

# SUPPLEMENTAL DOCUMENTATION

This document contains larger versions of images presented in the Pictorial, and many additional images documenting our process and intermediate design outcomes.

## CONTENTS

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**Scenarios Booklet** | Sample Pages

**Detailed Design Proposals** | Sample Pages

**Landscape Analysis and Design Frameworks** | Process Examples

**Design Process** | Sample Sketches and Interaction Flows

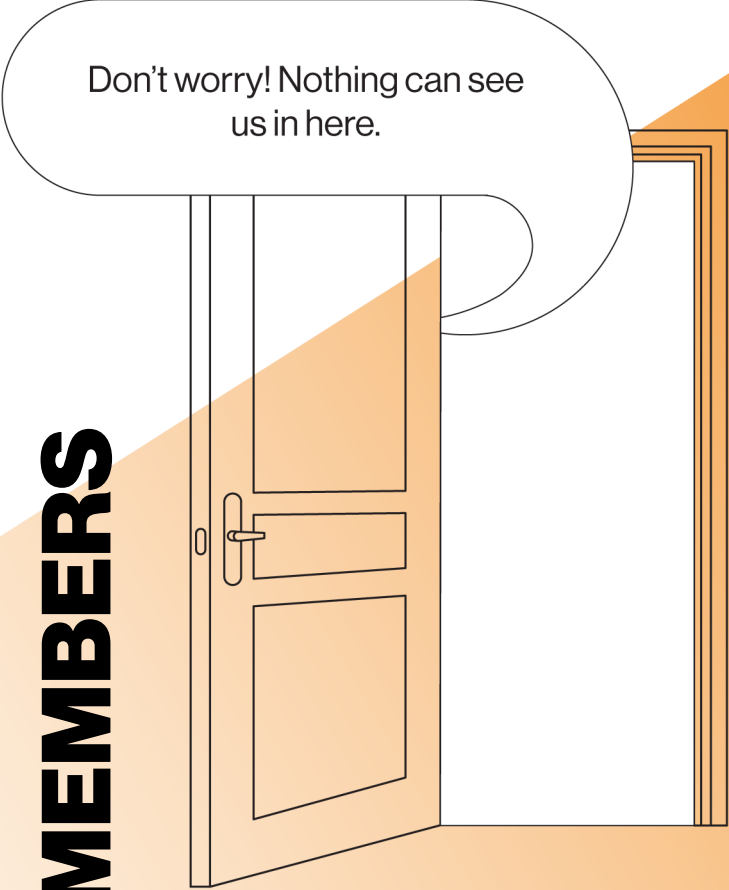
**Simplified Design Proposals (For Participants)** | Full Set

**Discussion Guide** | Complete Interview Protocol

# **SCENARIOS BOOKLET**

## Sample Pages

# HOUSEHOLD MEMBERS



Don't worry! Nothing can see us in here.

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**You have lots of smart cameras in your home, including some mobile ones. You don't want certain areas or activities of your house to be tracked.**

# HOUSEHOLD MEMBERS

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**General Situation:** There are lots of smart cameras inside the home, including mobile ones. Household members want to be certain the cameras aren't in areas or sensing activities they shouldn't.

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## Basic Scenarios

**Turn 'em all off.** Your house is totally wired up with cameras for different types of monitoring and general peace of mind. But you really wish anyone in the house could easily turn them all off, like flipping the lights.

**Forgot it's on.** The cameras are usually off during the day, but someone left it on. You wish you'd known before you did something a little embarrassing—of worse.

**First one home.** The cameras are on during the day to watch the pets and keep an eye on things. But the first person home wants them off. Sometimes they forget they're on.

**Who put that there?!** Someone moved one of the mobile smart cameras somewhere it isn't usually or shouldn't be.

### Not So Basic Scenarios

**Food thief.** The bathroom is an off-limits area for obvious reasons, but you are also always scared that a murderer is hiding behind the shower curtain. Although you know this is an irrational thought, you still would want the camera's security in that event.'

