The Power of Realization

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TEXAS INSTRUMENTS

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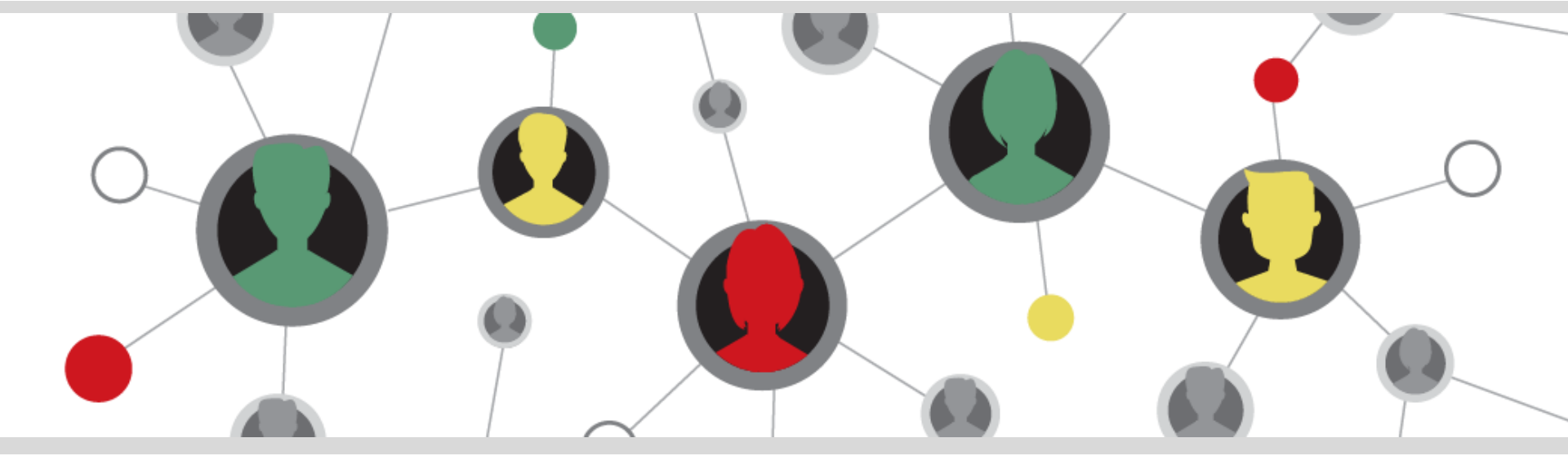
Physics with TI Innovator:

Strange Case of ’Pecorino_Cheese’



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Milk or not milk, that is the question

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2019, September, Sardinia

IL DATO

Coldiretti: "Tre milioni di litri di latte 'gettati' nei giorni della protesta"

L'associazione ribadisce massima attenzione sulla vicenda che coinvolge "12mila allevamenti della Sardegna"

A possible solution: small high-quality production with the technology of Texas Instruments

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TI nSpire CX and HUB innovator in the field of cheese production

The case for the cheese “pecorino a crosta fiorita”: a matter of technology and raw materials

Ingredients

- ✓ 8 liters pasteurized sheep milk
- ✓ 160 gr white yogurt, no sugar, not flavoured
- ✓ 3.2 ml liquid rennet
- ✓ Brine (400 gr salt dissolved in 2 lt water)
- ✓ 1 small slice of brie (to take the mold from)

