Smart Dryer

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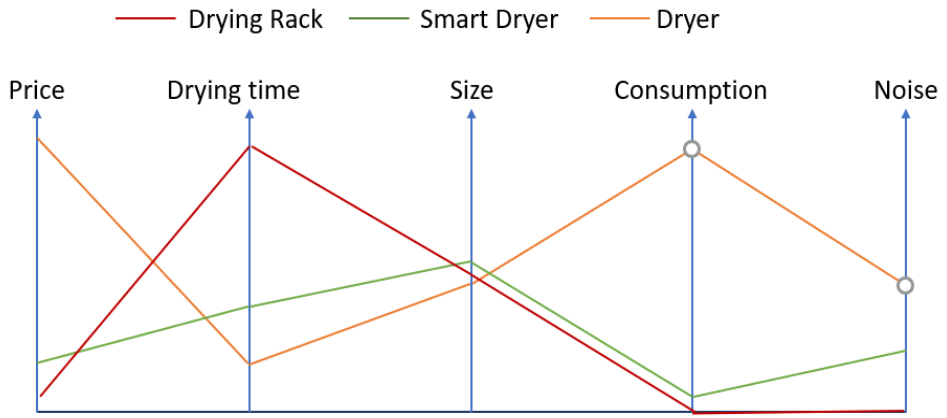
Poll and Market Analysis

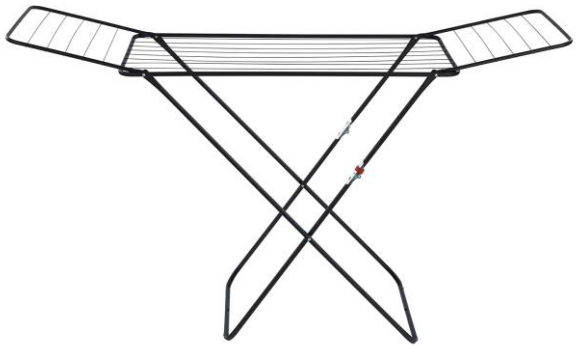
	Not much	Quite enough	A lot
How much is important that the clothes dry fast?	16,5%	47,1%	36,5%
How much is important that a drying system has little dimensions?	11,8%	60%	29,4%
How much is important that drying system is quiet?	3,5%	35,3	61,2%

Considering a drying system would you choose:	(1)	(2)
(1) Fast but expensive (2) Slow but cheap	23,5 %	76,5%
(1) Fast but with high consumption (2) Slow but with low consumption	9%	89,4%



1.Comparison of the main characteristics of the drying systems

Introduction



2. Drying Rack

3. Dryer

4. Electric drying rack

Washing and drying clothes is a necessary everyday activity.

There are already several devices designed to solve the problem of drying clothes.

Our study aims to create a low-cost smart system to optimize this process.

System Description

The moisture content can be approximated as a linear function of time:

$$m(t) = -C(T, V_{air}, RH)t + m_0$$

Total time to dry the clothes:

$$T_{tot}(q) = \frac{m_0}{qC_{on} + (1-q)C_{off}}$$

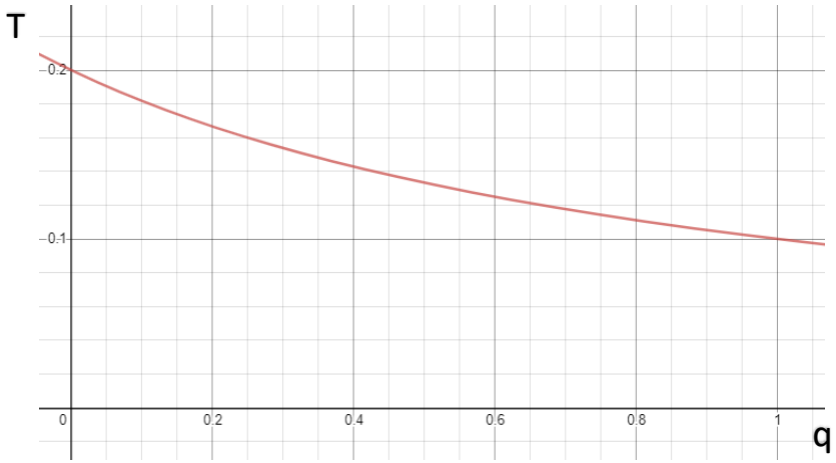
Where $q = \frac{T_{on}}{T_{period}} = \frac{T_{on}}{T_{on}+T_{off}}$

With:

