UNIVERSITÄT HOHENHEIM
INSTITUTE OF AGRICULTURAL ENGINEERING
Tropics and Subtropics Group

Smart Power Management for Improved Energy Performance of an Inflatable Solar Dryer

Ana Salvatierra-Rojas, Marcus Nagle and Joachim Müller
University of Hohenheim, Agricultural Engineering, Tropics and Subtropics Group, Germany

Introduction

- An Inflatable Solar Dryer (ISD) has been developed based on the Hohenheim-type tunnel dryer (Fig. 1).
- The ISD does not require a solid structure as the ventilators inflate the dryer to form a tunnel, thus the system is collapsible and can easily be transported.

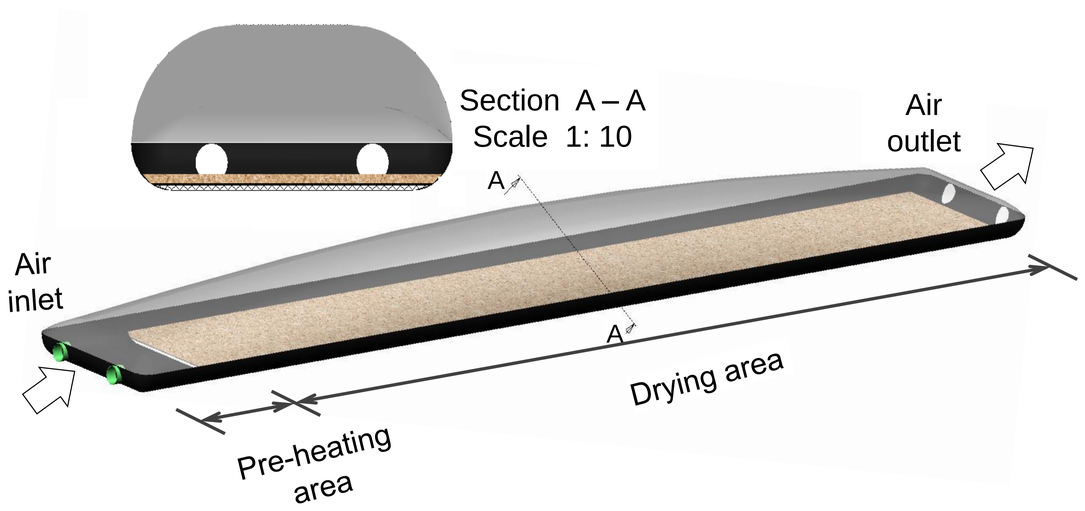

Fig. 1. Inflatable solar dryer (ISD)

- However, forced ventilation is driven by PV-charged batteries which can quickly become depleted.
- Improvement of the operation is required to regulate energy consumption according to demands of the drying process to prolong the battery charge.

Material and Methods

- An embedded ‘smart’ controller was designed using a PI unit and analog temperature sensor to regulate power supply to the ventilators (Fig 2).
- The control unit was tested measuring air conditions and power consumption in the ISD (Fig 3).

