Development of self-powered low-power sensing/tracker platform for IoT applications (wearables, environmental sensing…)

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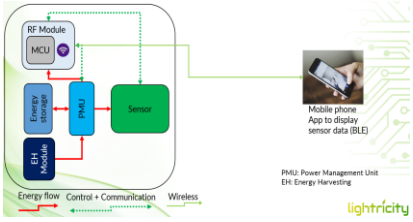
ABSTRACT

Lightricity is a high-tech SME company located in the prestigious Oxford Science Park.

Lightricity is developing Photovoltaics Energy Harvesting technology for Internet of Things (IoT) devices and products. The company's main field is renewable energy for connected sensors and IoT devices.



GOAL

- Evaluate new sensors of Silicon Labs and check their compatibility to Lightricity's criteria of energy harvesting.
- The compatibility criteria focus on the power consumption. The sensor(s) must consume a minimum of power during sleep mode and a minimum of energy during active periods (measurement).
- Develop firmware to handle the operations of the different sensors in a smart and efficient way so that the sensors can consume a minimum of energy

WORKFLOW

➢ **Background reading:**

- Understand the context of previous project.
- Ressource and tutorial research, keyword: Energy Harvesting, Bluetooth Low Energy, Bluetooth beacon, iBeacon, Sensor, Thunderboard, Silicon Labs, Energy Mode....
- Current leakage dissection of MCU and other on-board peripheral (sensors, IC…) including: study the board's schematic, datasheet, reference manual…

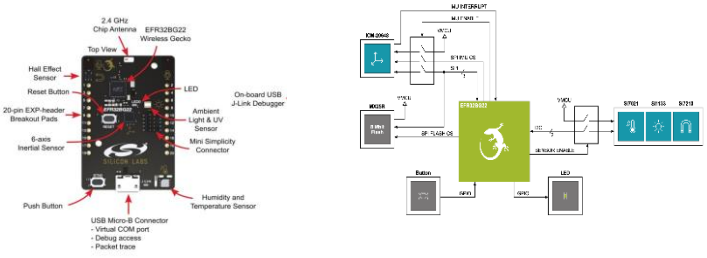


Figure 1. Silabs's Thunderboard EFRB2BG22

➢ **Develop firmware/application:**

- Develop iBeacon advertising firmware and analyze the board's energy/current consumption in iBeacon advertising.
- Develop applications to put the board into its differents Energy Modes and analyze the MCU's energy/current consumption when running each application.
- Develop iBeacon-wakeup application to schedule the advertise of 1 iBeacon package every determined period.

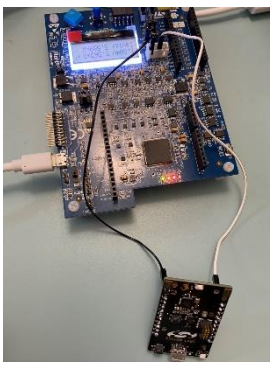


Figure 2. My typical daily workflow

RESULTS

- The result of the MCU's energy performance in each application is better or comparable with Silabs's data.
- This result is compatible with Lightricity's criteria of Energy Harvesting.
- Exchange and discussion with Silabs's engineer give good lead so someone else can easily continue my project.

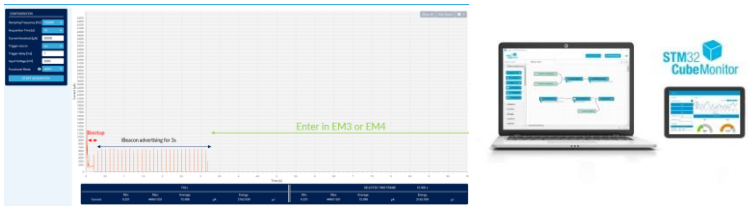


Figure 3. Energy monitoring in STM32CubeMonitor

TECHNICAL CONCLUSION

- Energy consumption is a vital parameter of developing wearables, self-powered IoT devices.
- The Thunderboard has good potential for energy harvesting that can meet Lightricity's criteria.
- Finished software documentation in a intuitive way and transferred my work to Lightricity so that this project could be easily taken up by someone else.

PERSONAL OUTLOOK

- Discover a whole new perspective in IoT's world.
- Improve embedded programming skill with Simplicity Studio IDE, Arduino IDE… and other tools like STM32Cube, Gitlab..
- Develop capacity of autonomous work and self studying new technology.
- Improve software documentation and project's organisation skill.
- Improve interpersonal and communication skill, especially in English.