$m_0 = 1\ g$

$C_{on} = 10\ g/min$

$C_{off} = 1\ g/min$



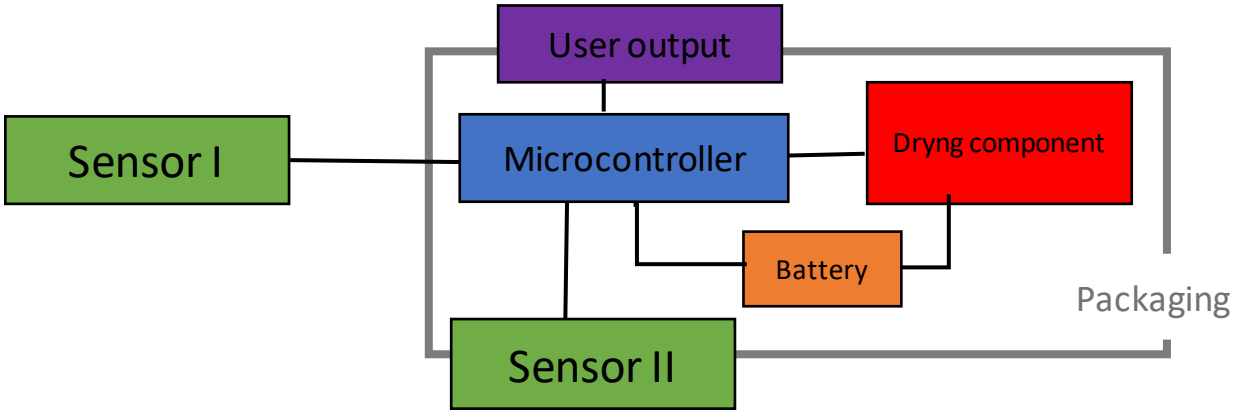
System Specification and General Architecture

The system must:

- make the drying process faster,
- understand when the clothes are dry,
- notice the user that the clothes are dry.

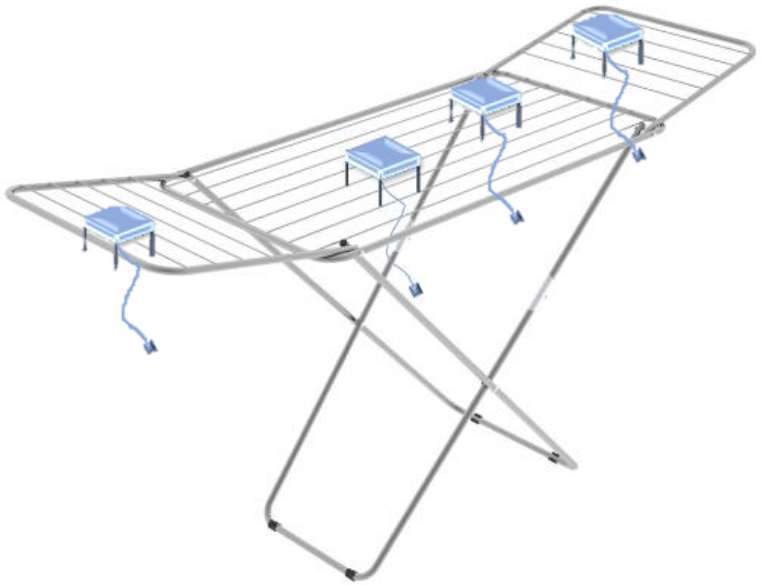
Evaluate drying → Humidity sensor

Drying component → Fan



5. Schematic representation of the system

System Characteristics



=module

6. Possible positioning of the module on different drying rack

Customer rack adaptable

Customer preferences adaptable

three modalities:

- fast drying: fan always on until the drying is complete;
- normal regime: 5 minutes on and 5 off, repeat until the drying is complete;
- energy saving: 3 minutes on and 9 off, repeat until the drying is complete.

