction to the Special Theme**  
by Edgar Weippl and Pietro Manzoni

## Invited articles

- 10 Reality Mining at the Convergence of Cloud Computing and Mobile Computing**  
by Matthias Steinbauer, Ismail Khalil and Gabriele Kotsis
- 11 Positioning Terminals in Mobile Computing Networks**  
by Francisco Barcelo-Arroyo, Israel Martin-Escalona and Marc Ciurana-Adell
- 12 DarkDroid - Exposing the Dark Side of Malicious Mobile Applications**  
by Engin Kirda

## Computing services

- 14 Automatic Offloading of Mobile Applications Using Evolutionary Algorithms**  
by Gianluigi Folino and Francesco Sergio Pisani
- 15 Scheduling Data Mining Applications in Mobile Computing Environments**  
by Carmela Comito, Deborah Falcone, Domenico Talia and Paolo Trunfio
- 17 On the Benefits of a Poly-Cultural Sensor Setup: Controlling Embedded Sensors with a Smart Phone**  
by Rolf Adelsberger and Gerhard Tröster
- 18 SmartLab: Empowering Mobile Computing Research through an Open Smartphone Cloud**  
by Georgios Larkou, Panayiotis Andreou, Andreas Konstantinidis and Demetrios Zeinalipour-Yazti
- 19 Phone Accessories as an Interface**  
by Mattias Jacobsson, Stina Nylander and Ylva Fernaeus
- 21 Boosting Performance of Wireless Networks with Concurrent Access by Smart Traffic Splitting**  
by Gerard Hoekstra and Rob van der Mei

## Platforms

- 22 CoMobility: A Mobile Platform for Transport Sharing**  
by Carlos E. Cuesta, Paloma Cáceres, Belén Vela and José María Cavero
- 23 Quality of Service Information System: Get to Know the Performance of Your Mobile Network Operator Anywhere-Anytime**  
by Katarzyna Wac
- 25 Mobile Service Platforms Based on Opportunistic Computing: The SCAMPI Project**  
by Marco Conti, Franca Delmastro and Andrea Passarella

**27 TravelDashboard - a Framework for the Delivery of Personalized Mobility Services to Urban Travellers**  
by Licia Capra, Pierre Chatel, Animesh Pathak and Roberto Speicys Cardoso

**28 APISENSE: Crowd-Sensing Made Easy**  
by Nicolas Haderer, Romain Rouvoy, Christophe Ribeiro and Lionel Seinturier

#### Security and privacy

**30 Mobilities: Analyzing Privacy Leaks in Smartphones**  
Jagdish Prasad Acharya, Franck Baudot, Claude Castelluccia, Geoffrey Delcroix and Vincent Roca

**31 Privacy-Preserving Interest-Cast for Android Smartphones**  
by Gianpiero Costantino, Fabio Martinelli and Paolo Santi

**32 Market-Based Security for Mobile Devices**  
by Gabriele Costa, Alessio Merlo and Luca Verderame

**34 Revealing Social Links Between Owners of Wi-Fi Enabled Smartphones**  
by Mathieu Cunche, Mohamed Ali Kaafar and Roksana Boreli

**35 Secure Collaboration for Smartphones**  
by Abdessamad Imine and Michaël Rusinowitch

#### Localization

**36 Indoor User Localization Using Mobile Devices**  
by Jonáš Ševčík

**37 Airplace: Indoor Geolocation on Smartphones Through WiFi Fingerprinting**  
by Christos Laoudias, Georgios Larkou, Demetrios Zeinalipour-Yazti and Christos G. Panayiotou

**39 Knowledge Representation and Management in Indoor Mobile Environments**  
by Imad Afyouni, Cyril Ray and Christophe Claramunt

#### Applications

**41 Mobile Real Time Applications for Enhancing Public Transport User Experience - The MOVE-ME Project**  
by João Falcão e Cunha, Teresa Galvão and Jeremy Pitt

**42 U-AirPoll: Mobile Distributed and Collaborative Air Pollution Measurement**  
by Marino Linaje and Luis Miguel Dominguez-Peinado

**43 ARGO Sentinel: The Mobile App for Reporting Oil Spillages at Sea**  
by Massimo Martinelli, Davide Moroni and Ovidio Salvetti

**45 Mobile Devices to Improve Breast Cancer Information Management**  
by Damià Segrelles, Maite Giménez and Ignacio Blanquer

## RESEARCH AND INNOVATION

This section features news about research activities and innovative developments from European research institutes

