Batteryless photovoltaic IoT device powered by the AEM10941

DEMO KIT

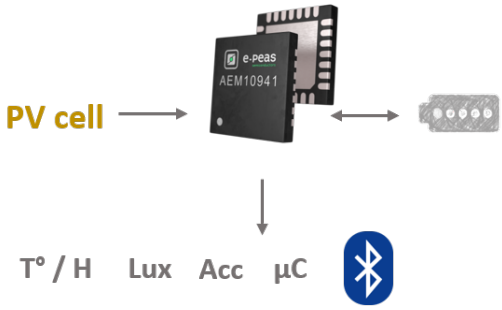
In a nutshell

Features:
- Self-powered and maintenance-free device
- Temperature, humidity and light measurement
- Battery voltage monitoring
- Wireless transmission of measures to any Android tablet or smartphone
- Easy to deploy

Energy harvesting main components:
- Photovoltaic cell
- AEM10941 from **e-peas**
- Supercapacitor 160 mF

Power consumption:
- Supply voltage: 2.5 V delivered by the AEM10941
- Average consumption is about 15.7 µA.
  While sending alert when detecting a fall, the consumption is about 137.5 µA.

Global view



Introduction

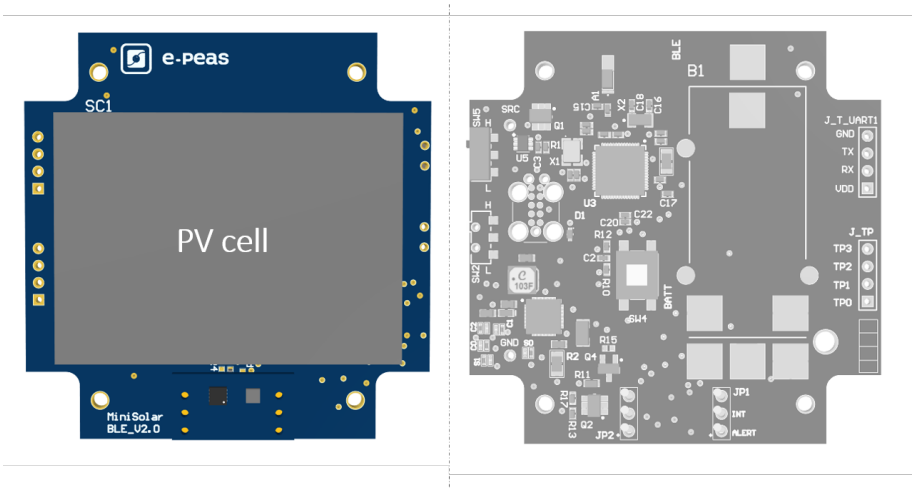
The demonstration board is an example of a connected wireless device featuring the AEM10941. It includes light, humidity and temperature sensors as well as a wireless communication module powered by a solar cell. An accelerometer can be added for shock detection.

The objective of this device is to demonstrate the efficiency of the AEM10941 for a wireless application. The board works with an ultra-low energy consumption. As a result a small solar cell is sufficient to operate it in an indoor environment. The global device is compact as shown below, making it a good choice for a wide range of applications. The supercapacitor size can be adapted to have a longer autonomy (800 mF will give 24 hours of autonomy).

Global information

Features	
Size	65 x 65 x 15 mm
Temperature sensor accuracy	±0.7 °C
Lux sensor accuracy	±10 %
Relative humidity accuracy	±2 %
Accelerometer sensivity	±0.977 mg
Lifetime	More than 15 years
Sensor sampling period	Each 60 s
Supercap voltage sampling period	Each 9.5 s
Communication	BLE beacon each 9.5 s
Autonomy:	
Above 100 lux	Continuous operation
No light	5 hours with the fully charged supercapacitor

