Energize Me! Powering a Geiger-Müller-Counter using thermoelectronic generators

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MOTIVATION AND SCIENTIFIC MERIT

- Motivtion behind tracking radiation
  - radiation kills people.
  - exposure can not be noticed naturally, but is harmful even on the short term
  - irradiated particles naturally move
  - harmful levels of radiation can usually not be predicted
- merit of using independent power supply
  1. some sensors need to be deployed in remote areas
  2. not all areas have a steady power supply
  3. nuclear catastrophes may destroy energy infrastructure

METHODS AND SCHEMATICS

- How does the power supply work?
  - a solar-reflective parabollic trough mirror reflects sunlight on a Peltier Element
  - Peltier elements generate electric energy through temperature differences between their sides
  - light reflecting Parabolic mirrors bundle light, generating heat at their hotspots

focal line
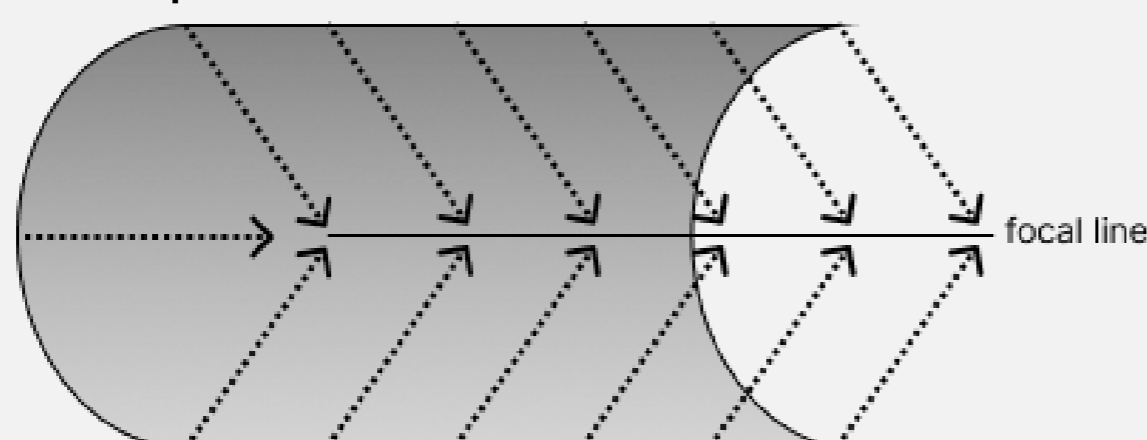
- How does the sensor receive power at night?
  - An Uninterupted Power Supply (UPS) is interposed between powersource and sensor
  - the UPS functions as a Power adapter
 - The UPS has a projected batterylife of 40 hours when supplying the sensor system

- basic Sensor system
 - the system uses an SBM-20 Geiger-Müller tube

  - The Geiger-Müller tube is deployed on the Multigeiger-PCB by Ecocurious
  - Outputs of the tube are handled and sumbmitted to the server by a WiFi-kit-32
  - The sensor system has an estimated power consumption of 5 Volts and 100 Milliamperes
- improvements to conserve power
  - The only way to achieve lower enegry consumption would be to use deep sleep mode of the WiFi-kit-32
    * This shuts off the energy supply to the SBM-20, meaning the system would have to be awoken by a timer
    * users of the system would prefer to know about increased irradiation immediately rather than after a timer runs out

