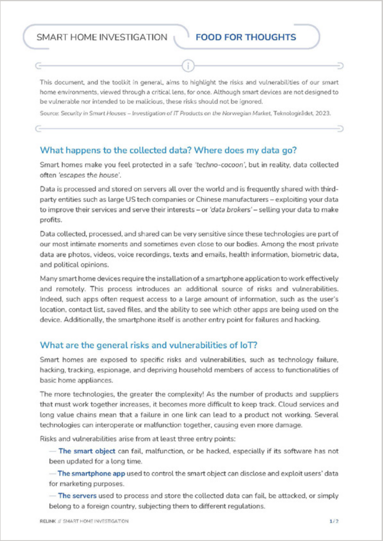
#3 MISSION DEBRIEFING

When your tour is finished, collect all the TECH CARDS and return to your classroom.

Now, read the card sides providing information about sensitive data and risks. Does it change your evaluation of these devices?

Take a moment to read the '*Food for thought*' sheet to learn key issues at stake with regard to smart homes and IoT.



SMART HOME INVESTIGATION FOOD FOR THOUGHTS

This document, and the toolkit in general, aims to highlight the risks and vulnerabilities of our smart home environments, viewed through a critical lens, for once. Although smart devices are not designed to be vulnerable nor intended to be malicious, these risks should not be ignored.

Source: *Security in Smart Houses – Investigation of IT Products on the Norwegian Market*, Teknologirådet, 2023.

What happens to the collected data? Where does my data go?

Smart homes make you feel protected in a safe *'techno-cocoon'*, but in reality, data collected often *'escapes the house'*.

Data is processed and stored on servers all over the world and is frequently shared with third-party entities such as large US tech companies or Chinese manufacturers – exploiting your data to improve their services and serve their interests – or *'data brokers'* – selling your data to make profits.

Data collected, processed, and shared can be very sensitive since these technologies are part of our most intimate moments and sometimes even close to our bodies. Among the most private data are photos, videos, voice recordings, texts and emails, health information, biometric data, and political opinions.

Many smart home devices require the installation of a smartphone application to work effectively and remotely. This process introduces an additional source of risks and vulnerabilities. Indeed, such apps often request access to a large amount of information, such as the user's location, contact list, saved files, and the ability to see which other apps are being used on the device. Additionally, the smartphone itself is another entry point for failures and hacking.

What are the general risks and vulnerabilities of IoT?

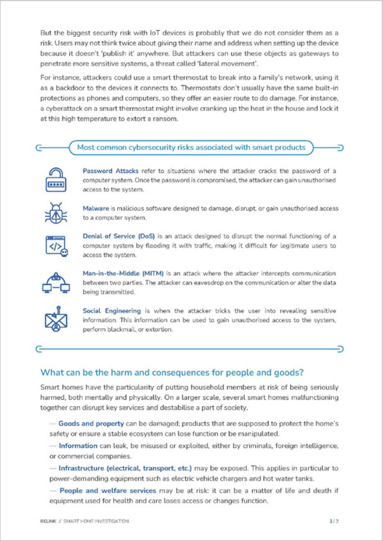
Smart homes are exposed to specific risks and vulnerabilities, such as technology failure, hacking, tracking, espionage, and depriving household members of access to functionalities of basic home appliances.

The more technologies, the greater the complexity! As the number of products and suppliers that must work together increases, it becomes more difficult to keep track. Cloud services and long value chains mean that a failure in one link can lead to a product not working. Several technologies can interoperate or malfunction together, causing even more damage.

Risks and vulnerabilities arise from at least three entry points:

- **The smart object** can fail, malfunction, or be hacked, especially if its software has not been updated for a long time.
- **The smartphone app** used to control the smart object can disclose and exploit users' data for marketing purposes.
- **The servers** used to process and store the collected data can fail, be attacked, or simply belong to a foreign country, subjecting them to different regulations.

