

Integrating Remote Sensors in a Smartphone: "Sensors for Android in Embedded systems"



S. Rinaldi, A. Depari, A. Flammini, A. Vezzoli

Dept. of Information Engineering - University of Brescia, Via Branze, 38 - 25123
angelo.vezzoli@unibs.it

Introduction

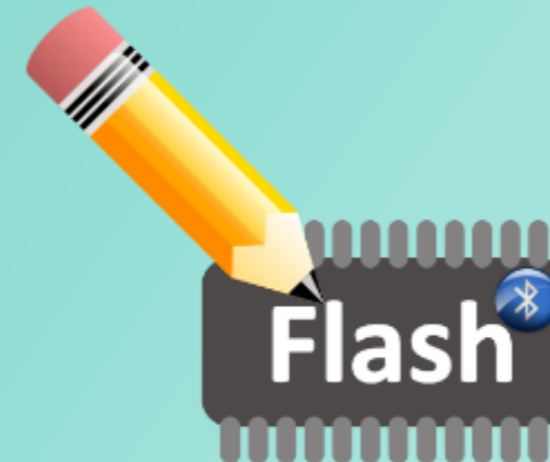
Smartphones integrate high quality sensors and communication systems, easily managed by simple APPs under Android¹. On the contrary, managing remote sensors/actuators requires a big effort in programming, both on the sensor and on the Smartphone side.

SAndroidE approach: virtually embedding several external sensors/actuators within the Smartphone, according to a library-based architecture. The framework allows easy development of sensor-fusion applications, managing internal sensors and external sensors, even from different manufacturers, in the same way. The proposed architecture reduces the distance between remote resources and the Smartphone, providing the tools to make the link between them transparent (from the developer/user point of view). Although the idea can be applied to every communication technology supported by Smartphones, Bluetooth 4.0-4.1² has been chosen for this work, because it seems the most promising for wireless sensor battery powered applications.

Structure



• a library to be used in Android programming to access external sensors/actuators and treat them as if they were embedded (same mechanisms for notifications, timestamping, and so on)

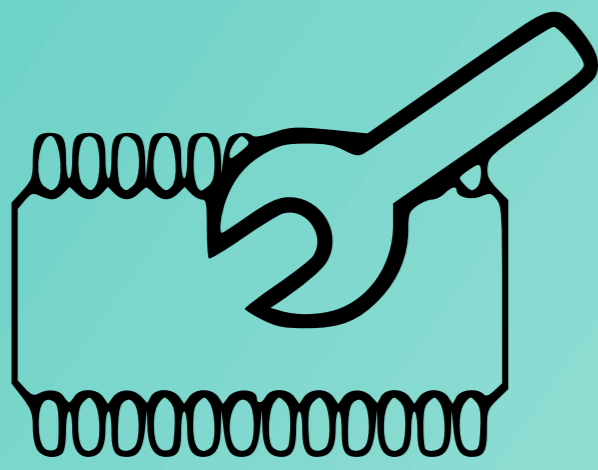


• an APP for identification, configuration and naming of external sensors and actuators, each of them supported by means of an XML file related to the remote device firmware (FW)

- External devices must have a communication link supported by ANDROID (up to now, only Bluetooth Low Energy -BLE- is supported)
- External devices must be programmed with a known or described firmware in order to be supported by the framework. The framework supports a list of devices and, in the case of programmable devices, the APP allows the user to program the node (USB OTG required) with a suitable FW furnished by the framework. Guidelines to develop FWs naturally supported by SAndroidE will be available soon.
- External devices are treated as a container of items, each one representing a sensor or an actuator. We support: Android Sensors (e.g. accelerometers, temperature sensors,...), Buttons, Vibrating alerts, Generic Sensors and Generic Actuators (value, buffer, structure, not yet supported).

