

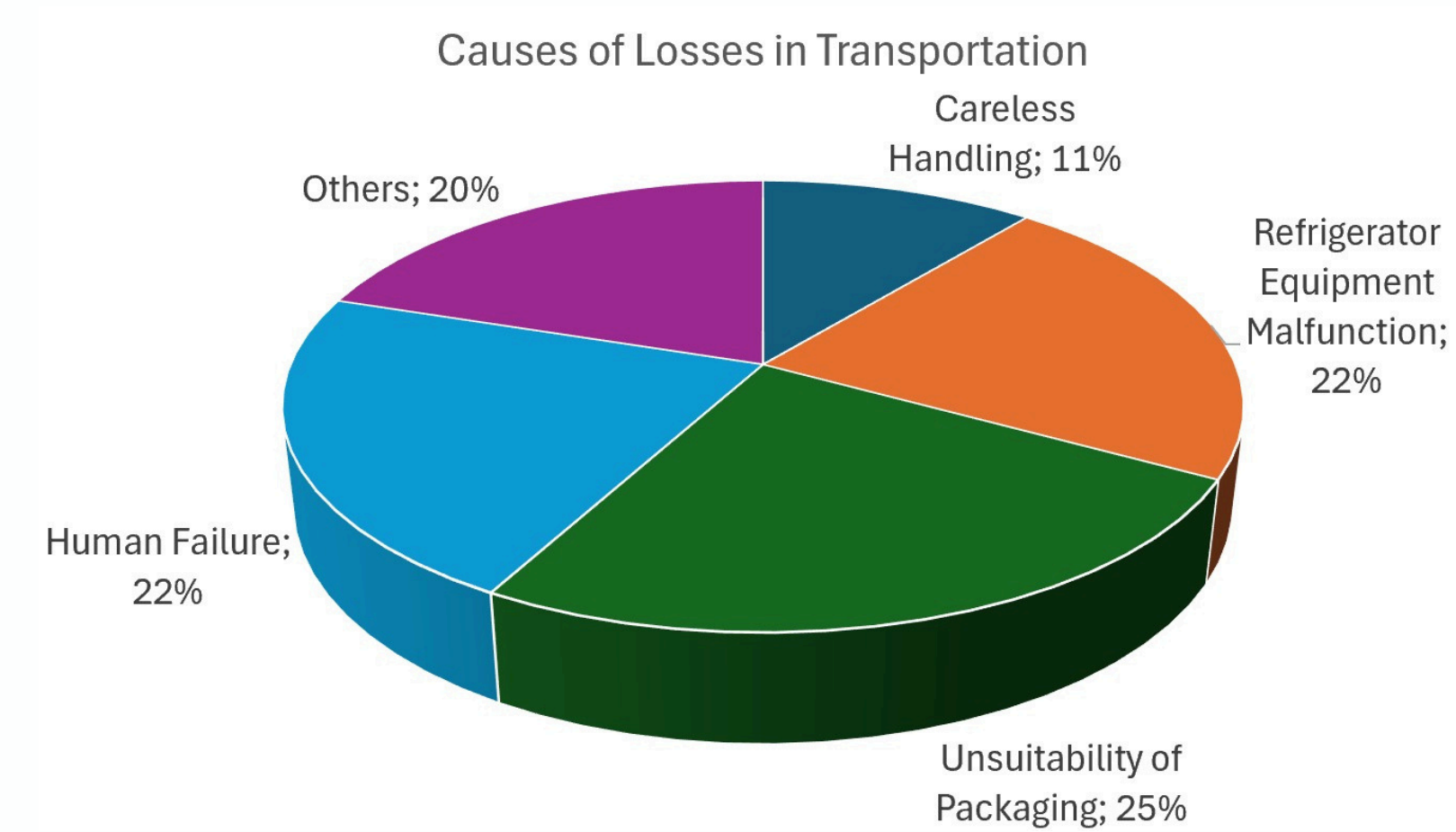
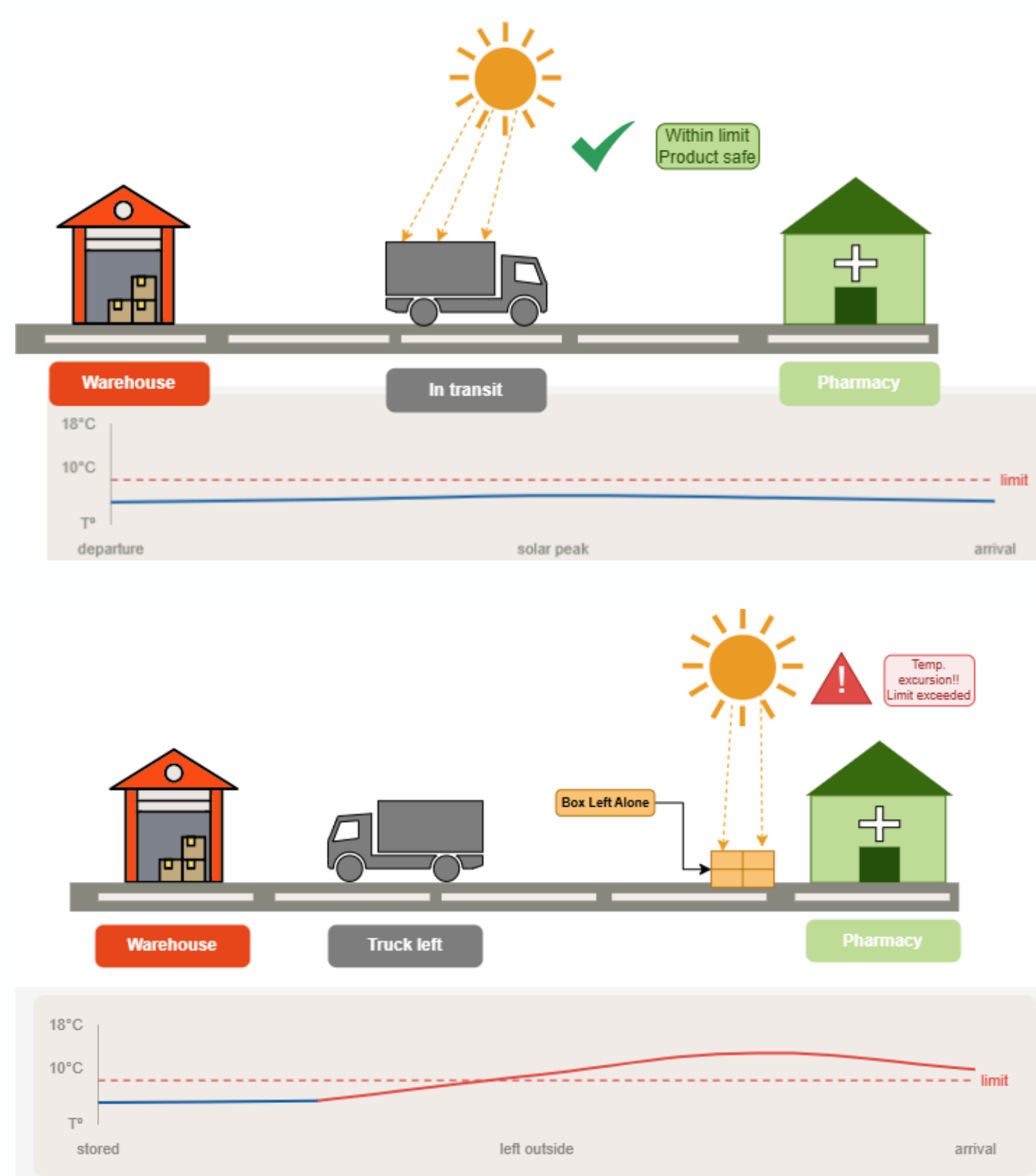
CHAINGUARD — IOT COLD CHAIN INTEGRITY MONITOR

