SMART BUILDING ENVELOPE WITH SOLAR ENERGY STORAGE

Author: Jānis Narbuts
Supervisors: Ruta Vanaga, Andra Blumberga
Co-supervisor: Dainius Paliulis

Introduction

Energy efficiency and energy demand reduction are highlighted as key mitigation choices by many IPCC Assessment Reports and UNFCCC documents, protocols and international agreements.

Accounting for concerning 40% of EU's final energy and 36% of CO_2 emissions, buildings are related to a major untapped energy saving potential.

A lot of the energy presently used in buildings is wasted because of out-of-date construction practices.

There is a high demand of innovative technological solutions for the significant reduction of heating and cooling in buildings.

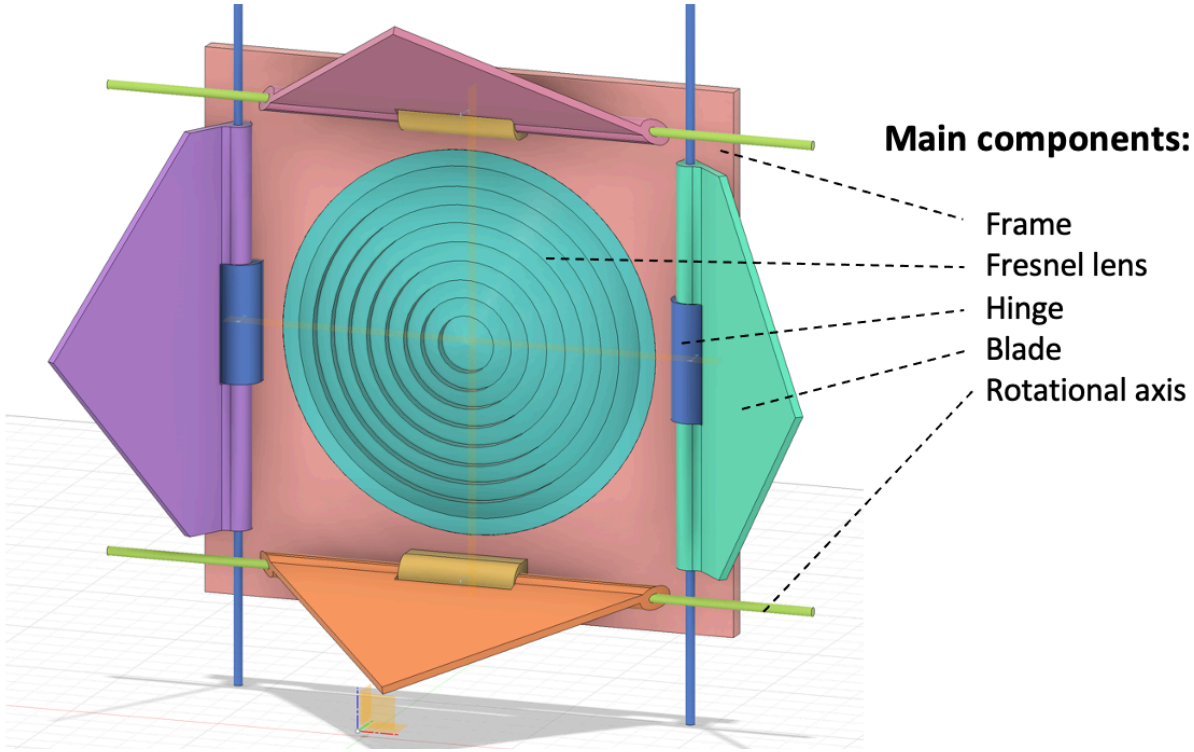
Aim of the work

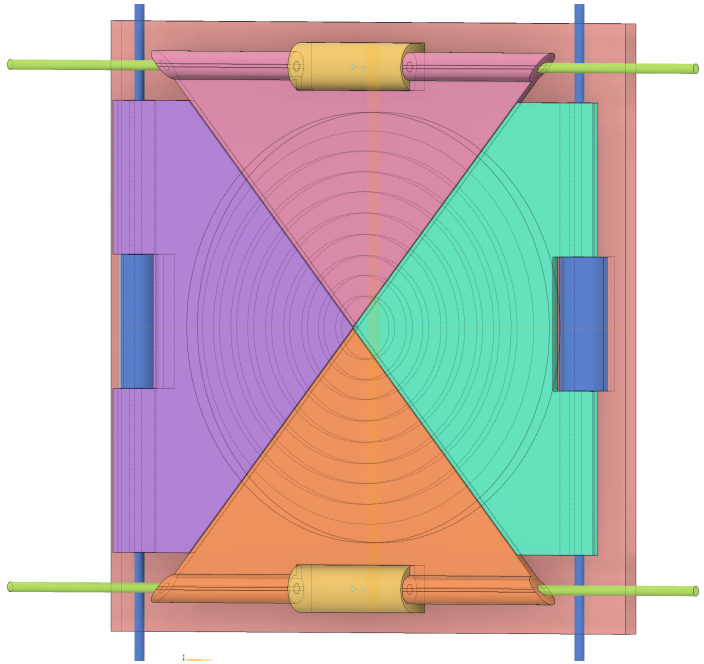
The main goal of the study is to develop an innovative dynamic facade system with solar energy storage

