MClimate | We make any home smart.

Vicki LoRaWAN | Battery life estimation

Foreword

The following document describes estimation of Vicki LoRaWAN theoretical battery life based on real-life data from over 2000 analyzed devices over the course of 1 winter season. Battery life is negatively affected by moisture, high temperature and others. Most battery manufacturers declare maximum battery life of 10 or 20 years incl. storage.

MClimate recommends Energizer Ultimate Lithium L91, on which the estimations in this documents are based on.

More information about the performed accelerated ageing test can be requested from MClimate under NDA.

Battery Life Estimations (in Years)

Number of Actuations / Heating season 90 days	SF7	SF9	SF11
<1	12+	12+	12+
2	12+	12+	11.3
3	12+	12+	7.5
4	12+	10.6	5.6
5	9.5	8.5	4.5
6	7.9	7.0	3.8
7	6.8	6.0	3.2

Number of Actuations / Heating season 180 days	SF7	SF9	SF11
<1	12+	12+	12+
2	11.8	10.6	5.6
3	7.9	7.0	3.8
4	5.9	5.3	2.8
5	4.7	4.2	2.3
6	3.9	3.5	1.9
7	3.4	3.0	1.6

Base usage data

We define “base usage data” as a term defining the typical usage of Vicki in residential environments with 3 timers per day. The data is based on real-world data from over 30 residential buildings or 2000 Vicki thermostats over a period of 9 months during the winter season in the country.

a) Definition of “actuation”

We call an “actuation” movement of Vicki’s motor from fully closed TRV to fully open or vice-versa. Going from fully closed to fully open is 1 (one) actuation. Going from fully closed to fully open and then fully closed again is 2 (two) actuations.

Important note: In real-life conditions Vicki doesn’t usually fully open or close the valve when the measured temperature is below the target temperature. Instead, it slowly opens the TRV with configurable amount of steps (default: 20 steps or about 5% in most cases). For more information about the internal temperature control algorithm, please consult “Vicki LoRaWAN Device protocol documentation v1.7”

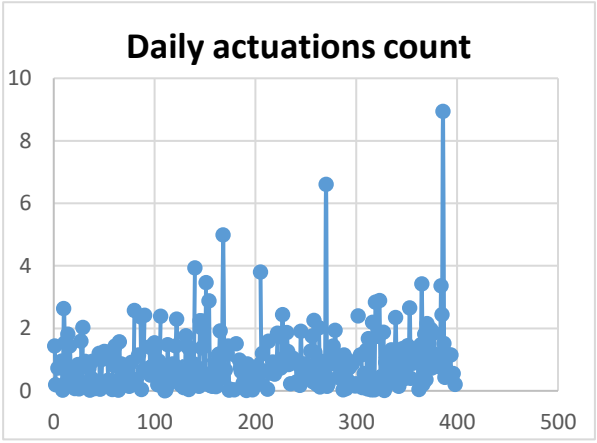
b) Data set extract and analysis

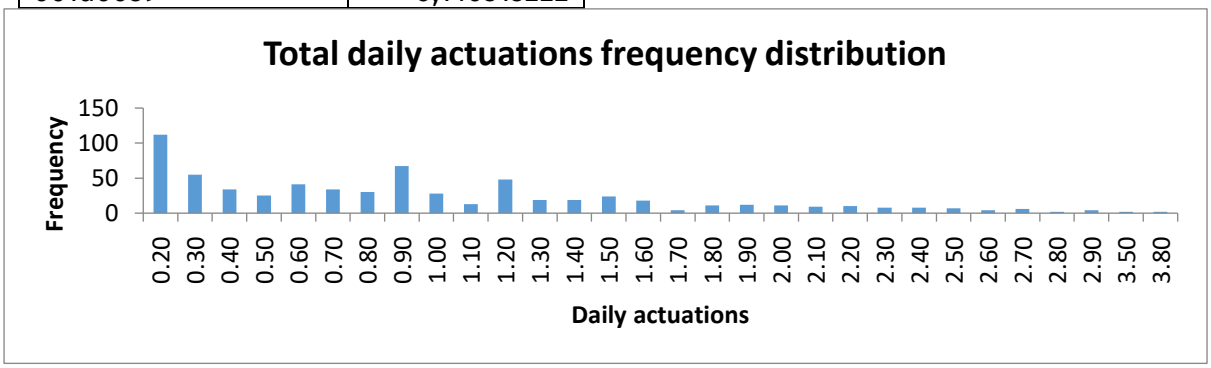
Data set extract for illustration:
(14/2000 devices)

Anonymized device ID	Daily actuations
003c001e	0,948334274
3ba1e6b5	0,019933555
0138475f	2,633039946
388c9a58	1,539973788
ff0a0039	0,285714286
ff25001f	1,807812946
001b003e	0,263101889
ff330062	0,543042271
000d0041	0,285714286
003b0032	0,69699727
0033001e	1,435955694
fd22001e	2,291864691
edb9ede9	0,726477024
001d0059	0,140515222

Analysis:

Average Daily actuations	0,9408520
Min Daily actuations	0,00060
Max Daily actuations	8,9373776
Median Daily Actuations	0,8300999





c) Conclusion

As seen in data set scatter plot, there are some small outliers, which we shall disregard. As it becomes clear from the frequency distribution, between 0,9 and 1,2 actuations are required to regulate temperature in residential buildings with 3 (three) heating schedules daily.

Important note: Unlike many manufacturers, we have designed our own LoRaWAN module, which can be regarded as taking care of the SX12XX radio part only, meaning it does NOT have an additional MCU like modules other manufacturers use. The LoRaWAN stack is implemented on the same MCU as the rest of the firmware of the device. This allows us to decrease the required energy to operate MClimate devices significantly and reach the full potential of LoRaWAN.

Resources:

- Energizer Ultimate Lithium L91 datasheet: https://data.energizer.com/pdfs/l91.pdf