Project Team 24: Filipe Lavos, Francisco Mendonça, Francisco Motta, João Ferreira, José Guita, Vasco Oliveira

Mentor: Luis Caldas de Oliveira

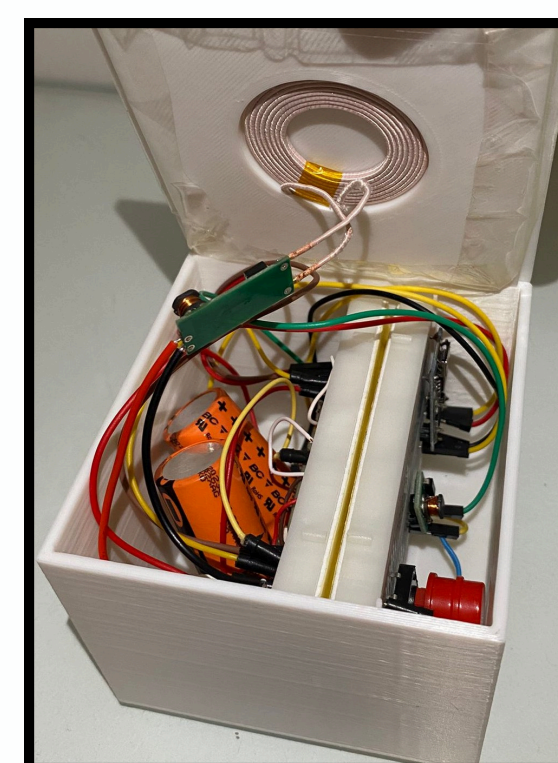
Problem Statement

Vaccines, medicines, and food are transported daily in refrigerated trucks. However, current sensors are fixed to the truck and do not monitor individual boxes, resulting in undetected temperature failures until the damage has occurred.



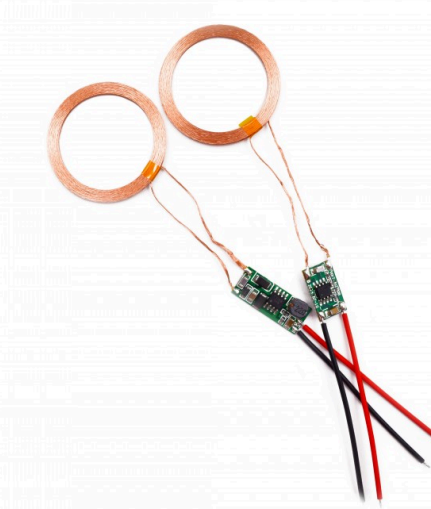
"20% of temperature-sensitive medicines are impacted due to temperature excursions during transport" Klopott (2021)

Our Solution



Our solution involves a fully automated device that monitors temperature and humidity inside every transport box, from the warehouse to destination, providing traceable data to verify if the integrity of the goods was maintained throughout the journey.

Hardware Selection



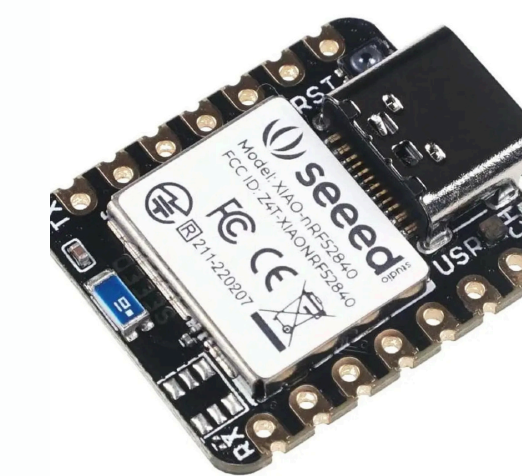
2× 5V Induction Coils

- Enables wireless charging of the device
- No cables or connectors needed



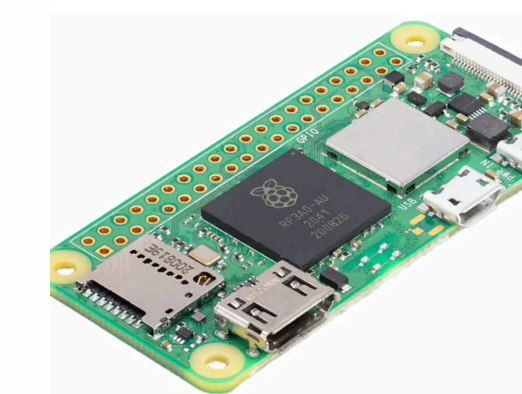
Supercapacitors 2× 50F

- 24 hour autonomy
- Quick charging



Microcontroller XIAO nRF52840

- Connected to a temperature and humidity sensor and a real-time clock, records synchronized environmental data every 60 seconds



Raspberry Pi

- Detects when the device arrives at its destination, receives data from the XIAO, and forwards it to the server

