

# Software Engineering of Internet of Things

## Sampling Exercise: Frequency of a Blink

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### 1 Context

Both types of IoT devices have serial light sensors and LEDs.

### 2 Exercise

Program one IoT device to generate a visual clock signal and the other one to output a newline over the (USB) serial line when it detects a transient in the light level. Use this setup to record timestamps for the transitions of the generated clock signal and do an analysis of how precise the timing is.

### 3 Recipe

1. Locate your documentation.
2. Configure one device to blink an LED at 100Hz.
3. Configure another device to wait for a change in (ambient) light levels and write a newline character to the serial port when this happens.
4. On a laptop, timestamp the reception of the generated newlines at ns granularity.
5. Let it run for approx 5 minutes.
6. Produce a histogram or a *kernel density plot* of the differences between successive timestamps.
7. Explain what you see.

## 4 Hints

1. You may want to take a look at the serial logger at [https://e-learn.sdu.dk/webapps/blackboard/content/listContentEditable.jsp?content\\_id=\\_5849769\\_1&course\\_id=\\_413474\\_1](https://e-learn.sdu.dk/webapps/blackboard/content/listContentEditable.jsp?content_id=_5849769_1&course_id=_413474_1)
2. If you are on the ESP32, locate the light sensor on the schematics of the board, and check out which serial unit, protocol and address it is connected to.
3. If you have trouble getting your light sensor to detect light level at 100Hz investigate whether this restriction is a property of the sensor itself (look up the datasheet to verify) or one of the code interfacing with it. If the restriction comes from the code, then figure out how to improve it (e.g., by trading precision). Otherwise, pick a more reasonable frequency.