**Vices exposed.** It's been a really tough year, and you've developed some not-so-healthy ways of coping. You promised your partner you would cut down on the drinking, but you slipped up and had a beer. They caught you since the smart home camera had you in view.

**Teen angst.** You are a teenager who is upset that your parents monitor you on the smart cameras. You feel that you are old enough to be trusted to come straight home and don't understand why your parents can't respect your privacy.

**Intimate time.** You and your partner were having intimate time on the couch last night, and forgot that there are cameras capturing that area. Since the area is not typically off limits, you worry your kids will be able to access the footage.

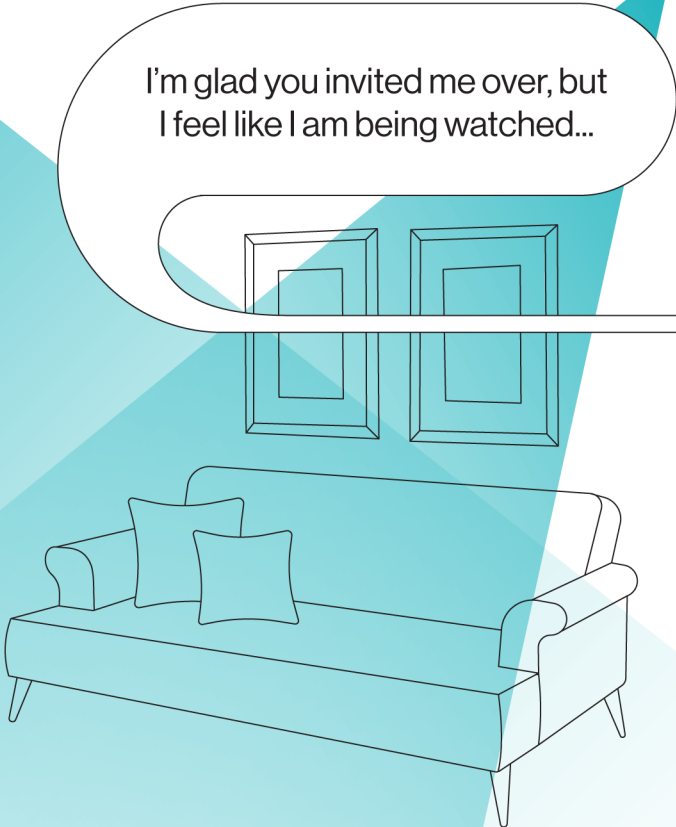
**Bathroom murder.** The bathroom is an off-limits area for obvious reasons, but you are also always scared that a murderer is hiding behind the shower curtain. Although you know this is an irrational thought, you still would want the camera's security in that event.

### **More Not So Basic Scenarios**

**Adoption privacy.** You have a foster child that you are hoping to adopt one day. Because of child protective laws, no images or videos can be released on the internet of this child. These laws could even prohibit you from adopting if they are not followed.

**Uninvited cameras.** You aren't sure if any of your guests are bringing secret cameras into your home or maybe sporting wearable ones. You want to know if new cameras are in your home to protect the privacy of you and your family.

# GUESTS/WORKERS



I'm glad you invited me over, but I feel like I am being watched...

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**You have indoor and outdoor cameras. You don't want to make your guests uncomfortable by making them feel that they're always on watch.**

# SHORT-TERM GUESTS

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**General Situation:** When guests visit, the home's cameras may make them uncomfortable, suspicious, or resentful. Guests may be too shy or disempowered to speak up. With friends and family, camera owners and guests may want the exact same thing: to clearly turn the cameras off.

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## Basic Scenarios

Don't worry, I turned 'em off. Your friend visits. You want to clearly disable your cameras so they feel comfortable.

Okay if I keep the cams on? A friend is visiting. You want to keep the cameras on to monitor the kids while you're outside hanging out casually point out the cameras so they know they're there.



# LONG-TERM GUESTS

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**General Situation:** Friend or family are staying at your home for an extended period of time. You'll need to let them know about your smart cameras, and decide whether to keep them or not.