FINDINGS USING SENSOR 71217 IN VECHTA, NIEDERSACHSEN, GERMANY

- **Radiation over the course of a day**
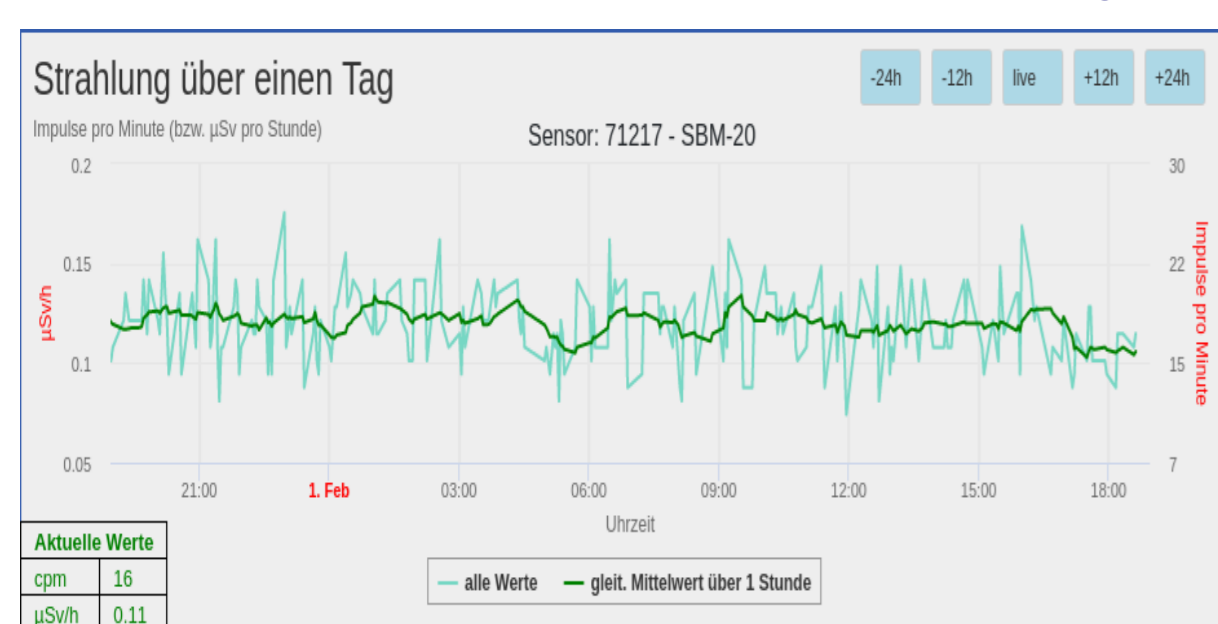
- **Radiation over the course of a month**
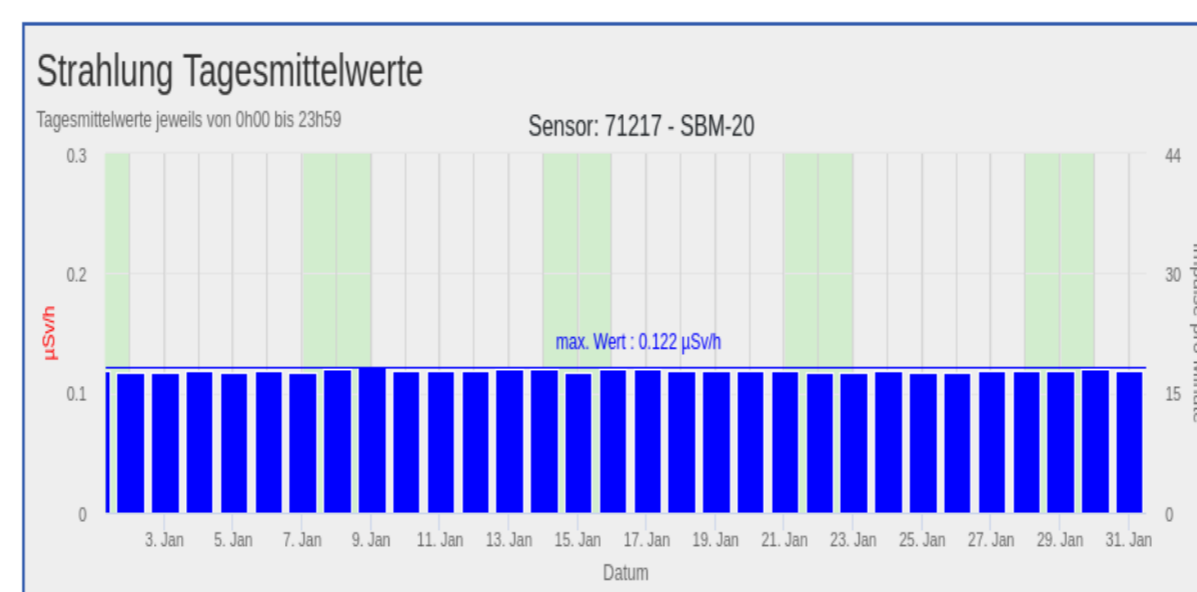
Power Supply

- The battery pack showed a charge of between 75% and 100% after roughly 48 hours of charging from 0% while not supplying the sensor system
- Therfore, the power supply underperforms and does not supply the required amount of electricity by a small margin

CONCLUSION

- How did it work?
  - The collector did not generate enough heat for the peltiers to power the system by a small margin
  - The battery pack will therefore run out of energy eventually
    * Power generated could be increased by using a bigger collector or more Peltier elements
  - The collector wasn't properly fixated, collaped in on itself and was disconnected from its fixation in a storm

SOURCES, LITERATURE

https://multigeiger.readthedocs.io/en/latest/index.html
https://ecocurious.de/multigeiger-karte
https://www.volker-quaschning.de/articles/fundamentals2/index.php
https://github.com/ecocurious2/MultiGeiger/tree/master/docs/hardware/GerberFiles
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