Smart Thermostat Proof of Concept

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Brainstorming

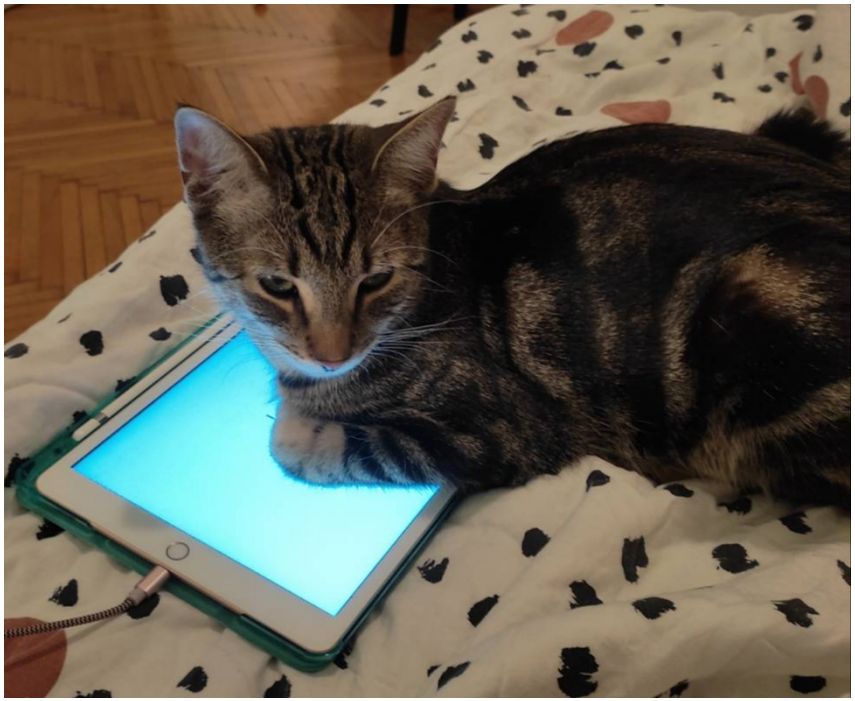

Figure: Head of Cat Interface Design

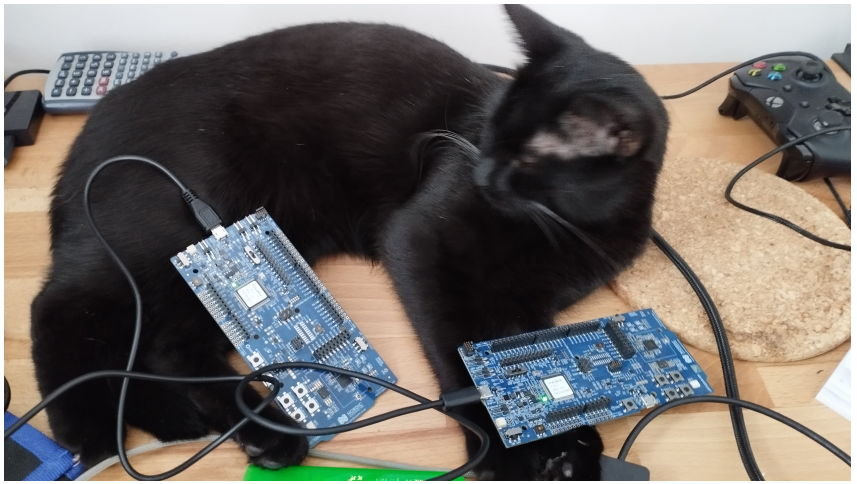

Figure: Lead Engineer of Smart Cat Toilets

Brainstorming

- Use Zephyr Real-Time Operating System (RTOS)
- Use Thread as communication network
- Use Constrained Application Protocol (CoAP) for interaction between systems
- Exchange air quality, humidity, presence and temperature data

CoAP Introduction

- Was designed to be easy translatable to Hypertext Transport Protocol (HTTP) for constrained devices which want to communicate with the internet
- Operates on top of User Datagram Protocol (UDP)
- Has *GET*,*POST*,*PUT* and *DELETE* requests
- Uses Uniform Resource Identifiers (URIs) comparable to MQ Telemetry Transport (MQTT)
- Exchange air quality, humidity, presence and temperature data

Project Design

Sensor Unit:

- Samples data from a light and a Passive Infrared (PIR) sensor, a BME680 which provides air pressure, air quality, humidity and temperature data
- Exposes that sensor values as CoAP resources
- Notifies observers on value change

Thermostat:

- Has a CoAP client observing data from the sensor unit
- Mimics a Heating Ventilation and Air Conditioning (HVAC) system
- Displays the current Air Quality Index (AQI), humidity and temperature.

Demo

Demo

Pitfalls

- Documentation on the usage of CoAP library is thin
- Executing `sprintf` or `snprintf` with a `float` or `double` leads to a buffer overflow.
- Reading out the PIR sensor value in the interrupt context causes Inter-Integrated Circuit (I2C) error and prohibits readings of the BME680.
- Checking if the server is reachable from the client is not trivial