**46 Secure and Privacy-Aware Mobile Identity Management**  
by Fabio Martinelli

**47 Social Electricity: When Awareness About Electricity Becomes Social**  
by Andreas Kamlaris, George Taliadoros and Andreas Pitsillides

**49 New Interaction Paradigms in Energy Management**  
by Paulo Carreira and Alfredo Ferreira

**50 VMC: A Tool for the Analysis of Variability in Software Product Lines**  
by Maurice ter Beek, Stefania Gnesi and Franco Mazzanti

**52 Wood Variety Recognition on Mobile Devices**  
by Pavel Vácha and Michal Haindl

**53 The New SHIELD Architectural Framework**  
by Mariana Esposito, Andrea Fiaschetti, Francesco Flammini

**54 A Biofeedback System for Self Empowerment and Improved Quality of Life**  
by Johanna Mercurio

**55 Software and Hardware-Intensive Activities for Supporting Creative Learning**  
by Michail Giannakos and Letizia Jaccheri

## EVENTS

**56 W3C at the Mobile World Congress 2013**  
by Marie-Claire Forgue

**56 PROMISE Winter School 2013 on Bridging between Information Retrieval and Databases**  
by Nicola Ferro

**57 Announcements**

## IN BRIEF

**59 CWI researcher Floor Sietsma youngest PhD in the Netherlands**

**59 Warsaw Center of Mathematics and Computer Science Established**

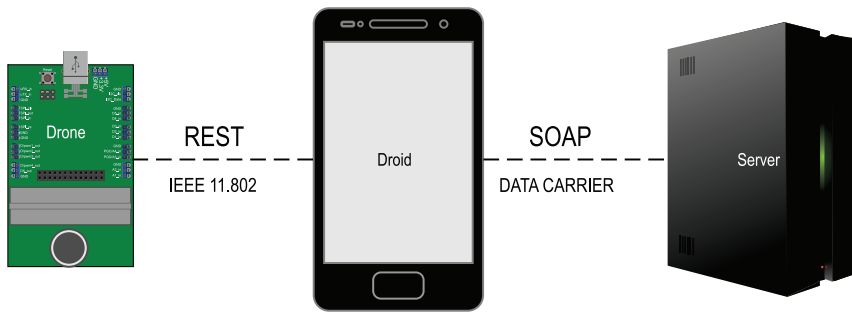


Figure 1: U-AirPoll communications architecture



Figure 2: Drone prototype

ever the user wants within the range of the user's Smartphone Wi-Fi connection (eg, the roof of a bus).

From the droid perspective, the drone is just a service that is used to acquire data. The droid is a mobile application that uses the smartphone geolocation to complete air pollution data from the drone. It is implemented using Apache Cordova multi-device development framework that can run in up to nine different mobile platforms such as Android, iOS or Windows Phone. Apache Cordova was also selected because its applications are coded using standard web development technologies (ie, HTML, CSS and Javascript).

When not connected, the droid tries to locate the drone and checks server connectivity. When the drone is detected, data capturing starts and the droid saves all measurements into a local database on the smartphone, which is cheaper than storing them in the drone (ie, additional storage hardware is not required). In order to upload data, login is required. Once logged in, the droid begins to send data (ie, the pollution data from the Drone augmented with the smartphone geolocation). In par-

allel, the droid requests data from a server in a range of coordinates to show a map in the smartphone. The trend in the Web of Things field is to use REST for the Web services provided. However, to prove that our approach does not fix the Web service technology used, REST and SOAP (Simple Object Access Protocol) are mixed in the final solution.

All the cloud services have been specified using a model driven development environment called WebRatio. All the Java code generated by this tool is open source. The cloud services provide anonymous data pollution concentrations and provide an open access to data. To avoid problems with multiple connections (also known as the c10k problem) a JSP and c10k capable server, such as JBoss, is required.

The main idea behind U-AirPoll is to set the foundations for an open, distributed and mobile air pollution measurement system which allows data to be easily consumed by custom end-user applications and services (eg, a user or organization that wants to create green traffic routes to run or to cycle). Since U-AirPoll is an open hardware project,

other people can add more pollution sensors, design their own enclosures or modify any piece of the project to better suit their needs.

Currently, U-AirPoll supports only 1:1 droid-drone connections. Our research is currently investigating N:N supports (multiple drones and droids shared among users).

This work has been funded by the Spanish Ministry of Science and Innovation (TIN2011-27340) and the European Regional Development Fund (ERDF).

**Links:**

- <http://sites.google.com/site/U-AirPoll/>
- <http://www.openpicus.com>
- <http://cordova.apache.org>
- <http://www.webratio.com>

**Reference:**

- [1] D. Vallero: "Fundamentals of air pollution", Academic press, 2007.

