Danmarks Tekniske Universitet

Group #1

The Smart Lunchbox

34315 Internet of Things - Applications and infrastructures

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Our Team

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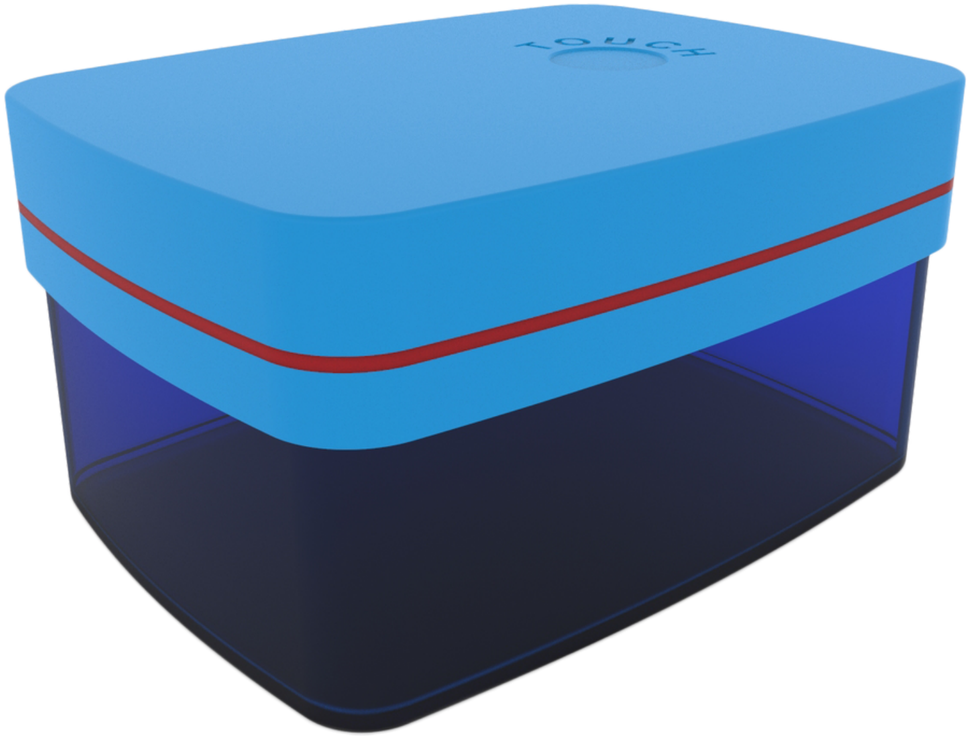
Agenda



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The Problem

You will understand why the world needs a smart lunchbox

2

Our Solution

You will understand the Smart Lunchbox solution, how it works technically and how it solves the problem at hand

3

What's next?

You will understand what should be done, in order to move forward with the product, as well as the key learnings of this project

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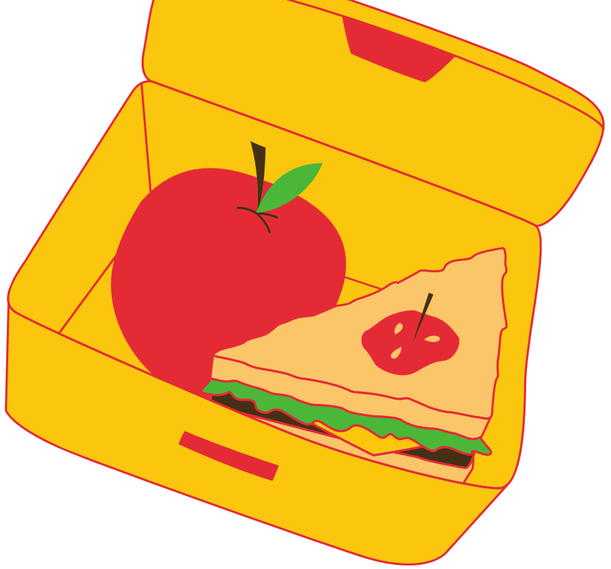
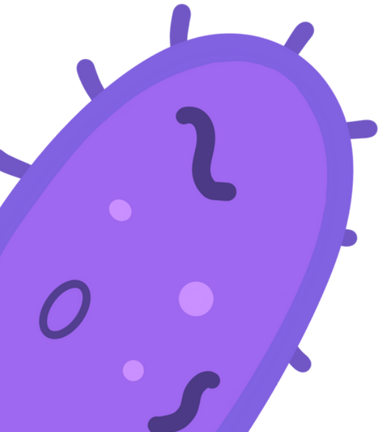
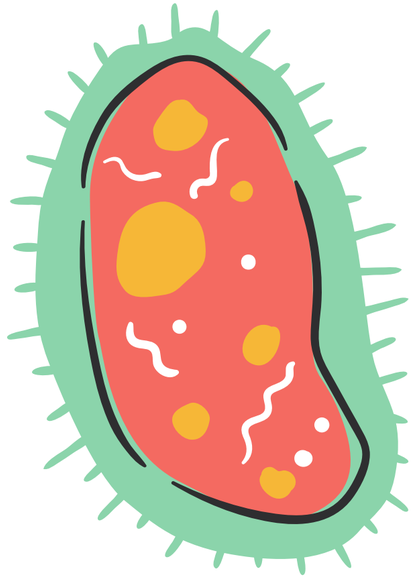