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## **Basic Scenarios (Owner Perspective)**

Part of the family. You completely trust your friend and want them to feel comfortable, so you share add them as a user to the camera app.

Ongoing negotiation. You want to keep the cameras on at times to watch the pets and kids. You tell the guest they can just unplug them if they're home alone.

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## **Basic Scenarios (Guest Perspective)**

Slightly on guard. Your friend is doing you a favor letting them crash at their place. Still, you find yourself a little creeped out that they know exactly when you come and go because of their doorbell camera.

# WORKERS

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**General Situation:** With workers, such as nannies or tradespeople, camera owners may want to maintain good relationships, but also keep be able to monitor their home and employees. Striking a balance can be tricky.

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## **Basic Scenarios (Primary User Perspective)**

Trusted worker. You completely trust your nanny, caregiver, or house cleaner, and treat them like a friend. You want them to be able to know the cameras are completely off when they're in your home.

Untrusted worker. A friend is visiting, but you want to keep the cameras on

Ongoing negotiation. Sometimes you want the cameras on, sometimes you don't. It really depends. You try to let nannies and tradespeople know whether they're on, and why.

### **Basic Scenarios (Worker Perspective)**

Part of the job. You have mixed feelings about the smart cameras, but generally you don't mind as long as your employer is open and honest with you.

Resentment. You really don't like that your employer insists on using cameras, even though they say it's for safety, not because they don't trust you. But if you speak up, you're afraid you might lose your job. And as a nanny, you lack worker protection rights.