Prototype

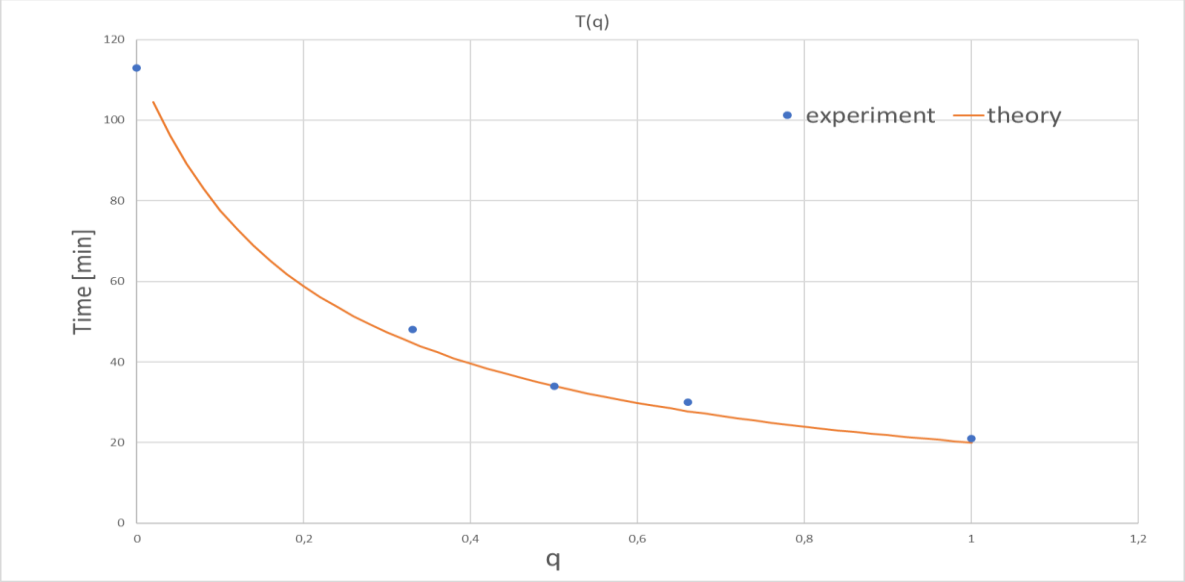
7. Humidity sensor DHT11

8. Sunon MEC0381V1-A99 fan

9. Prototype photo

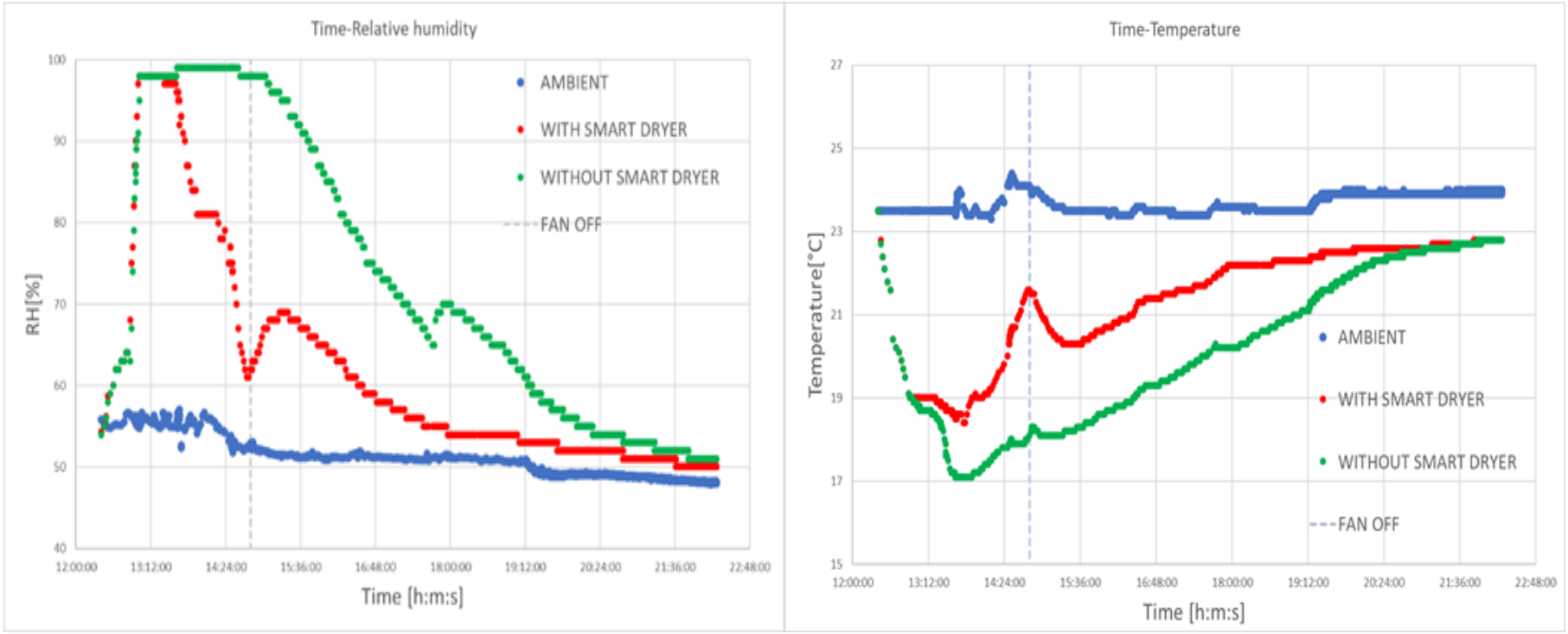
Experiments: physical model

OPERATING REGIME	Fan always off q=0	2 min off 1 min on q=0,33	1 min off 1 min on q=0,5	2 min off 2 min on q=0,5	3 min off 3 min on q=0,5	2 min off 1 min on q=0,66	Fan always on q=1
TIME	113 min	48 min	33 min	38 min	32 min	30 min	21 min



10. Comparison between experimental and theoretical results

Experiment: real application



11. Humidity and temperature over time in the final test of the system

Conclusion

Advantages:

- Good efficiency
- Cheap
- Low consumption
- Quiet
- Small

Further improvment:

- Explicit $C(T, V_{air}, RH)$ and find optimum V_{air}
- Insert a motor to tilt the fan in order to cover a bigger portion of the rack.

Thank you for your attention!