RELINK // SMART HOME INVESTIGATION 1/2



But the biggest security risk with IoT devices is probably that we do not consider them as a risk. Users may not think twice about giving their name and address when setting up the device because it doesn't 'publish it' anywhere. But attackers can use these objects as gateways to penetrate more sensitive systems, a threat called 'lateral movement'.

For instance, attackers could use a smart thermostat to break into a family's network, using it as a backdoor to the devices it connects to. Thermostats don't usually have the same built-in protections as phones and computers, so they offer an easier route to do damage. For instance, a cyberattack on a smart thermostat might involve cranking up the heat in the house and lock it at this high temperature to extort a ransom.

Most common cybersecurity risks associated with smart products

Password Attacks refer to situations where the attacker cracks the password of a computer system. Once the password is compromised, the attacker can gain unauthorised access to the system.

Malware is malicious software designed to damage, disrupt, or gain unauthorised access to a computer system.

Denial of Service (DoS) is an attack designed to disrupt the normal functioning of a computer system by flooding it with traffic, making it difficult for legitimate users to access the system.

Man-in-the-Middle (MITM) is an attack where the attacker intercepts communication between two parties. The attacker can eavesdrop on the communication or alter the data being transmitted.

Social Engineering is when the attacker tricks the user into revealing sensitive information. This information can be used to gain unauthorised access to the system, perform blackmail, or extortion.

What can be the harm and consequences for people and goods?

Smart homes have the particularity of putting household members at risk of being seriously harmed, both mentally and physically. On a larger scale, several smart homes malfunctioning together can disrupt key services and destabilise a part of society.

- **Goods and property** can be damaged; products that are supposed to protect the home's safety or ensure a stable ecosystem can lose function or be manipulated.
- **Information** can leak, be misused or exploited, either by criminals, foreign intelligence, or commercial companies.
- **Infrastructure (electrical, transport, etc.)** may be exposed. This applies in particular to power-demanding equipment such as electric vehicle chargers and hot water tanks.
- **People and welfare services** may be at risk: it can be a matter of life and death if equipment used for health and care loses access or changes function.

RELINK // SMART HOME INVESTIGATION 2/2

Well done, detectives!
Next, move on to the SMART CRIME investigation.

ACTIVITY GUIDE // STUDENT EDITION

SMART HOME INVESTIGATION

OBSERVATION TOUR

Sharpen your eyes to spot and assess smart devices in a familiar environment

Dear soon-to-be *IoT* Crime Detectives*,

Welcome to this special training. Soon, you will be in charge of investigating some of the most intricate crime cases involving smart home technologies.

The purpose of this initial exercise is to train your detective eye in spotting smart devices around you, especially in domestic environments where they often remain unnoticed.

Indeed, smart objects are designed to be frictionless in their uses to such a point that we *'forget'* about them, particularly in our familiar environments – at home, at school, at work – where they have become integral to our daily routines.

The issue is that while they add convenience to everyday life, they also pose many risks that one must remain vigilant about. We often perceive the *Internet of Things* as a magical entity operating without back-end systems or infrastructure, without impact, and without human labour. As you will learn, this is an illusion.

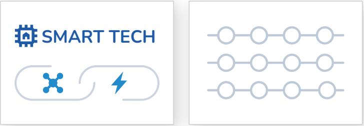
**IoT, 'Internet of Things', describes devices that embed sensors, connect and exchange data with other devices and systems over the Internet or other communications networks.*

In other words, they are items that contain a computer and are connected to the Internet, but are not used like a traditional PC, smartphone or tablet.

START YOUR INVESTIGATION >

#1 GET STARTED!