Credits: http//blog.giallozafferano.it/formaggiofaidame/brie-fai-da-me/

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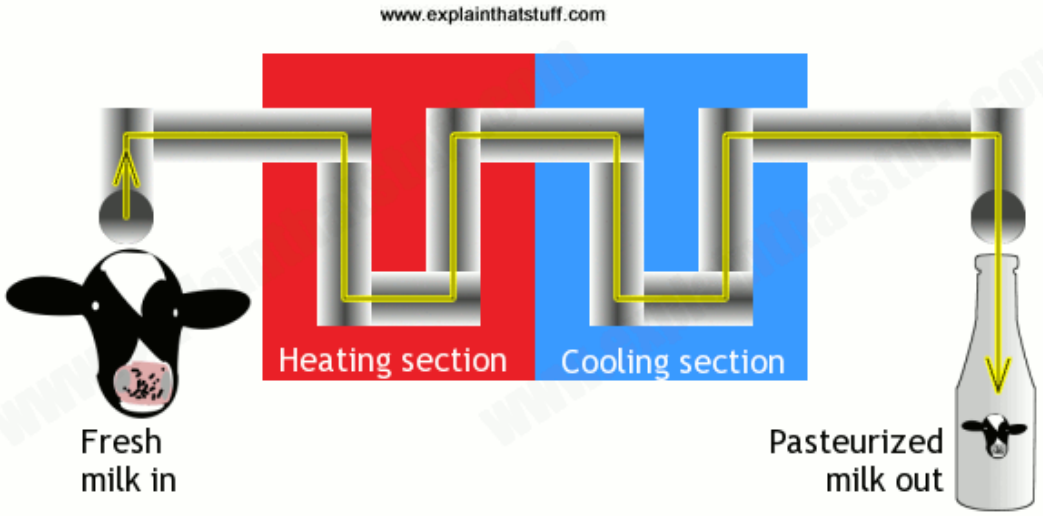
The pasteurization process



Pasteurization or **pasteurization** is a process in which certain packaged and non-packaged foods (such as milk and fruit juice) are treated with mild heat, usually less than 100 °C (212 °F), to eliminate pathogens and extend shelf life.

The process is intended to stabilize foods by destroying or inactivating organisms and enzymes that contribute to spoilage, including vegetative bacteria but not bacterial spores.
Since Pasteurization is not sterilization, and does not kill spores, a second "double" pasteurization will extend the quality by killing spores that have germinated.

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Credits: https://en.wikipedia.org/wiki/Pasteurization

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The pasteurization process and TI tools

Instructions

- ✓ Heat up the sheep milk to a temperature of 72°C for 20 sec
- ✓ Quikly cool it down
- ✓ At home it will be easily done by **using the termometer 167440 Easy Temp** and the **module Vernier Data Quest from TI nSpire CX**, heat up the milk up to 72°C for 20 sec and then immediately cool it down in a sink full of cold water and ice.
- ✓ The pasteurization allows to obtain a sanitized milk, minimizing the risks for health caused by dangerous microorganisms such as bacteria, fungus e yeasts.

Tools:

- ✓ **TI nSpire CX**
- ✓ **167440 Easy Temp**

Vernier EasyTemp®

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The curd and TI tools (1/2)

Instructions

1. Heat up the milk sheep to a temperature of 37°C
2. Add up the yogurt, mix all up and cover up with a blanket to keep the temperature constant and allow the ferments of the yogurt to acctivate.
3. After 20 min measure the temperature. If it has cooled down switch the cooker on again and bring the temperature back to 37 °C.

   Add up the rennet measuring it with a syringe and cover it up again with the blanket.
   Wait 40 minutes

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Tools:
- ✓ **TI nSpire CX**
- ✓ **167440 Easy Temp**

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The curd and TI tools (2/2)

Instructions

4. Cut the curd in 5x5 cm cubes, wait 20 min, cut again, this time using a whip (dimentions of a nut), wait 5 min, gently turn over the curd, wait 10 min and then transfer into the “fuscella”
5. Put the “fuscella” in a closed plastic box (the ones used for clothes) for the room-temperature stewing. Turn over after 25 min, then again after 45 min and after 60 min. Keep in the box for another hour
6. Saulting
7. Immerse the cheese in the brine at 20% in weight, one hour per side and per kg of cheese

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Tools:
- ✓ **TI nSpire CX**
- ✓ **167440 Easy Temp**