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## ARGO Sentinel: The Mobile App for Reporting Oil Spillages at Sea

by Massimo Martinelli, Davide Moroni and Ovidio Salvetti

**We believe that the contribution of volunteers could play a fundamental role in monitoring and protecting the environment. People at sea sighting pollution caused by oil or hydrocarbon spillages can now immediately report this using a freely downloadable mobile application.**

At the Signals and Images Laboratory (SI-LAB) of the Institute of Information Science and Technology of the National

Research Council of Pisa (ISTI-CNR), we have developed a Marine Information System (MIS) for moni-

toring vessel traffic and oil spills within the Mediterranean basin. The MIS collects and integrates geotagged data

related to safety and health issues of the sea from various sources (satellites, optical sensors, electronic noses, autonomous underwater vehicle systems) and provides predictive models to assist the authorities in the management of emergencies at sea.

An integrant part of the MIS is represented by the data that can be collected and shared by volunteers who want to collaborate in monitoring the status of the sea.

For this purpose, we have developed ARGO Sentinel, a free application for smartphones with a Geolocation System (GPS)[1]. Two versions of the app have been implemented: an HTML5 version, running as an Opera widget distributed only to our partners of the ArgoMarine project, and a native Android (v2.2 or higher) publicly distributed because of its level of stability, and downloadable by anyone from Google Play (see Link below).

The app was conceived on the intuition that the contribution of volunteers could play a fundamental role in monitoring and protecting the environment. Using the app, whenever someone at sea sights signs of oil or hydrocarbon pollution they can immediately report this to the SI-LAB in Pisa. The information is recorded in the MIS and complements the data obtained from more traditional sources (eg satellites), improving the quality and coverage of marine monitoring, especially in protected areas. In this way we can build up a detailed map of the status of our seas.

The application – distributed in Italian, English and Greek – sends reports of suspected spills to our Lab, providing a description of the spill and specifying the precise point and severity.

The main screen of ARGO Sentinel shows: a "Message" area where a description of the sighting is entered; a "Red Alert" button to signal a major oil spill with a diameter greater than or equal to 20 meters approx.; a "Yellow Alert" button: to report a mild/moderate amount of oil spill with a diameter less than 20 meters approx.; an "i" button: for information on the use of the app; an "exit" button to close the app (See Figure 1).

By clicking on the red or yellow alarm buttons, an SMS is sent to the CNR

headquarters, which will process the received data.

The app has been installed by about 700 individuals all over the world. By integrating the alerts sent by the volunteers with all the other information sources collected in the MIS, a semi-automatic analysis eliminated the alerts identified as false positive. Even though we have no formal obligations as the project is for research purposes only, we forward



Figure 1: the main screen of the "ARGO Sentinel" mobile app

all the significant information to the General Command of the Italian Coast Guards in Rome, Italy.

Our field tests demonstrate that the use of this new technology could be really important in combating pollution. Our experience suggests that this kind of technology can be applied to many other fields where environmental monitoring and safety is crucial.

An important result is that, during the period of the project's activity, we have acquired a more detailed and immediate knowledge of the conditions of the sea. The use of this application represents a step forward in marine environmental monitoring, because, in addition to the other technologies that are used by the Argomarine project, it also adds the contribution of volunteers who can easily communicate the sighting of a

spill. Knowing that deliberate spills can be detected in a timely fashion is in itself a deterrent to malicious actions. Possible developments may allow a more effective intervention by the authorities.

A new version of the ARGO Sentinel app is now under development and will also be released for iOS user.

ARGO Sentinel is has been developed in the framework of the European research project ArgoMarine, ("Automatic Oil spill Recognition and Geopositioning integrated in a Marine Monitoring Network") which aims at traffic and marine pollution monitoring. Coordinated by the Tuscan Archipelago National Park, the partners of ArgoMarine include ISTI-CNR, the National Technical University of Athens, the Nansen Environmental and Remote Sensing Center, the Centro de Investigação Marinha and Ambiental, Universidade do Algarve, the National Maritime Park of Zakynthos, the Joint Research Center and the NATO Undersea Research Center.

#### Links:

ARGO Sentinel:  
<http://tinyurl.com/argosentinel>  
 Argomarine Project:  
<http://www.argomarine.eu>

#### Reference:

[1] "ARGO Sentinel: the application for reporting oil spillages at sea", [http://www.cnr.it/istituti/FocusByN\\_eng.html?cds=074&nfocus=22](http://www.cnr.it/istituti/FocusByN_eng.html?cds=074&nfocus=22), CNR Focus, National Research Council, 2012

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