Alright detectives, let's practise some fieldwork!
For this activity, you need the following equipment:



The deck og TECH CARDS

A pen

#2 SPOT THE SMART DEVICES

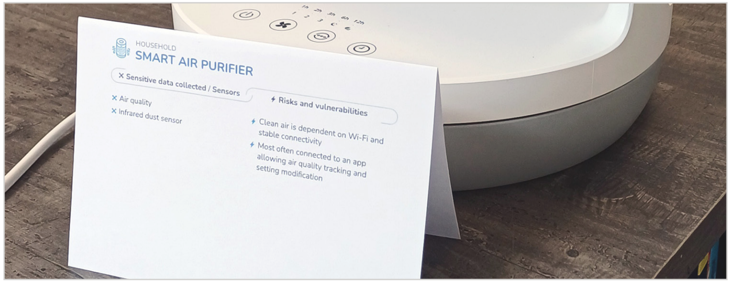
Form groups of 3 or 4 student detectives and take a tour of your school. **Each time you spot smart tech or a sensor, pick up the matching TECH CARD**. For the sake of the exercise, **imagine that these technologies are '*made smart*' and located in your home.**

Take a moment to conduct your personal evaluation of this tech.

If you have different perceptions, grade these dimensions according to the average feeling of the group. For now, focus on the '*Evaluation*' side, without reviewing other side of the card (listing sensitive data and risks):

1. According to you, is it rather **USELESS** or **USEFUL** in your everyday life? In other words, is it closer to a gadget, or a key device?
2. According to you, is it rather **INTRUSIVE** or **RESPECTFUL** of your personal and intimate life? In other words, do you feel safe or spied on?
3. Does living with this technology in your everyday life make you feel rather **VULNERABLE** or **IN CONTROL**? In other words, do you master this technology or do you feel mastered by it?

PRO TIPS


HOUSEHOLD
SMART AIR PURIFIER
Sensitive data collected / Sensors
Air quality
Infrared dust sensor
Risks and vulnerabilities
Clean air is dependent on Wi-Fi and stable connectivity
Most often connected to an app allowing air quality tracking and setting modification

You can fold the card in half to make it stand upright and leave it where you spotted the device, like evidence tents at a crime scene.

Tick the boxes for smart technologies you have spotted on your tour. It will give you a clearer overview of your observation and will make it easier to retrieve all the TECH CARDS at the end of the exercise.

☐ Smart thermostat
☐ Smart meter
☐ Smart light
☐ Smart sprinkler
☐ Smart EV charger
☐ Robot vacuum cleaner
☐ Smart kitchen equipment
☐ Smart air purifier
☐ Smart pet feeder
☐ Smart security camera
☐ Smart garage door
☐ Smart doorbell
☐ Smart alarm system
☐ Smart health device
☐ Smart watch/bracelet
☐ Smart scale
☐ Smart TV
☐ Smart speaker
☐ Connected toy
☐ Gaming console
☐ Wireless router
☐ Smart printer
☐ Webcam
☐ Smart mug

Did you check yourself as well?

Some IoT devices are wearable technologies: we carry them close to our bodies, often to achieve physical goals (e.g. fitness bracelets), health purposes (e.g. fall detection bracelets), or simply for convenience (e.g. smart watch).

BONUS CRITICAL INSPIRATIONS

Speculative design and critical engineering are practices of creating fictional and often provocative objects in order to foster debates about future issues of our societies. Not meant for sale, these projects may inspire better tech choices:

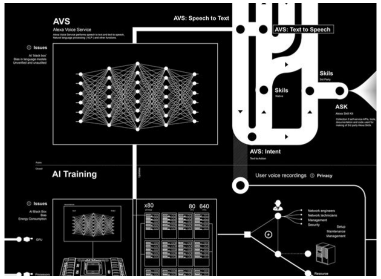
The White Box (Automato, 2015)

A (fictional) concept of a 'smart-but-transparent' interface for connected home environment monitoring.

The system allows household members to adjust home parameters and privacy levels through a simple and familiar switchboard.

The Transparency Grenade (J. Oliver, 2012)

This device captures network traffic and audio at the explosion site, securely and anonymously streams it to a server for analysis, and then displays the extracted data on a public online map at the detonation location.