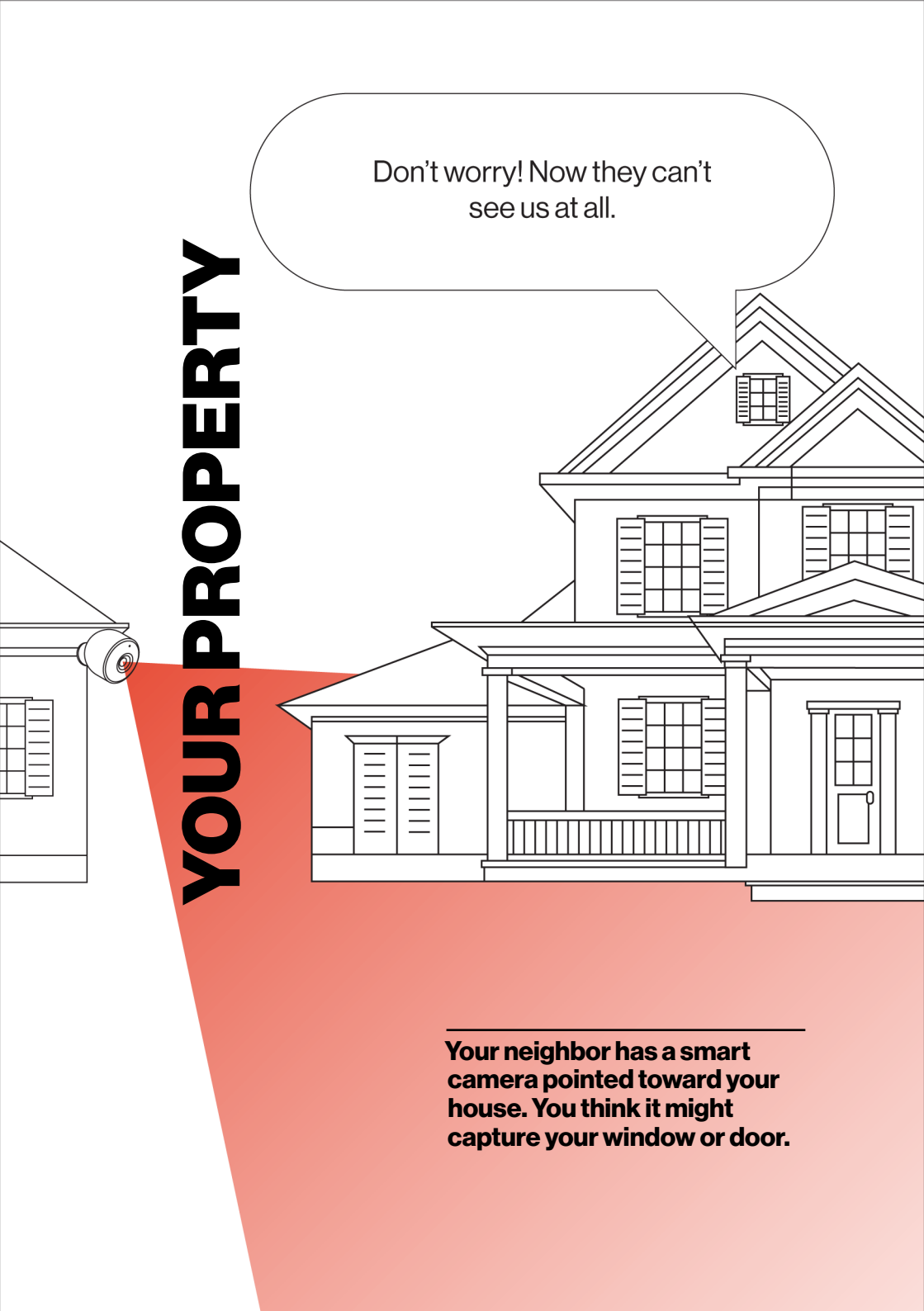
### Not So Basic Scenarios

**Poor communication.** You turn off your indoor smart cameras before your neighbor drops their toddler off for you to babysit. The next day your neighbor is concerned after their toddler said they saw a camera in your living room. You are embarrassed and try to deescalate the situation.

**Kid drama.** Your daughter has a friend over. You can hear them begin to argue. Her friend saw all of the security cameras in the home and accused your daughter of being creepy. Now your daughter is embarrassed and blames you for the incident.

**Family celebration.** You are having your family over to celebrate the holiday season. You turn off your smart cameras but now have to explain to everyone that the cameras are not activated. You wish there was an easier, quicker way for everyone to know they are not being filmed.

**Burglary while guest is over.** Wanting to make your guests comfortable, you turn off your cameras before they arrive. However, while hanging out with them, someone breaks into your home and steals things. Thankfully you and your guest did not get hurt but you wish you had been filming.



Don't worry! Now they can't  
see us at all.

**YOUR PROPERTY**

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**Your neighbor has a smart  
camera pointed toward your  
house. You think it might  
capture your window or door.**

# YOUR PROPERTY

---

**General Situation:** Your neighbors have smart cameras. Some of them may be pointed at your property.

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## Basic Scenarios

**Hardly noticed.** Many of your neighbors have smart cameras. So do you. You hardly notice and definitely don't mind.

**Slightly annoyed.** Your neighbor has a doorbell camera, and you know they can probably see you coming and leaving your house. You're accustomed to it by now, but you still find yourself trying to avoid that area whenever possible.

**Seriously pissed.** Your neighbor just installed a camera that overlooks your yard. You think it may be deliberate. But either way, you're very upset.

## **Not So Basic Scenarios**

**Get your camera outta my window.** Your neighbor recently installed a smart camera. It seems to capture a view of your living room through the window. You feel like your privacy is invaded so now you close your curtains. You wish your neighbor would block out videos that include your home.

**Creepy neighbor.** A neighbor installs security cameras around his house. One of the cameras includes a view of your bedroom window. You think the neighbor is weird and don't know how to approach him. Do you knock on his door to tell him to turn it off? Do you call the police?

**Sharing is caring.** With all of the new cameras around your neighborhood, you are curious about what is being captured. You want your neighbor to share their surveillance footage with you, but you don't think it's legal.

**Be a homebody like everyone is watching.** The smart camera pointed toward your window makes you think about the private things you do at home, even without a smart camera present) like get dressed or argue with your partner. You start to modify your behavior more.

**Don't know your rights.** Your apartment complex wraps around a courtyard. Your neighbor from across the courtyard has a camera pointed towards your window.

