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# LAB EMBEDDED SYSTEM DESIGN 2 PROJECT

## Currents

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### 1 Happy Gecko – Energy modes

We jump between EM0 and EM2. *The following data is from the datasheet.*

**EM0** 230  $\mu\text{A}/\text{MHz}$

**EM1** 67  $\mu\text{A}/\text{MHz}$

**EM2** 0,95  $\mu\text{A}$  (RTC disabled – not in our case since every hour we need to wake up?)

**EM3** 0,65  $\mu\text{A}$

**EM4** 20 nA

### 2 ADXL362

We use the accelerometer now @ 12,5 Hz ODR<sup>1</sup> so the actual current should be lower. *The following data is from the datasheet.*

**100 Hz ODR @ 2V** 1,8  $\mu\text{A}$

**400 Hz ODR @ 2V** 3,0  $\mu\text{A}$

**Wakeup mode @ 2V** 270 nA<sup>2</sup>

### 3 Happy Gecko + ADXL362

*The following data is approximated using measurements.*

**Both active** 2,30 mA

**Happy Gecko @ EM2, ADXL active** < 4  $\mu\text{A}$ <sup>3</sup>

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<sup>1</sup>Output Data Rate

<sup>2</sup>Not yet implemented, 6 checks/second.

<sup>3</sup>ADXL measuring @ ODR 12,5 Hz and waiting to generate an interrupt.

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## 4 Time and current estimates

*The following data is approximated using measurements and common sense. They are pretty worst-case and should represent the total currents used by everything.*

**Every hour measurements** 1s @ 2,8 mA

**Every day sending LoRaWAN data** 2s @ 30 mA

**Sleep** 5  $\mu$ A

$$E_{measure/day} = 24 [times] \cdot 1 [second] \cdot 2,8 mA \cdot 3,3 V = 0,22176 [J]$$

$$E_{send/day} = 1 [time] \cdot 2 [seconds] \cdot 30 mA \cdot 3,3 V = 0,198 [J]$$

$$t_{sleep} = (24 [hours] \cdot 60 [minutes] \cdot 60 [seconds]) - 24 \cdot 1 [second] - 2 [seconds]$$

$$t_{sleep} = 86374 [seconds]$$

$$E_{sleep/day} = 86374 [seconds] \cdot 5 \mu A \cdot 3,3 V = 1,425171 [J]$$

$$E_{total/day} = 0,22176 [J] + 0,198 [J] + 1,425171 [J] = 1,844931 [J]$$

- $[J] \Rightarrow [mAh]: /3,6/V_{DD}$
- How much years will it last? (at least 5!)
  1. You have a number in Joules/day, convert it to the mean current throughout the whole day.
  2. Take the mAh value of the battery and use it to calculate the lifetime in years.