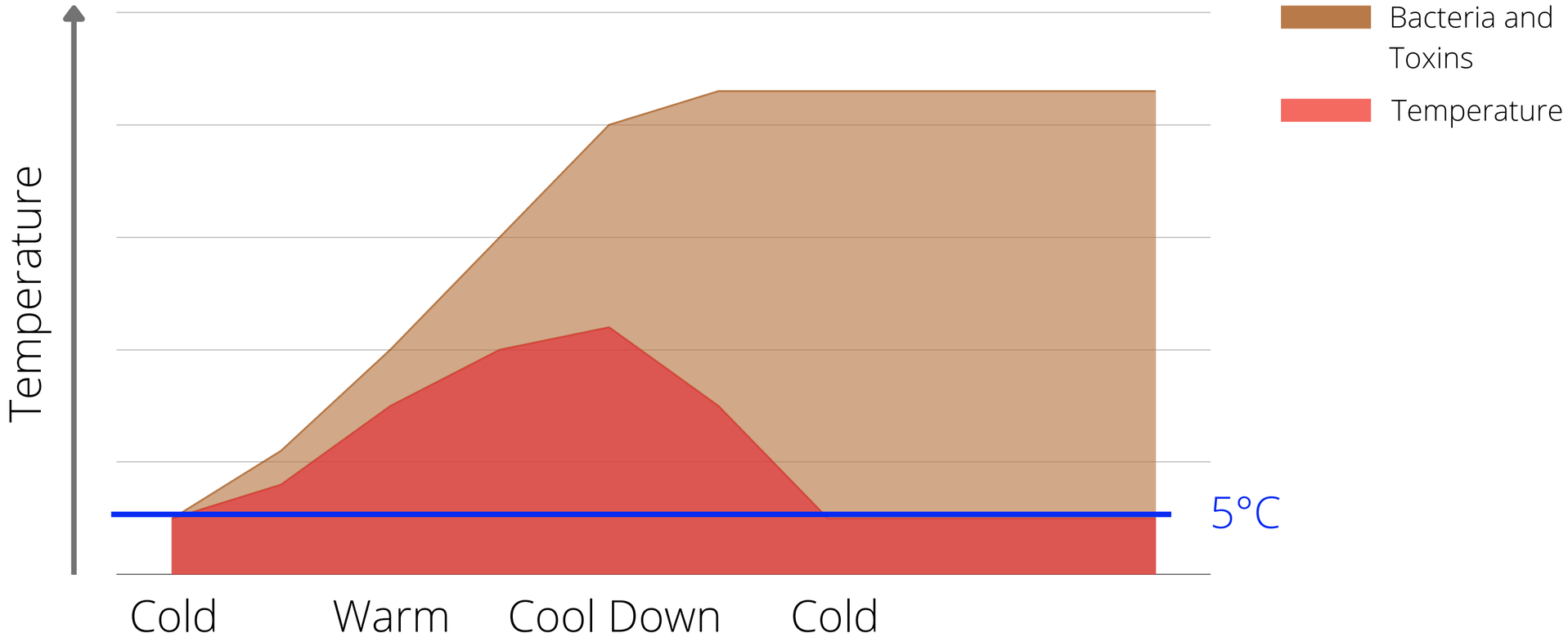
Our lunchbox **helps parents/kids** who wants to **prevent bacteria growth** in lunchboxes by **monitoring growth factors** and **nudge/optimize behaviour** for both parents and kids.

