Zurich University
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Autonomus and energy autarkic ventilation system

In old buildings, damp cellars are often a problem. To regulate the room climate, regular and correct ventilation is therefore required. The aim of this work was to develop a functioning demonstrator in the form of a window that enables automated ventilation. The system should include an integrated energy storage device and an energy harvester to limit the structural changes to the window and the building itself. The kinematics for opening and closing the window were analyzed theoretically and experimentally. From the collected data, an energetically optimized drive concept with a passive mechanical memory was created. Of the various possibilities for energy harvesting, photovoltaics was selected based on price, performance and complexity. The energy storage was realized with a lithium ion capacitor (LiC). This combines a good energy density with a long service life and low self-discharge. The system is controlled by a BMD-340 module with a Nordic nRF52840 (ARM Cortex M). The results show that the optimized mechanics were able to reduce the energy required to open and close the window by more than 50 %. With the photovoltaic cells perpendicular to the earth's surface, the storage tank can be charged within 2 min 41 sec with a global radiation of 685 W/m2. The storage is enough for 2 days 16 hours operating time with one ventilation cycle every 120 minutes. If the deep discharge protection responds to the LiC, a non-destructive storage of 10-month weeks can be guaranteed.

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Demonstrator of the autonomous and autarcic ventilation system

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