EasyIoT

EASY PERIPHERALS FOR THE INTERNET OF THINGS

The Problem

The *Internet of Things* (*IoT*) is booming, and more than 25 million devices are expected to be part of it by 2020. The growth is mostly supported by the ever increasing amount of sensing circuitry embedded in all sorts of user devices, appliances and wearables, among others. However, the abundance of information in itself does not provide knowledge, as the raw data must first be treated and processed. In order to do so, and still keep up with the technological demand, the development of new solutions and applications has to be very efficient and expedite.

Some of the major setbacks when developing *IoT* solutions are the interfaces available (or not) to interact with the sensory devices and retrieve measurements data. Quite often, these interfaces have to be custom developed for each prototype or solution.

The Solution

In order to accelerate prototyping and the development of Android based solutions, the EasyIoT project aims to relieve Android developers of the tasks

Fig1.   Android device running the Pandlet API demo application.

of establishing and managing the communication with the Pandlet sensory platform, as well as easing the interaction and collection of data from the available sensors.

To achieve this result, an Application Programming Interface (API) is used, seamlessly integrating the Pandlet platform into the Android development environment, as an extension of the Android device.

The proposed solution requires the implementation of not only the top-most system layer (API), but also of all the ones bellow it.

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Pandlets

Pandlets is an hardware platform developed by Fraunhofer Portugal to measure human behavior and environmental context. It includes a set of sensing capabilities and an Android API that allows for seamlessly integration of external hardware into Android's platform.

Flexible and Adaptable System

The modular and layered structure of the developed solution enables other data collection devices and sensory platforms to become compatible with the system. Any device that implements the designed communication protocol may interact with the system peer devices.

In fact, the developed solution is immediately compatible with any platform the uses the Nordic nRF51822 System on Chip, requiring no changes or adaptations whatsoever.
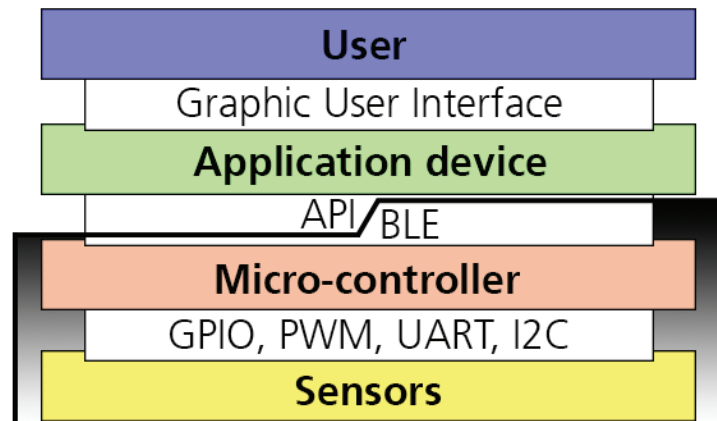

Fig2. System layers and abstraction provided by the API.

Communication

To establish the communication between a sensory node, such as the Pandlet platform, and a data collection device, such as an Android smartphone, a complete communication protocol was designed and implemented on top of Bluetooth Low Energy. The protocol allows the devices to exchange information using previously defined formats, through a *header* and *payload* structure. Any device that implements the designed protocol may replace the Android device or the Pandlet platform, without requiring adjustments to the peer device.

Pandlet Firmware

The described solution requires the firmware to be generalist and not implement any specific functionality on its own. Instead, it should provide access to as many features as possible and be able to be configured, at runtime, to perform as many tasks as possible.

Currently, the implemented firmware supports the use of four modules –

General Purpose Input/Output (GPIO), Pulse Width Modulation (PWM), Inter-Integrated Circuit (I2C) and Universal Asynchronous Receiver/Transmitter (UART). The I2C module enables the communication with all of the Pandlet on-board sensors, as well as any external I2C or TWI sensors that may be added. The UART module allows wired communications with other devices, such as GPS modules or micro-controllers. The PWM and GPIO modules enable the Pandlet to be used in a myriad of situations and contexts, from simple port switching to the control of servo motors.

Android API

The API is composed by a collection of classes that encapsulate the functionalities offered by the Pandlet platform. Instances of these classes may be used to easily interact with the Pandlet modules and collect data from its sensors.

The developer is also able to program the Pandlet to perform predefined tasks whenever a GPIO event is detected.