Value Proposition
The Smart Lunchbox





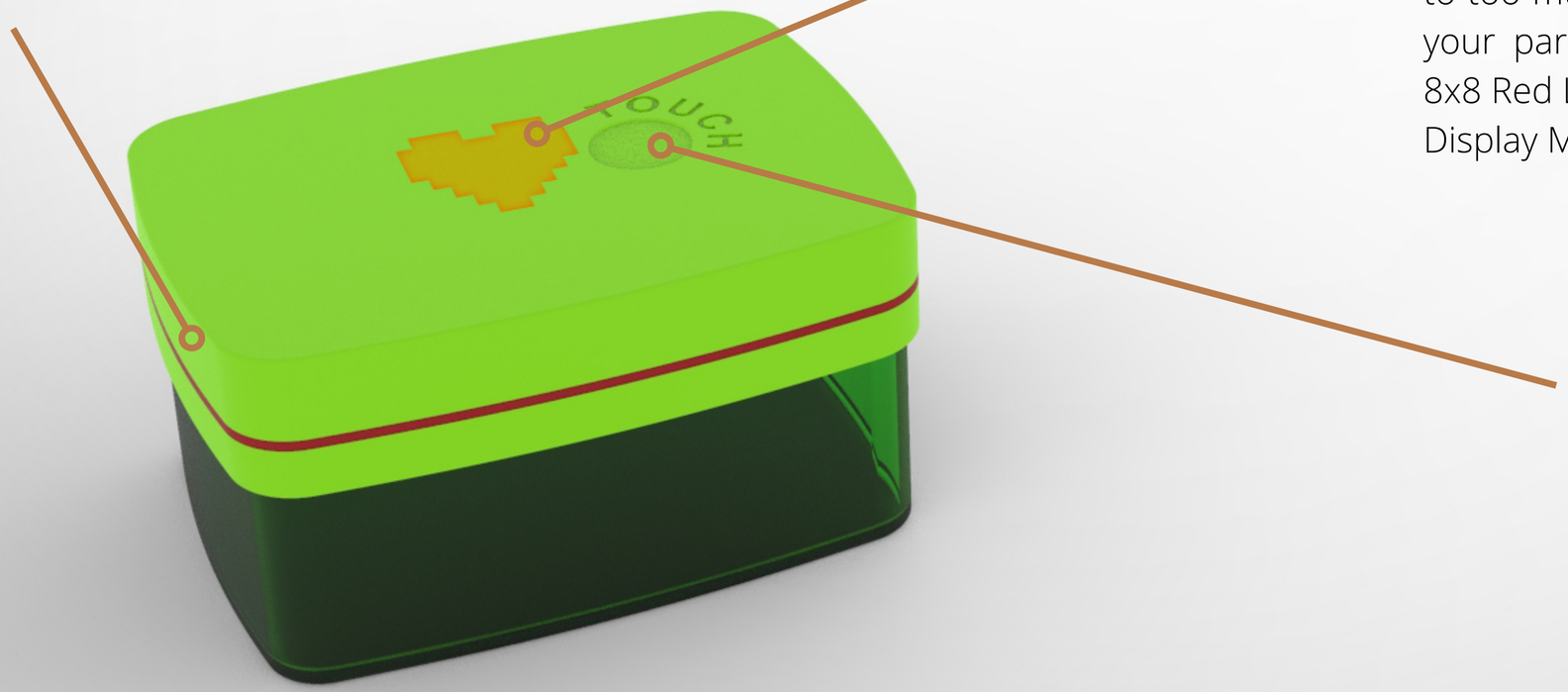
Concept of bacteria growth and toxins in Lunchboxes



Product Functions

The Box

The electronics are kept safe in the upper box, with a rubber sealing.
The lid-box is attached to the food box using a snap-fit.



Display

The display shows a happy face if the food has been kept cold, a sad face if the food has been exposed to too much heat, or a heart from your parents. This model uses a 8x8 Red LED Matrix.
Display Model: MAX7219ENG

Touch

The capacitive touch sensor turns on the display, which indicates the state of the food.
Sensor: TTP223-BA6

Product Build

Microprocessor

The ESP-WROOM-32 module has a built-in WiFi that is used for communication purposes for this project. As well as 34 programable GPIO pins.

Model ESP-WROOM-32

Photoresistor

The photoresistor inputs the surrounding light intensity, and controls the displays brightness accordingly.