Appearance



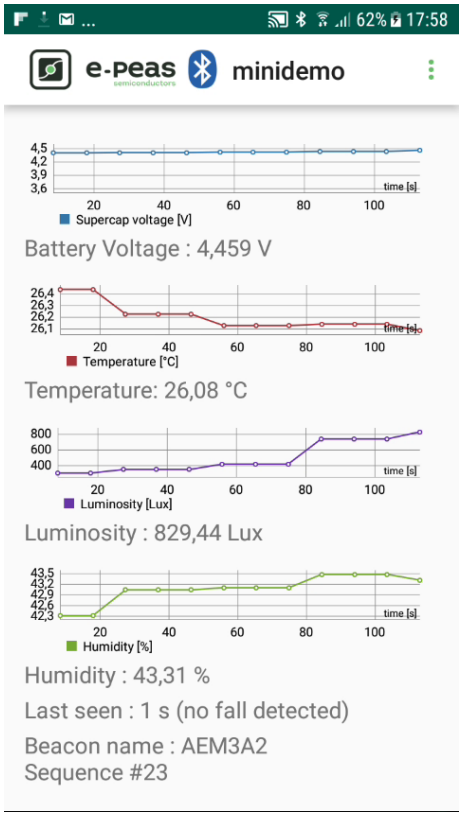
Description

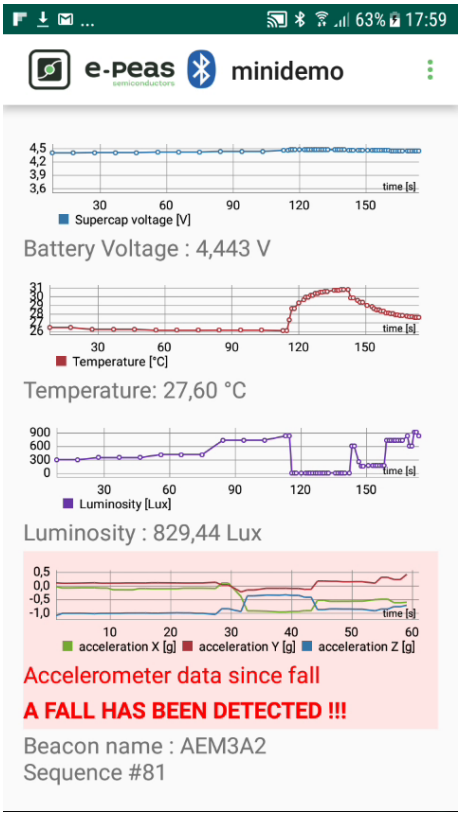
The demonstration board includes the following components:

- The AEM10941 - *ambient energy manager* - transferring the energy from the photovoltaic harvester to the storage and the load. It starts from no-voltage if 3 µW and 380 mV are available at the solar cell outputs. After coldstarting, the AEM10941 extracts the maximum power thanks to its MPP tracking function and boosts the energy into a storage element. This storage element is protected from overvoltage and overdischarge by the AEM10941. Furthermore, it provides 2 regulated voltages to supply the load. In this case, one output - *HVOUT* - is defined at 2.5 V to supply the microcontroller and the sensors used to build the application.
- A photovoltaic cell of 35 mm x 50 mm harvesting the energy which will be used to operate the microcontroller and the sensors.
- A supercapacitor, as the electrical energy storage element, storing the energy harvested by the solar cell. This energy will be delivered to the system by the AEM10941 to guarantee continuous operations.
- Three sensors monitoring the temperature, humidity and luminosity.
- A microcontroller (MCU) fetching the data from the sensors and sending it on the air using the BLE 4.1 (Bluetooth Low Energy) technology.

Data visualization

The data sent by BLE can be visualized on a dedicated tablet or smartphone (Android) application.
An Android Package (APK) file is provided with the device so that the application can be easily installed on any Android device tablet or smartphone. In normal mode, it features graphs of the received battery voltage, temperature, luminosity, humidity information as well as the numeric sensors values provided by the last BLE message. It also shows the current device name, the sequence number of the last message and a counter which indicates the time elapsed since the last message.
When the accelerometer detects a shock, a warning message is displayed and the humidity graph is replaced by another graph showing the accelerometer's 3 axis values. During this mode, a message is sent every second. After one minute, the system returns then to its "normal" state.
Below are screenshots of the running application.





Part number	
Demo PV BLE	4AAEMPVBLE0010

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