Industries We Serve

Pharma & Labs: Vaccines, biological samples, and medicines

Competitive Advantage

Current Solutions	ChainGuard
Disposable battery	Supercapacitor
Manual USB	Automatic BLE
Fixed to truck	Inside each box
Battery replacement	No battery waste

Validation Results

✓ ±0.3°C Thermal Accuracy	✓ ≥ 10h Battery Autonomy
✓ ≤ 10 min Wireless Recharge	✓ ≥ 99.5% Data Transfer Reliability

Partners

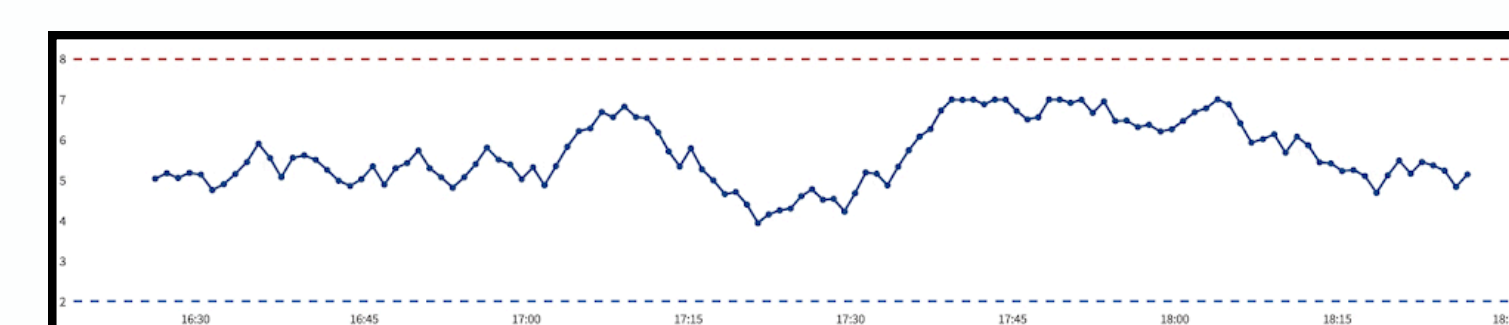
Instituto Nacional de Saúde
Doutor Ricardo Jorge



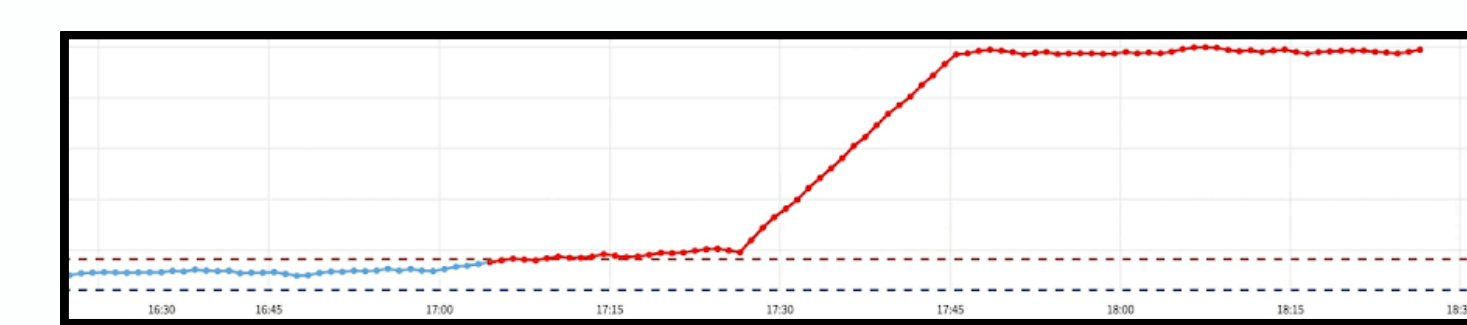
How It Works?

- **Beginning of the Trip:** The device is taken from its wireless charging dock and placed in the transport box with the product.
- **During the Trip:** Every 60 seconds, the device records temperature and humidity samples to track the product's conditions.
- **End of the Trip:** Upon arrival, the device transmits stored data to our server, allowing you to instantly verify if the conditions were respected.

At the end of each trip, a graph displays the temperature and humidity changes throughout the journey.



(a)



(b)

In situation (a), everything went according to plan, in situation (b), the product's temperature limit was not respected.