Sensor: CdS-55

Batteries

The Smart Lunch Box runs on 6 AA batteries. This provides 25 days* of use with build-in light sleep mode. A future product would be rechargeable.

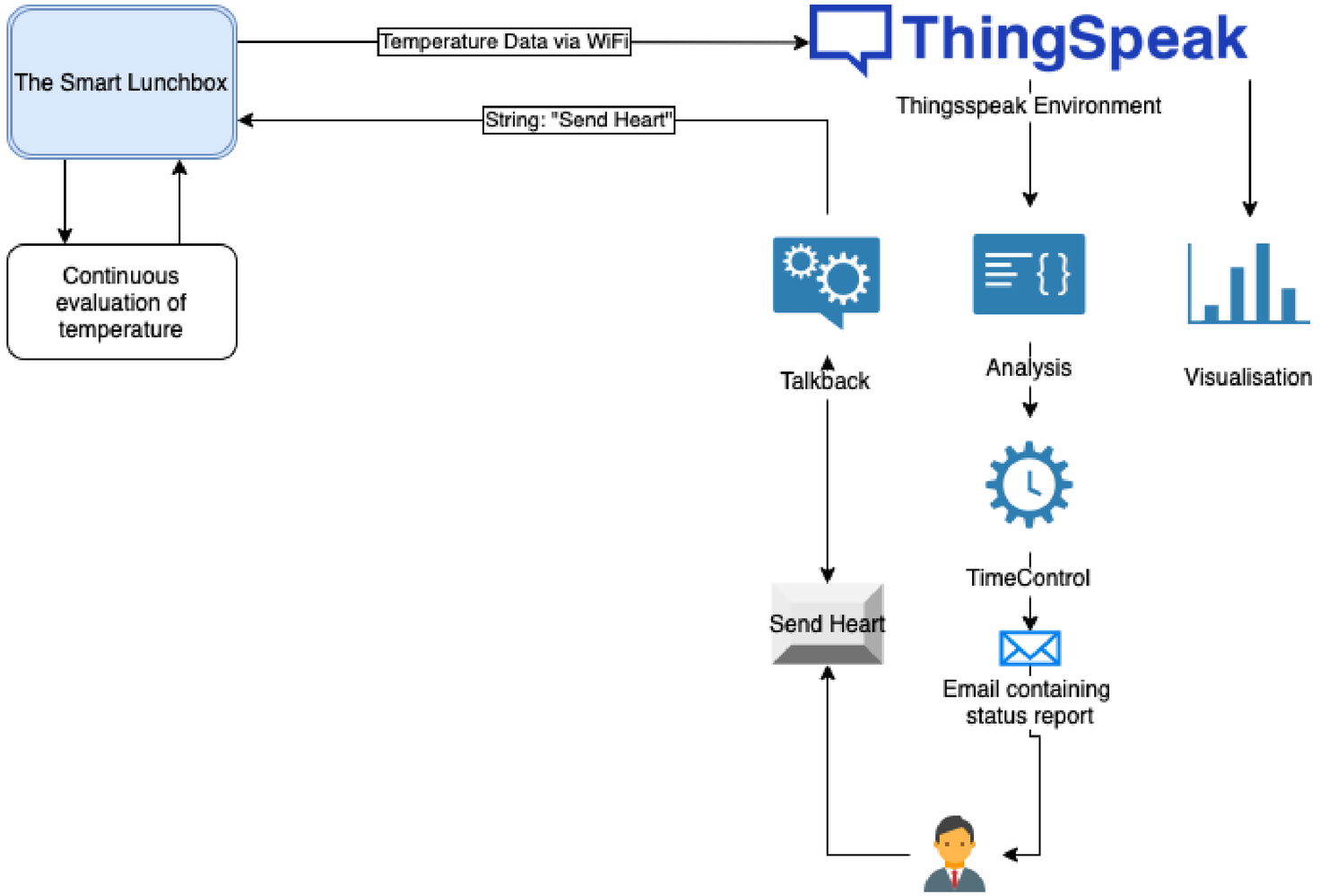
* Device active for 10 seconds out of 5 mins