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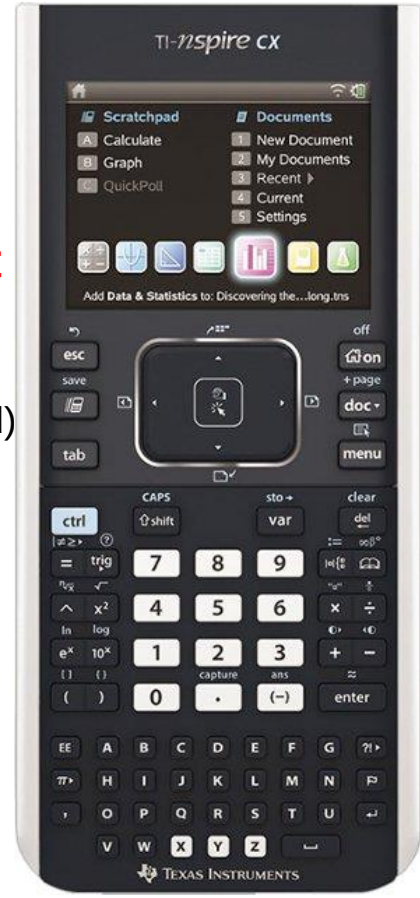
Seasoning

This is the phase in which technological innovations as TI nSpire CX and HUB Innovator became significantly relevant



Instructions:

- ✓ Take an **old** refrigerator (**NO Frost** or **ventilated** refrigerators **are not good**)
- ✓ Put the cheese inside for the seasoning.
  For the first 4 days still in the “fuscella”, turning over every 8 h.
  After the first 4 days turn over once a day.
- ✓ These are the internal conditions necessary:
  temperature between 12 and 15° C, relative humidity 85%-90%

Tools:

- ✓ **Old refrigerator**
- ✓ **TI nSpire CX**
- ✓ **HUB Innovator**
- ✓ **sensor DHT Grove**
- ✓ **Relè SRD and on/off switch**

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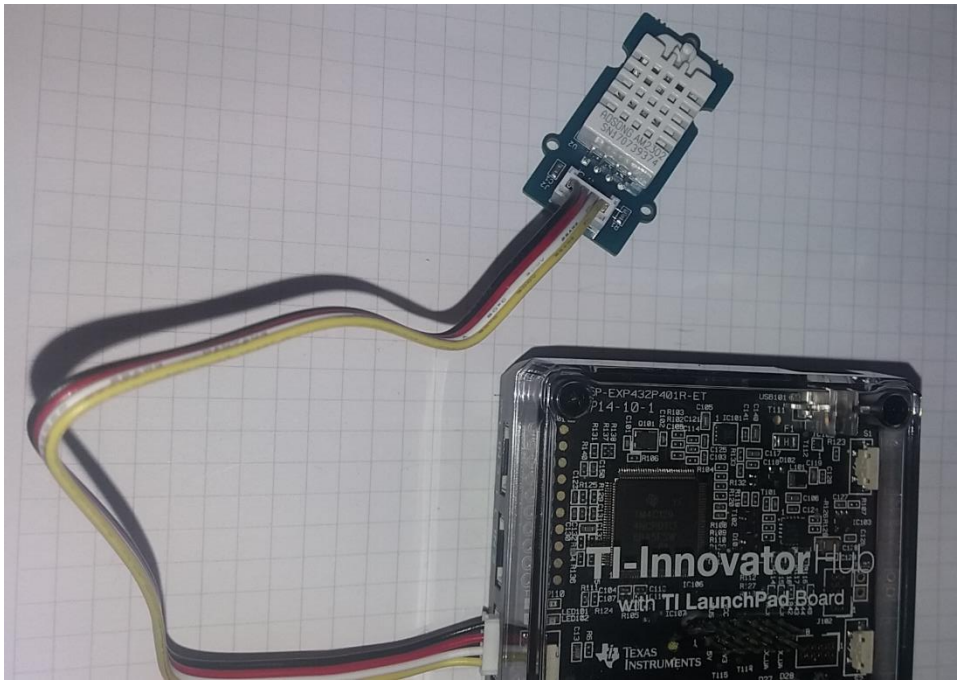
Measure of temperature and humidity during the seasoning phase

We have used:

- ✓ a **DHT Grove sensor** directly connected to the HUB innovator, on the port IN 1
- ✓ a **long cable put inside the sensor**.

The sensor reads the temperature and humidity and rings and light up the LED of the TI-Innovator HUB when it's out of range.