## **More Not So Basic Scenarios**

Duplex entrance. You live in a duplex where your front door is right next to your neighbors. You want to know when people approach your door, but don't want your neighbor's doorbell camera to also have that information. But if you get one, then they might get one too.



**DETAILED DESIGN  
PROPOSALS  
(FOR OUR TEAM)**  
Sample Pages

# Neighborhoodly Settings

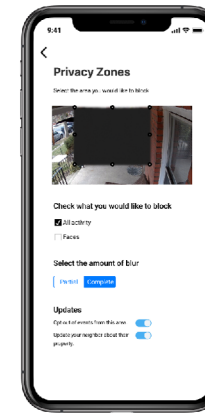
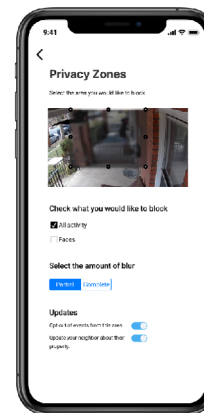
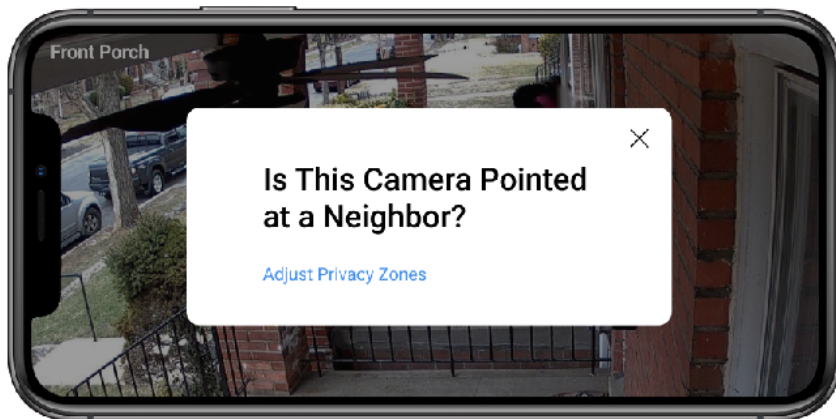
# **Neighbory Settings** helps camera users to practice the “Golden Rule” and act as good neighbors by obfuscating views of neighbor’s property and sensitive areas such as windows and doorways.

Setup nudges: Prompts can appear during contextual or guided tour onboarding. Contextual onboarding can be intelligent (e.g., detection of windows, doorways, porches, areas across a street, etc.)

Partially blur your neighbor’s property.

Fully block your neighbor’s property.

Show them you’re a good neighbor.