Temperature Sensor

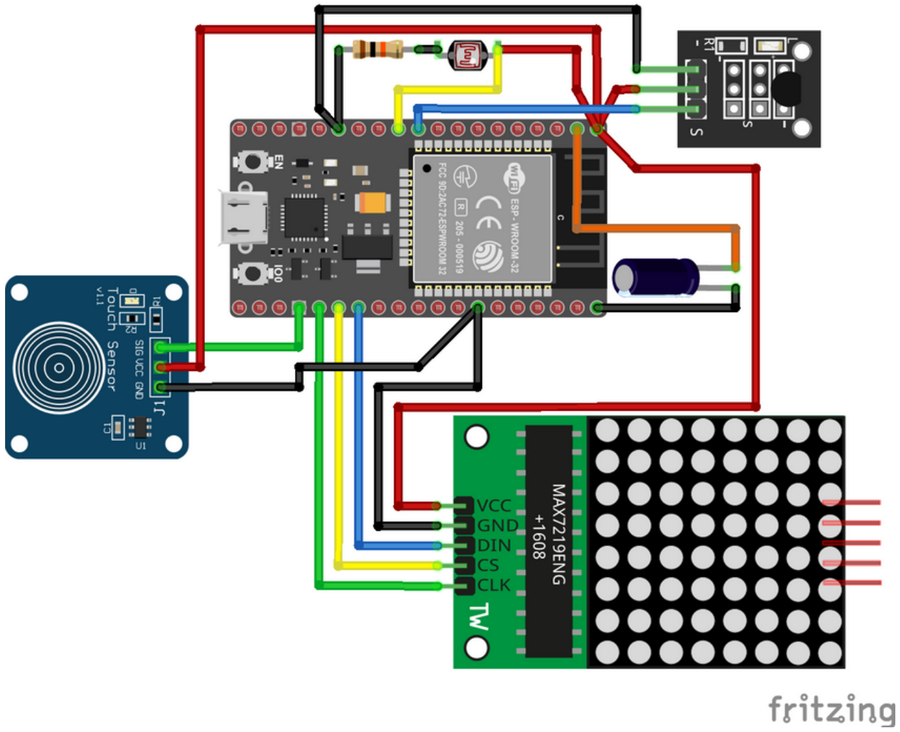
Measures the temperature with a 9-12Bits precision between -55°C and 125°C. Accuracy from -10°C to +85°C is ±0.5°C