The main task is to evaluate the energy efficiency of the technology based on experimentally obtained results

The concept of proposed technology

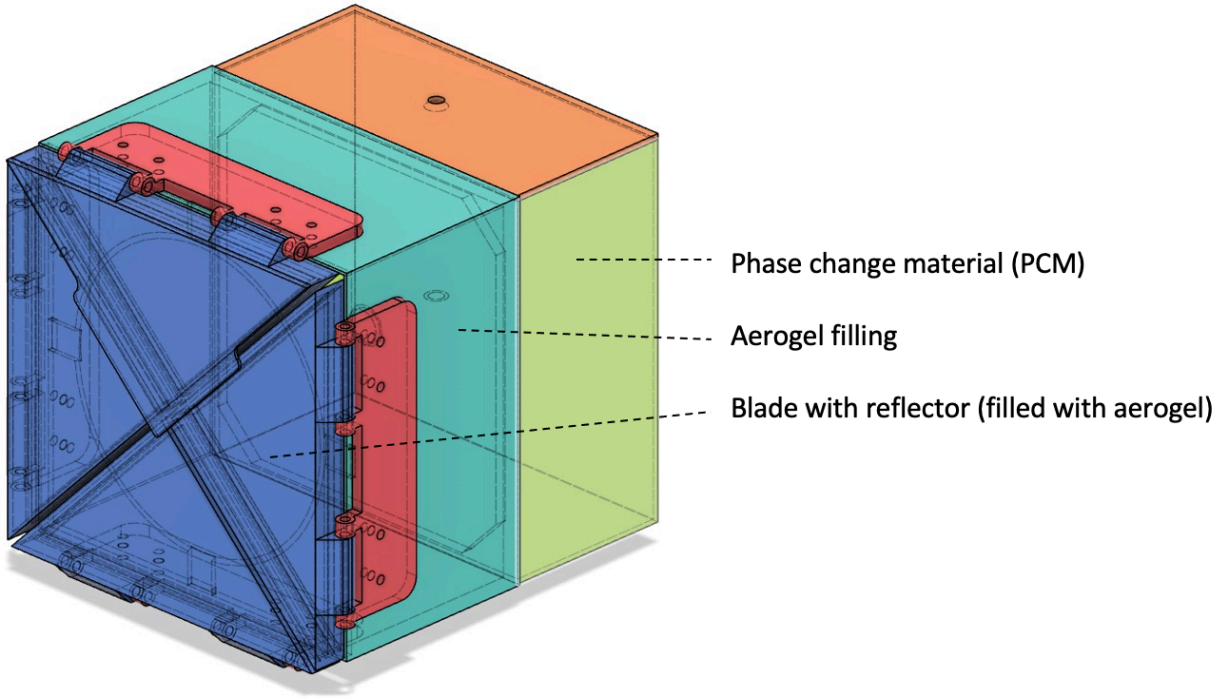
Facade module with solar radiation tracking and heat storage