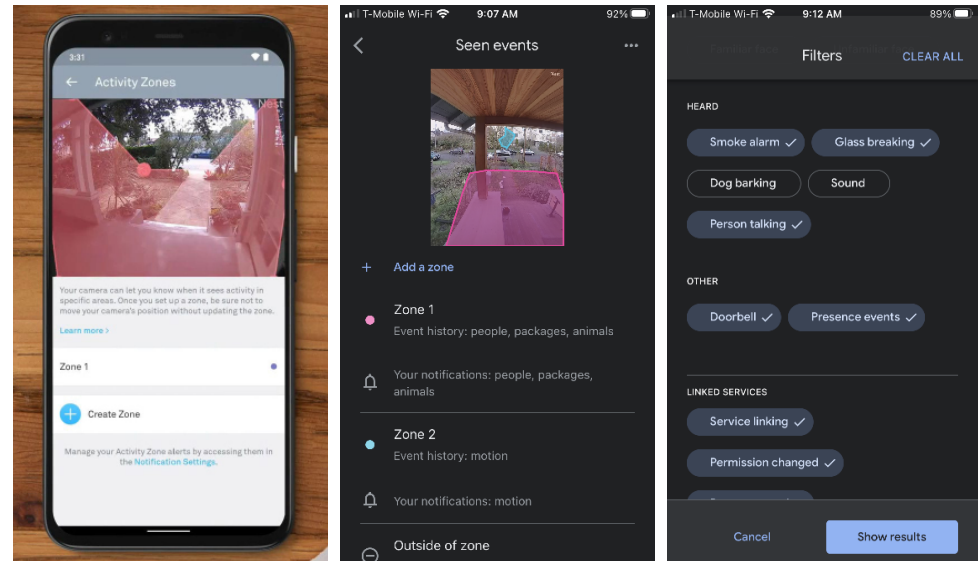
## **When and Where It's Used**

Used for outdoor cameras that may capture parts of a neighbor's property, such as their doorways, driveways, yards, porches, or windows.

## **How it Works**

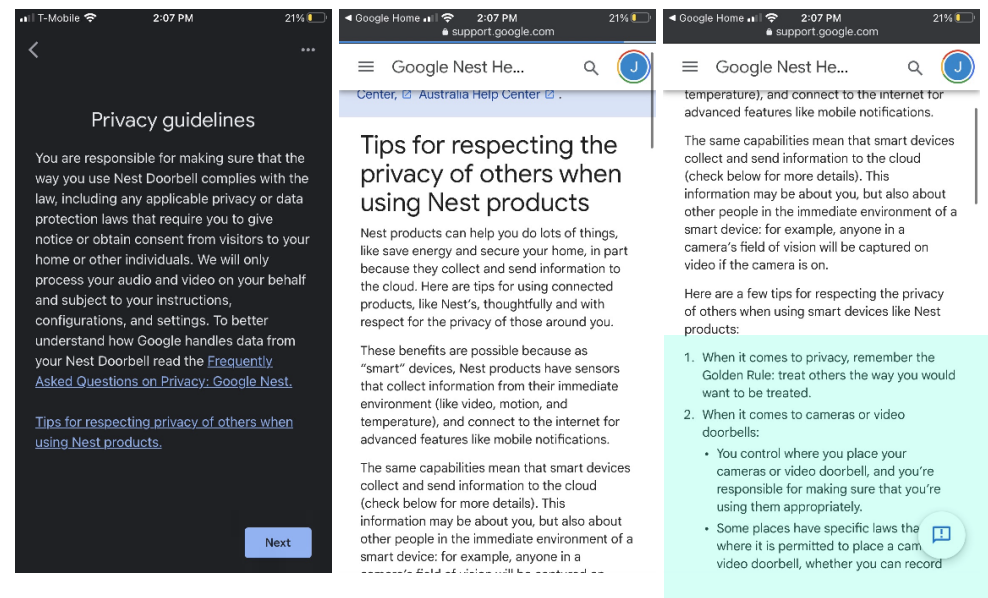
This feature works like the opposite of the “activity zones” feature: user place a mask over areas they do not want to sense, like a neighbor's window or backyard.

Neighborhood Settings works like the opposite of the “activity zones” feature: a user places a mask over areas they do not want to sense, like a neighbor’s window or backyard.



During guided onboarding, Google Nest Cameras offer Privacy Guidelines, but these are similar to Privacy Policies: easily ignore and not very actionable.

Buried within this document, the guidelines ask users to “Follow the golden rule: Treat others the way you’d like to be treated”