Sensor DS18B20
KY-001 Temperature sensor module

Conceptual Diagram

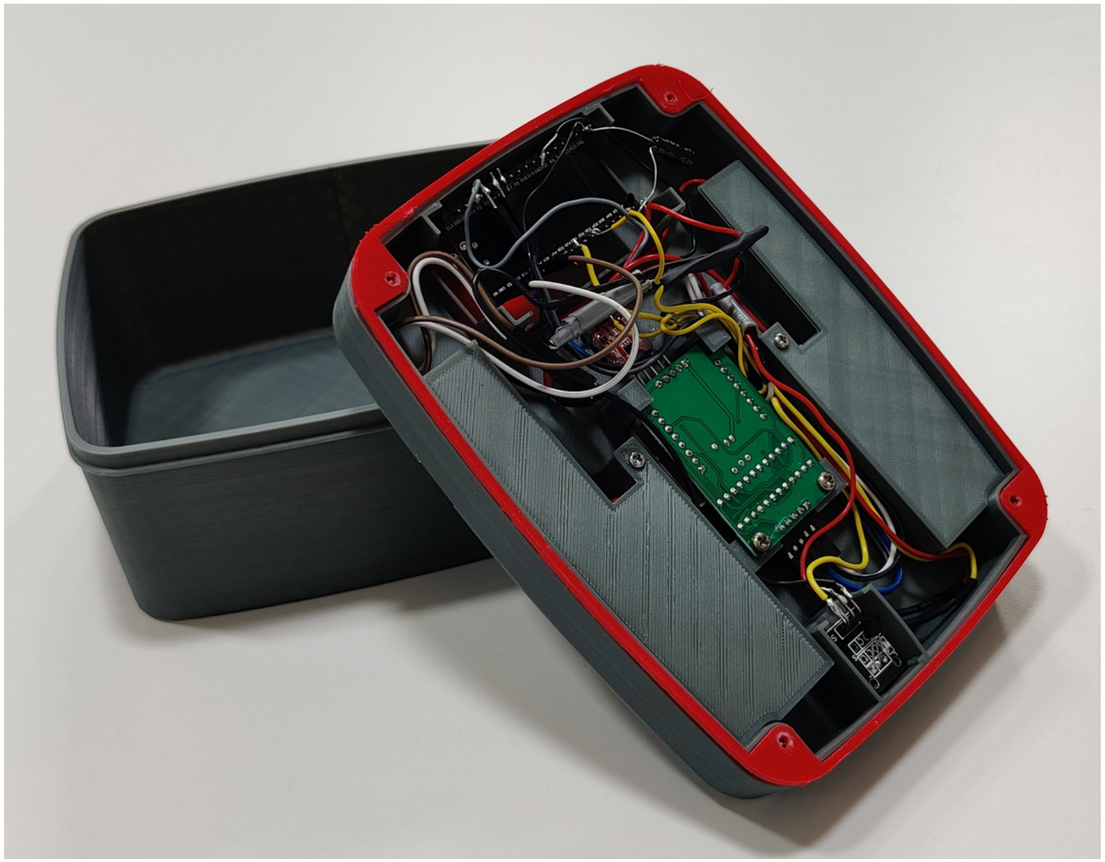


Hardware



Wiring Diagram

The ESP-Wroom-32 is power by either 5V USB or 9V through batteries. The components are all using 3.3V. The 10µF capacitor fixes an upload problem.

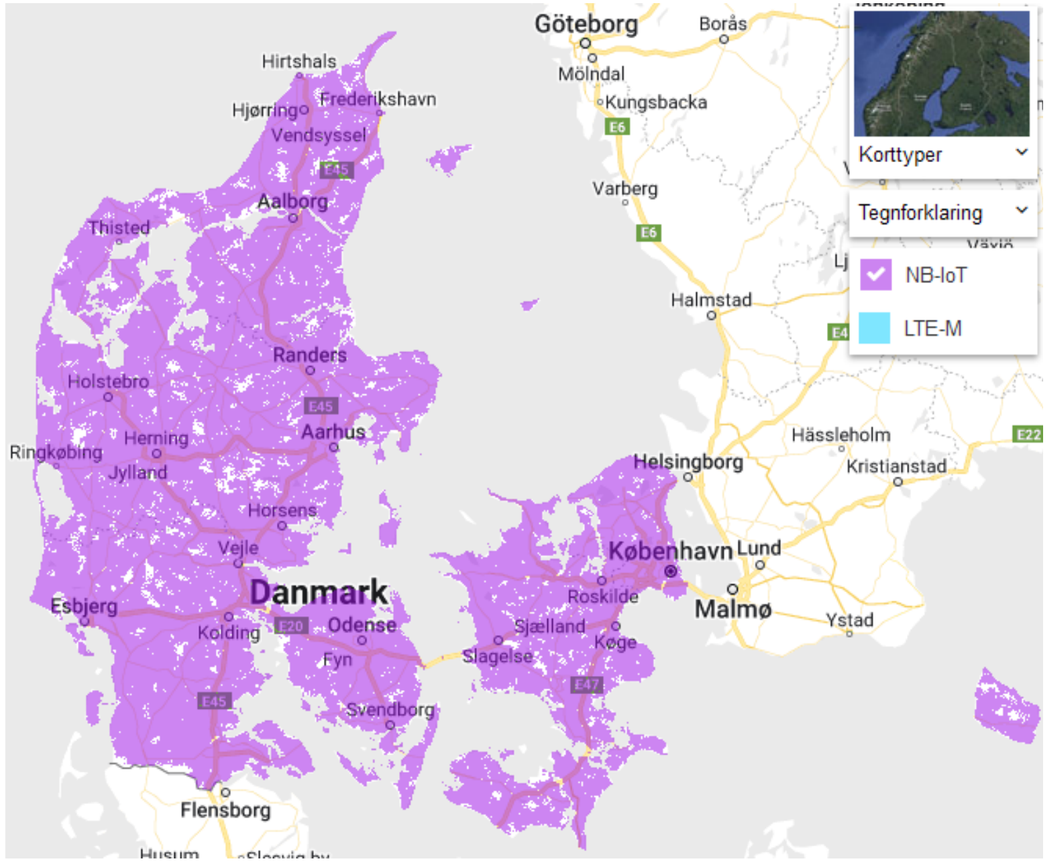


Physical Setup

All the electronics except for power supply are soldered together to ensure stable connectivity and minimalistic wiring.