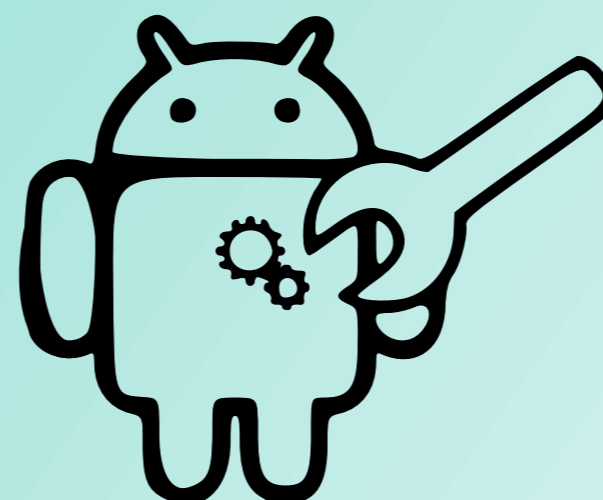
System actors

HW&FW Developers



Let the Developers easily share their work with SW Developers by only describing through a defined Descriptor their creations

SW Developers



Let the Developers easily handle in their projects external resources without worrying about the communication level or the HW composition

Users



Let the users download Applications based on SAndroidE framework and acquire HWs and FWs already developed for easily setting up a sensors/actuators system without a PC

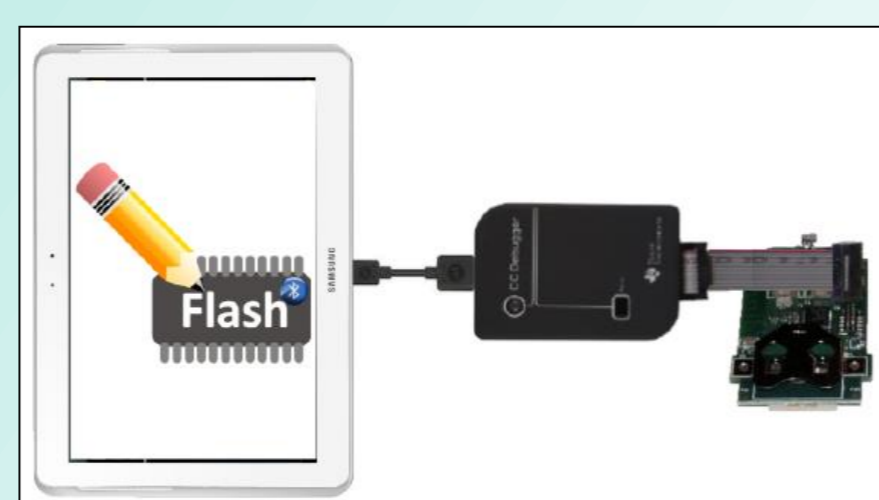
Simple example of Home Automation App

Application:

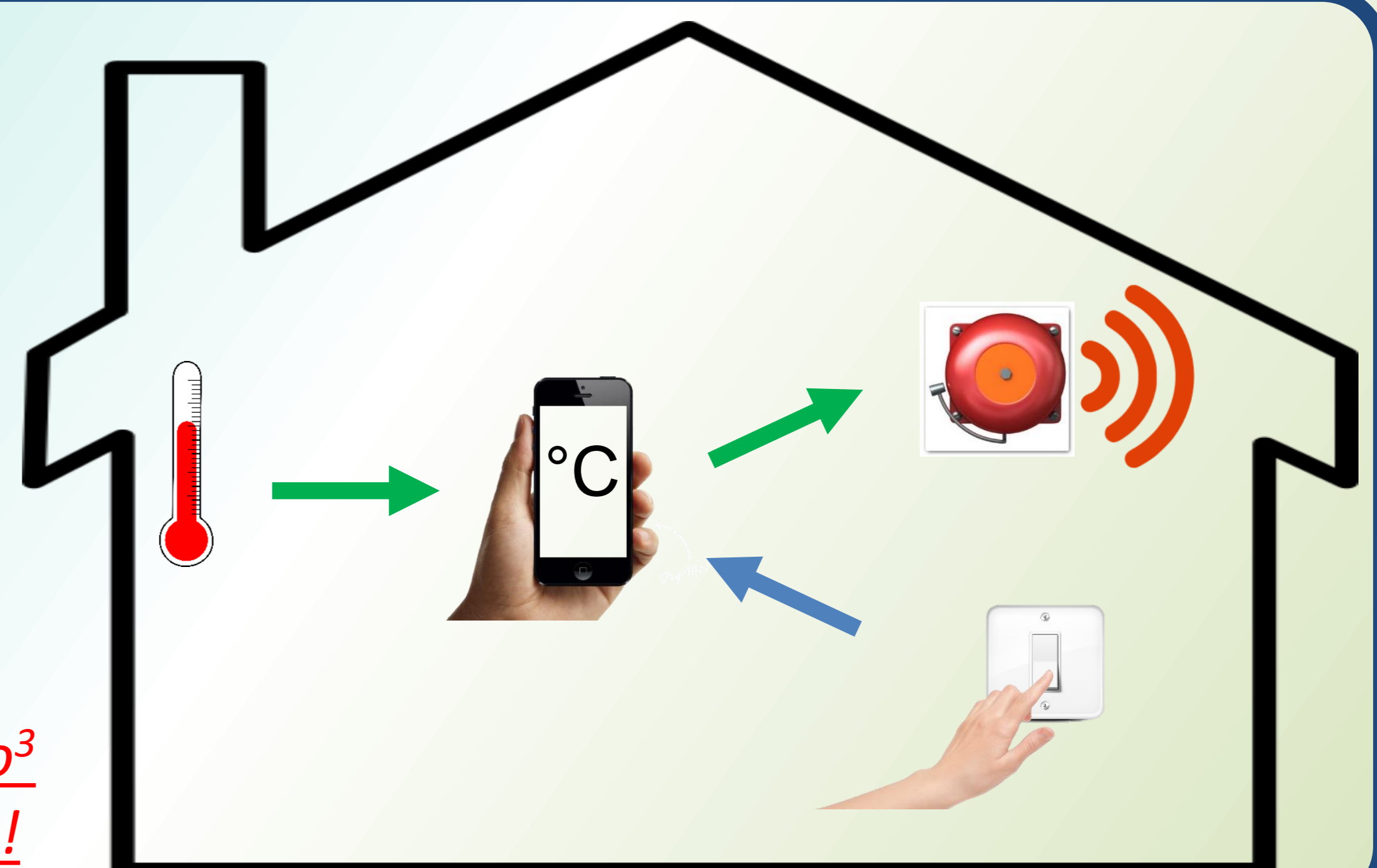
if temperature > 26°C then an alarm rings for 9s or until a button is pressed

Application requirements:

- external temperature sensor (dev.kit by STMicroelectronics⁴)
- external alarm (1° dev.kit by Texas Instruments⁵)
- external button (2° dev.kit by Texas Instruments⁵)
- Android (4.4 or upper) environment
- No customized firmware required (all dev.kits are programmed with default FW by the smartdevice via OTG using SAndroidE application, as depicted in the figure beside)



Take a look at the video³ to check how easy it is!!



The roadmap of SAndroidE

What is available now³ (free download):

- a prototype of the library to be used in Android programming supporting the two dev kits (Keyfob by TI⁵ and BlueNRG by STM⁴)
- a prototype of the APP for identifying and naming external devices (accelerometers, buttons and alarm for the Keyfob; accelerometers, thermometer for the BlueNRG). The same APP allows dev.kit programming ("BLEEMBEDDED flasher") by mobile (USB OTG required) with the FWs developed by the producers of the dev.kits.

What will be available within June 2016 (free download):

- a library for Beacon devices (normal Beacon with ID only and Beacon with sensing information) with XML files
- an APP for identifying, naming and configuring Beacon devices, each supported by means of an XML file related to the FW

What will be available within September 2016:

- support of Arduino and Raspberry based devices
- guidelines for FW and XML file development
- full specifications, open source full code available

REFERENCES

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3. <http://es3.unibs.it/SAndroidE/>

4. STEVAL-IDB002V1 -Bluetooth® SMART board based on the BlueNRG low energy network processor- DocID025382 Rev 2. www.st.com
5. <http://www.ti.com/tool/cc2541dk-mini>