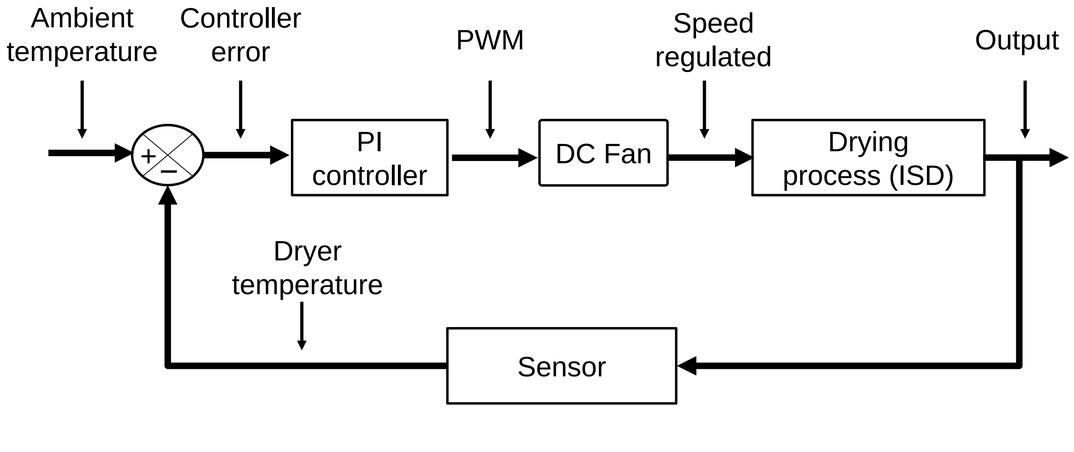

Fig. 2. PI ‘smart’ controller with flow chart

Results

- Energy consumption and air conditions inside the ISD with and without regulation are shown in Fig. 4.
- Ventilation was distinctly reduced, while temperature behavior was not considerably affected.
- This lead to substantial reduction in power demand until late afternoon, when consumption became similar.
- Overall, substantial energy savings were observed.

Fig. 3. Conducting power management experiments in the ISD

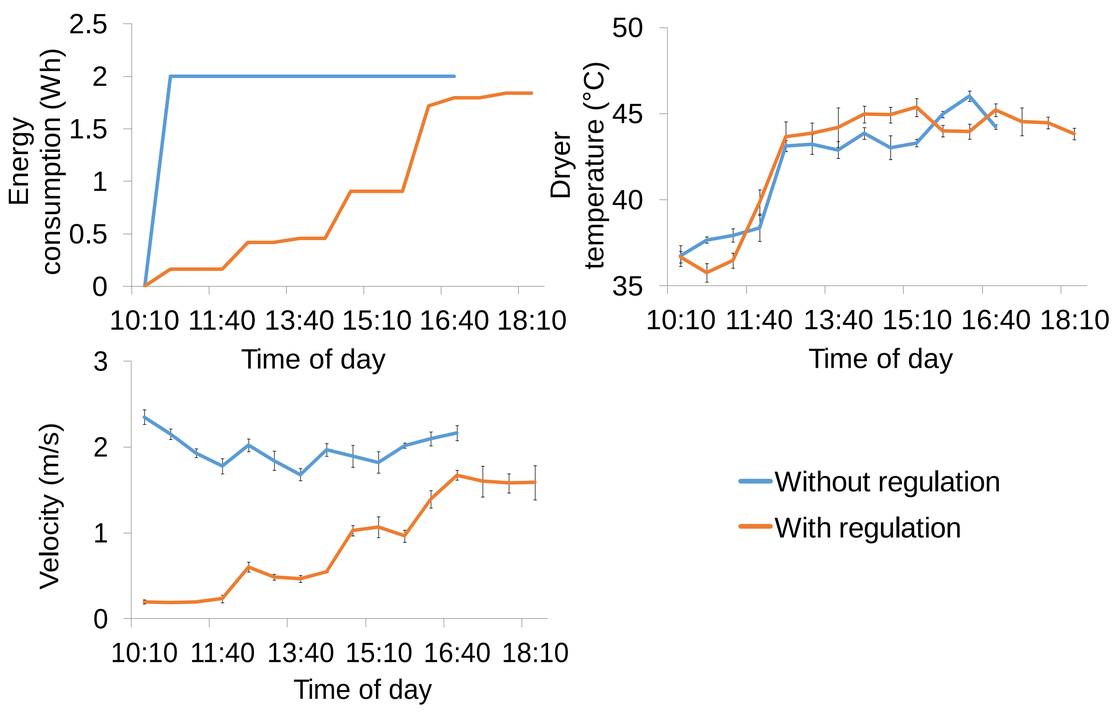

Fig. 4. Energy consumption of the ventilators as well as air velocity and temperature at the ISD outlet with and without ‘smart’ control.

Conclusions

- A PI controller was successfully integrated in the ISD system to reduce the energy consumption.
- Regulated ventilation was achieved over a range of temperatures without compromising drying conditions.
- A low-cost automated ‘smart’ control system for the ISD was successfully designed, implemented and tested.

giz
On behalf of Federal Ministry for Economic Cooperation and Development
Foundation fiat panis
Carl-Zeiss-Stiftung

Contact:
Ana Salvatierra-Rojas
Ana.SalvatierraRojas@uni-hohenheim.de