Communication

Requirement	LoraWAN and SigFox *Unlicensed*	NB-IoT *Licensed*	LTE-M *Licensed*
Capacity Bidirectional support for small data pack.	✓	✓	✓
Coverage High nationwide indoor urban coverage	✗	✓	✓
Consumption (Low latency) and long battery life	✓	✓	✓
Cost Low device and network cost	✓	✓	✗



Telia NB-IoT indoor Coverage

Arduino Coding

First Check

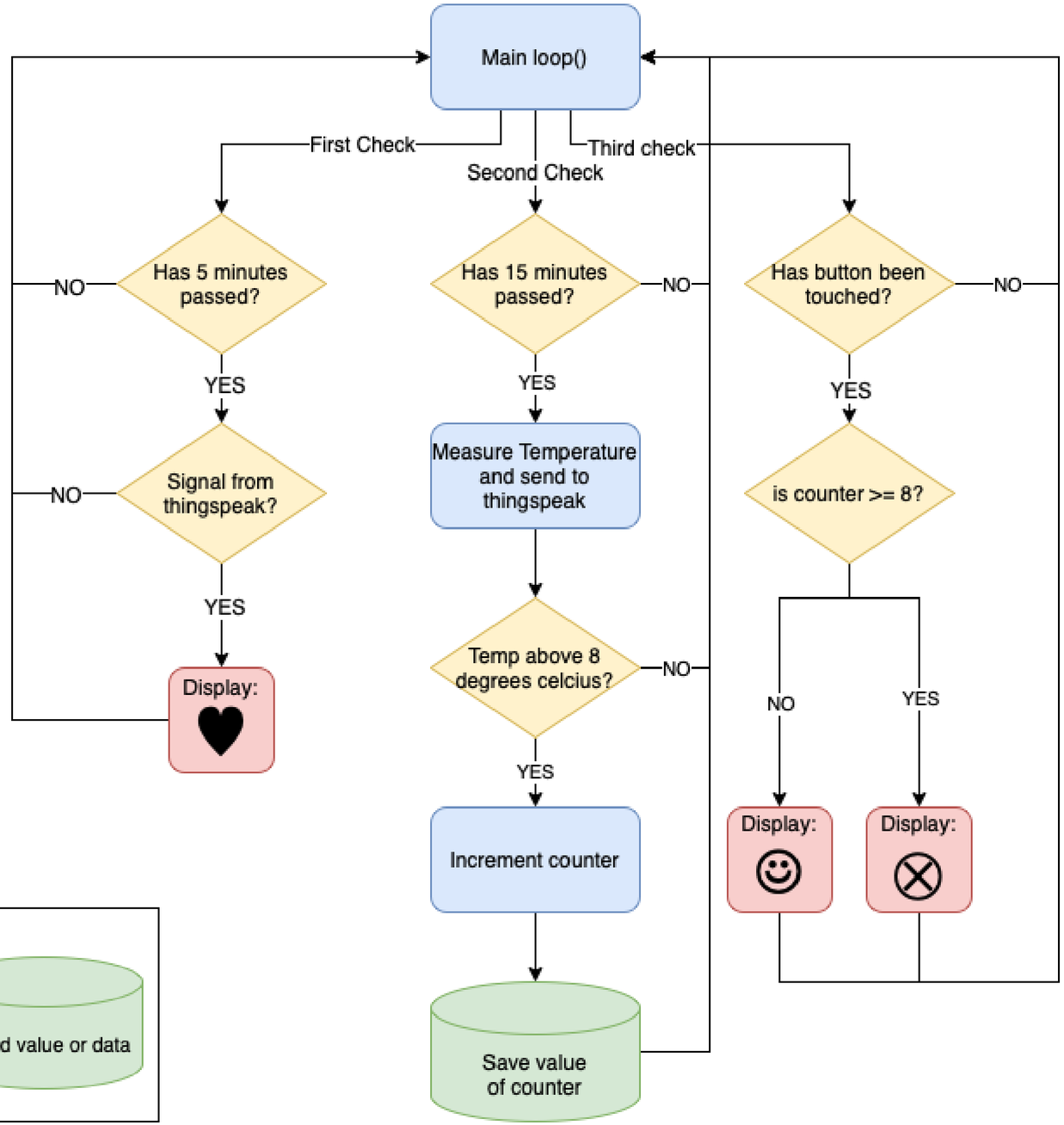
If five minutes have passed since last check, the talkback queue from thingspeak is checked.