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Code:

This is the TI-Basic code used:

```
end "BEGIN"
DelVar iostr.str0
GetStr iostr.str0
Disp iostr.str0
DelVar t,h,l,k,n
Send "CONNECT LIGHTLEVEL 1
TO IN2 "
Send "CONNECT DHT 1 TO IN1 "
© Mesures
Send "CONNECT DHT 1 TO IN1 "
Request "Nombre de mesures",n
©Request "Δt entre 2 mesures",k
k:=1
t:=newList(n)
```

```
h:=newList(n)
l:=newList(n)
p:=newList(n)
For i,1,n,k
Send "READ DHT 1
TEMPERATURE "
Get a
t[i]:=a
Send "READ DHT 1   HUMIDITY "
Get b
h[i]:=b
Send "READ LIGHTLEVEL 1"
Get c
l[i]:=c
Disp "N. ",i
Disp "°C  ",a
Disp "U.R.%",b
```

```
If a>30 or b>85 Then
Send "SET SOUND 440 TIME 1"
Send "SET LIGHT  ON"
EndIf
If a<25 or b<60 Then
Send "SET SOUND 110 TIME 1"
Send "SET LIGHT  ON":EndIf
If 25≤a≤30 and 60≤b≤85 Then
Send "SET LIGHT  OFF"
EndIf
Wait k
p[i]:=k
EndFor
Send "SET LIGHT  OFF«
>>>Link al codice
```

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Seasoning of the cheese (1/2)

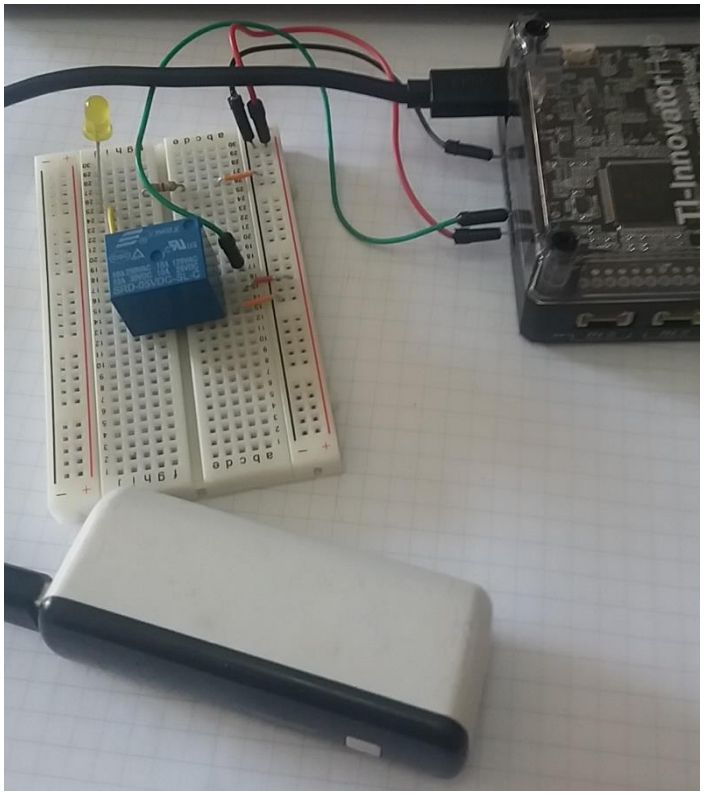
Temperature control:

A normal refrigerator has internal temperature of 4-5 °C.

The ideal condition for seasoning is instead of 12-15 °C.

To obtain these conditions **a relay is used,** connected to a switch of the refriferator and at the HUB Innovator that acts when the temperature is out of range.

It turns off when it goes down 12 °C and turns on when it goes up 15 °C



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Seasoning of the cheese (2/2)

Humidity control:

Put containers full of water inside the refrigerator. Choose the volume to obtain a certain range of humidity.

You could add a fan in order to obtain a constant relative humidity condition.

Ventilation could negatively affect the drying of the cheese.

