Off-the-shelf bi-directional visible light communication module for IoT devices and smartphones

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**Context and goals**

- Today consumers expect every **electronic products** to include **wireless connectivity**
- Manufacturing **costs** introduced by radio solutions are **non negligible**
- We propose a **low-cost alternative** using unmodified **hardware**: a cheap **LED** and a **smartphone**

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**Demo setup**

- **Hardware**
  - Low Power Cortex M0+, LED, 6-axis sensor
  - Raspberry Pi 3, Nexus 6P
- **Demo scenarios**
  - Wake-up and configure the VLC module
  - Get battery level and sensors values
  - Authenticate through visible light

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**LED-to-camera**

- **MCU Emitter**
- **PHY Layer**
  - 6KHz On-Off Keying
  - Manchester
- **Camera**
  - CMOS Sensor
  - Rolling Shutter Effect
  - Real time computation

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**Flash-to-LED**

- **V-PWM Modulation**
  - Built-in flashlight
  - 50-100Hz
  - ISI avoidance mechanism
- **LED receives** and **sends** at the same time
  - **Sampling** occurs when it transmits an **OFF symbol**
  - Wired in **reverse-bias** to the MCU ADC pin
  - Briefly charged, discharged, sense the residual tension
  - **Fast** discharge: Flash ON - **Slow** discharge: Flash OFF

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**Evaluation**

- **LED-to-camera evaluation**
- **Power consumption**
- **Flash-to-LED evaluation**

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**Use Cases**

- **Low cost** smart **consumer electronics**
- **Wireless** smart lock
- **Universal** alternative to **NFC**