

Small physics experiments using sensors and actuators with computer acquisition and control

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Today's physics experiments mostly involve some sensors, which convert physics parameters to be measured into electronic signals, and a computer reading these signals, storing and treating them and producing some human readable output.

The workshop will show all steps to be performed and give the participants a chance to implement simple simulated experiments themselves. Digital signals are generated with a push button switch, analogue signals with a potentiometer. As display we use a simple LED or a ring of rgb LEDs.

An ESP32 micro-controller with a MicroPython interpreter installed in its flash memory will be used to read out the sensors (switch and potentiometer) and to control the data display (LEDs). The hardware was selected for its very low price (13 US\$ per station) and its simplicity of use. The participants will develop their own short programs running on the micro-controller.

The course notes, slides, exercise sheet and solutions are freely available on the WEB:

<https://afnog.iotworkshop.africa/do/view/AFNOG/ASP2022>

This workshop is a very much stripped down version of a course on the Internet of Things (IoT) developed initially for the University of Cape Coast, Ghana. Again all information on this course is available at https://afnog.iotworkshop.africa/do/view/IoT_Course_English/WebHome or a slightly different version in French:

https://afnog.iotworkshop.africa/do/view/IoT_Course_French/WebHome.

Basic Python programming

(Micro)Python is an interpreted programming language. This means that we can talk directly to the interpreter (REPL the Read Execute Print Loop) allowing us to experiment with the language without writing any programs. *thonny*, a simple Python IDE (Integrated Development Environment) let's us

- communicate with REPL
- write, save and run programs
- see printed results

We will first use REPL as a calculator, then learn about the most basic Python syntax, just sufficient to do write the exercise programs. We will write a few simple programs to get acquainted with Python.

Hardware access

To do physics experiments we need access to sensors and actuators; we need hardware access. Here we will see how to program GPIO (General Purpose Input Output) lines to switch on an LED or to read the state of a switch.