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The inoculation of the molds

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Instructions

Buy a Camembert or Brie, take some mold from the crust (Penicillium camemberti), mix it up with water and, using a kitchen brush, cover all the surface of the cheese. Repeat after 4 days.

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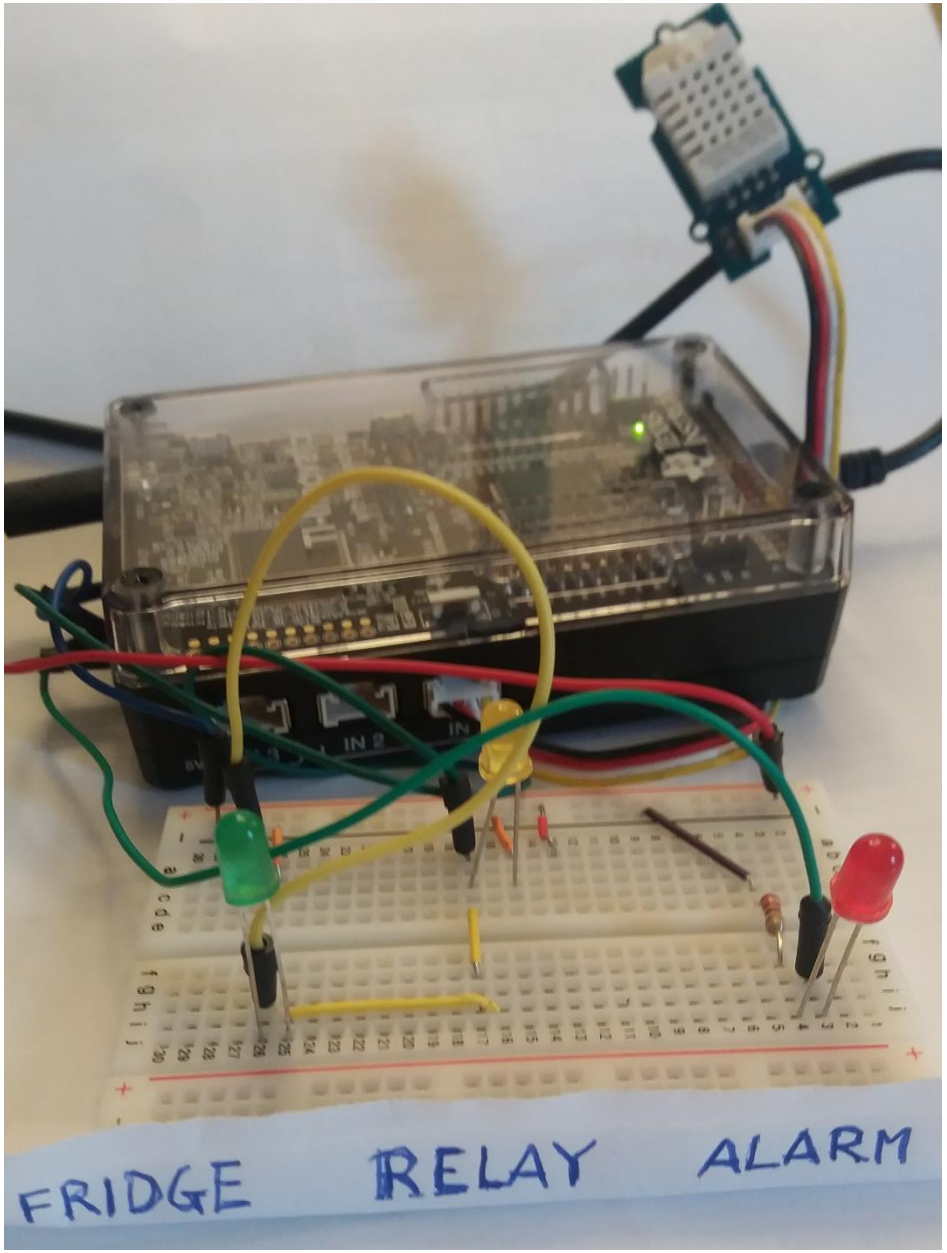
The simulation



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Thank you!

(and «enjoy your/our cheese»!!!)

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