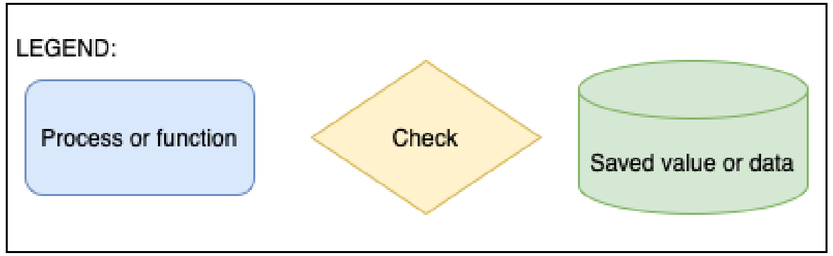
Second Check

If fifteen minutes have passed since last measurement, the temperature is measured and sent to thingspeak. Finally the counter is incremented if required.

Third Check

This final check runs for each iteration of the world loop (constantly), and monitors the capacitive touch-button. If itouched, either a happy face or a cross is shown depending on the counter.

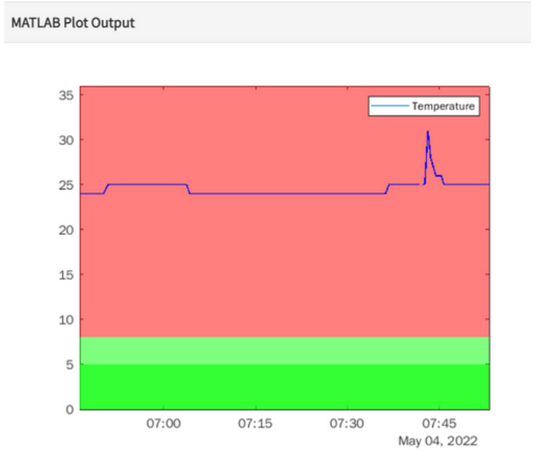




Thingspeak

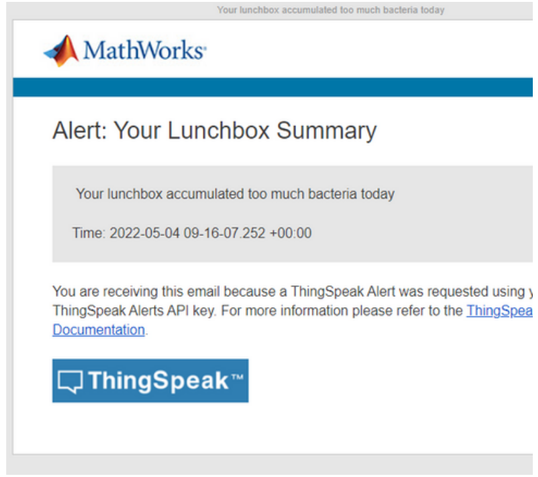
Thingsspeak Visualization + Matlab Vizualizaton

The Thingsspeak channel allows for visualization of the state of the lunch box, to the times throughout the day



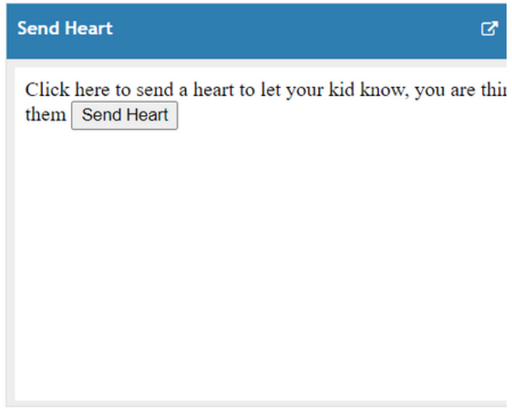
Matlab Analysis + Alert API + TimeControl

Once a day, the Matlab Analysis code will run, and an email will be send with a message regarding the state of the lunch box that day



Send a Heart: Plugin + Talkback

A simple HTML button plugin lets parents send their kids a heart to the screen. The message is transmitted using Talkback



Current state and future work

Prototype Level: Function Type

Function type which illustrates the working concept of the product containing:

Physical Prototype
Working sensors
Thingspeak Environment

This should be considered a proof of concept

Physical Improvements

IP certification, food-safe plastic and a more safe and easier locking mechanism

Battery

Rechargeable through USB.
Less voltage -> Less heat from regulator
Optimize battery lifetime through software

Purpose of Display

Test different kind of device interaction methods, to see what would be most optimal for solving the main problem

NarrowBand IoT

Upgrade hardware to support NB-IoT

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