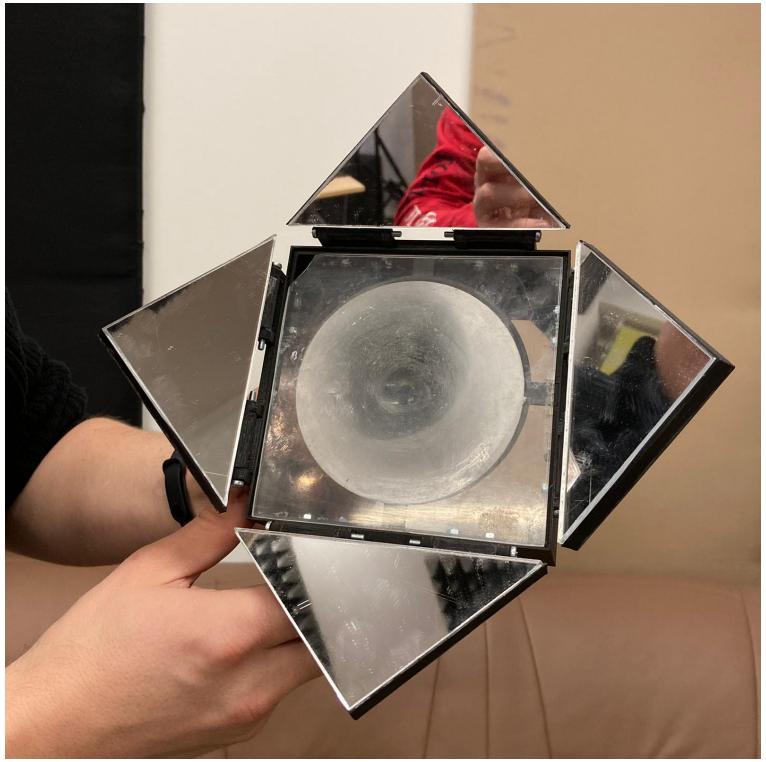




Prototype

Facade module with solar radiation tracking and heat storage



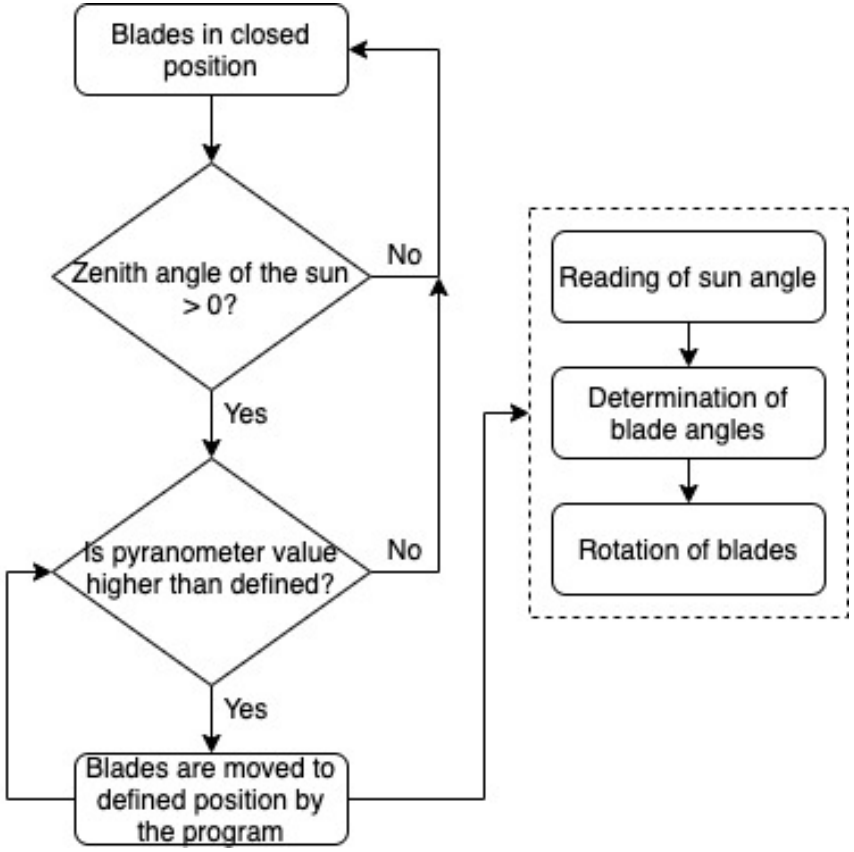


Control algorithm

Solar radiation is measured by pyranometer

Blade angles are calculated by program using information about solar position in time

Blades are moved by stepper motors



Expected results

Improvements compared to regular facade with thermal insulation:

- Use of phase change material (PCM) for efficient energy conservation
- Heat accumulation while the room temperature is in the comfort range (around 19-21^{o}C)
- Improved thermal insulation to avoid heat loss
- Increased energy efficiency of the building due to the charge and discharge cycles – energy is absorbed in the daytime and released at nigh
- The proposed technology is a climate adaptive building shell which plays a very significant role in overall energy balance of the building

Conclusions

The technology proposed has a great potential to reduce heating energy demand of a building especially in nothern climate

It would have positive impact on climate change by avoiding CO_2 emissions in unnecessary heating reducing the length of the heating season