Anatomy of an AI system (K. Crawford and V. Joker, 2018)

This map reveals the hidden side of the Amazon Echo, showing that each user's interaction relies on a global network powered by the extraction of non-renewable resources, labour, and data.

Congratulations, smart inspectors!
Now, take the OBSERVATION TOUR
if you haven't done so yet.

ACTIVITY GUIDE // STUDENT EDITION

SMART HOME INVESTIGATION

SMART CRIMES

Build scenarios to imagine how a smart product driven crime case may play out

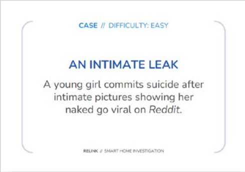
What could go (very) wrong with the smart objects we rely on in our everyday life? In this special training, you will discover fictional cases inspired by true stories that highlight current issues related to the uses and misuses of the *Internet of Things*.

Your mission, should you choose to accept it, is to investigate (fictional) *'smart crime cases'*: you know the end of the story, but you need to understand how it happened and build up a sequence of events.

How did one or more smart objects (aka *'the criminals'*) fail or malfunction, leading to the tragic outcome? There is no unique answer, but a variety of possible scenarios waiting to be imagined!

#1 GET PREPARED!

For this activity, you need the following equipment:



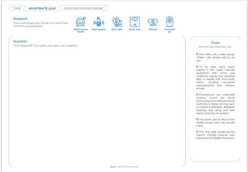
CASE // DIFFICULTY: EASY

AN INTIMATE LEAK

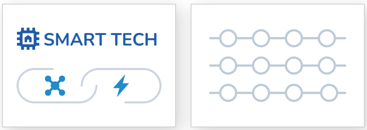
A young girl commits suicide after intimate pictures showing her naked go viral on *Reddit*.

RELINK // SMART HOME INVESTIGATION

The deck of CASE CARDS



The INVESTIGATION BOARD



The deck of TECH CARDS

Sticky notes and pens

Pick up a CASE CARD and the INVESTIGATION BOARD that matches this crime case. Two difficulty levels are available; if this is your first investigation, start with one of the easier cases.

Check out the *'Suspects'* listed on the INVESTIGATION BOARD and display the matching TECH CARDS. Fold the cards in half to make them stand upright around the board. You can also add the TECH CARDS matching the devices you previously spotted during the campus (or home) tour.

#2 SOLVE THE CRIME

Take time to read the *'Clues'* section of the INVESTIGATION BOARD, as well as the sensitive data and risks associated with each TECH CARD.

Cross-reference this information to form your first hypothesis. Warning: In *'expert'* cases, some clues can be misleading!

Imagine the series of events that could lead, step by step, to the tragic outcome.

Write and/or draw your favourite scenario on the INVESTIGATION BOARD.

SYNERGY CHALLENGE:

Imagine how several smart objects could be targeted or malfunction together! For an example, check the solved case on the right.

EXAMPLE

THE CRIME CASE:

A family had to pay a ransom to a hacker to regain control of their smart home.

THE SCENARIO:

The smart printer software had not been updated for a very long time. Someone hacked it and gained access to the users' data. From there, the attacker infiltrated and infected the smart home's global security system. All the connected appliances in the house were blocked.

The users were then forced by the hacker to pay a ransom in cryptocurrency to regain control of their smart home.

#4 REFLECT ON YOUR FINDINGS

After the investigation, if you want to discover the true story that inspired the fictional case, check out the STORIES sheet. What could have been done to avoid such a tragic outcome?

Look for online information to learn how one can implement better protection against smart home risks and vulnerabilities. Then, replay the sequence of events to imagine a different (and happier) ending!

As engineers and designers, we have a responsibility toward users of our products and services: What ethical choices can we make to positively impact society and create a more desirable tomorrow? What is the boundary between relevant smartness and a techno-gadget?

If you did the campus/school tour exercise earlier, think of the objects you assessed as rather USELESS and/or INTRUSIVE: are they really necessary?

Sometimes, the best smart home devices are the ones we decide not to build!