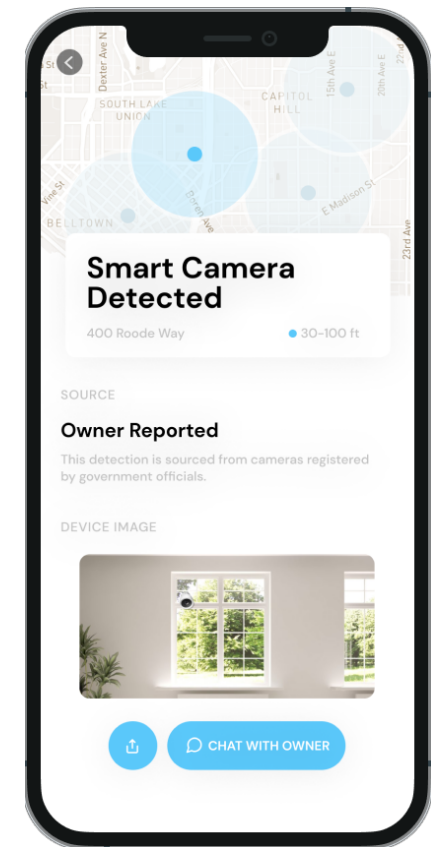
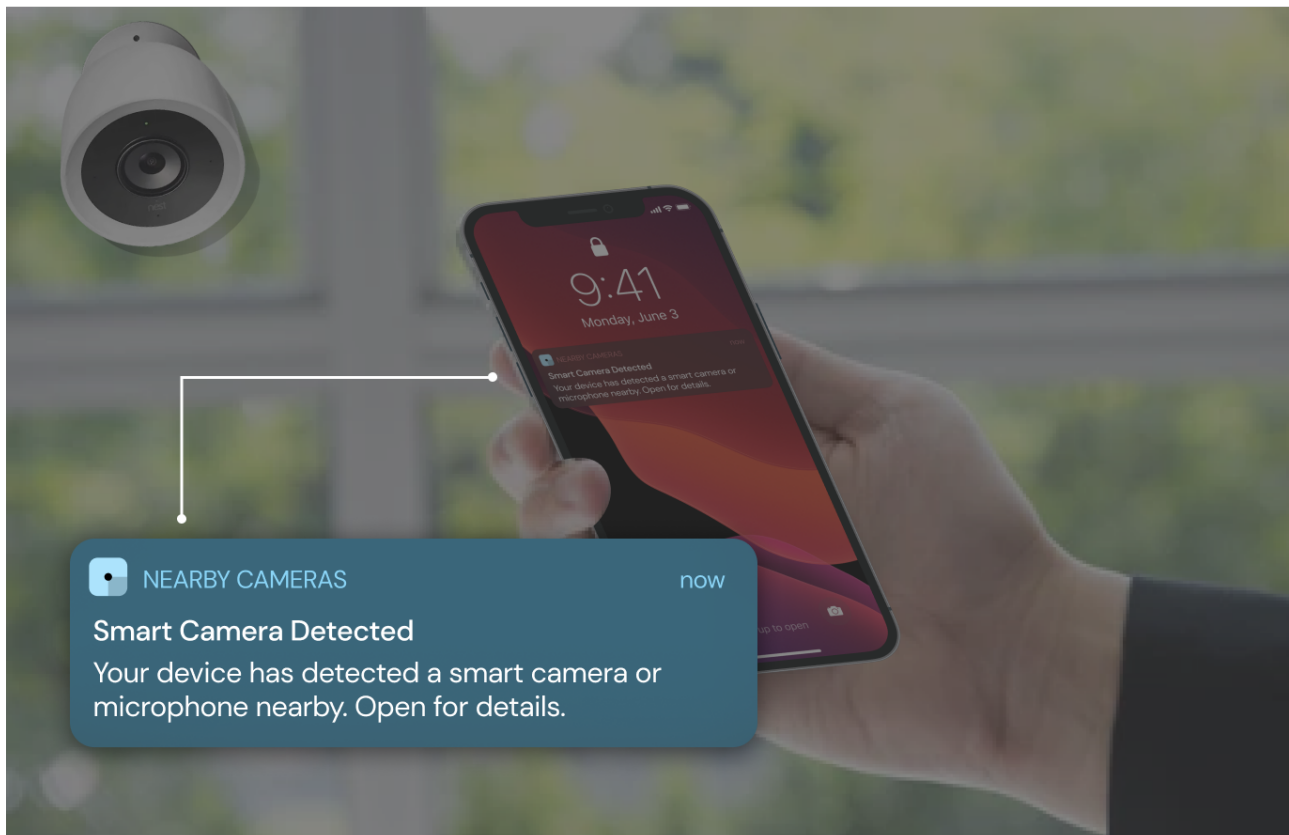


Here are a few tips for respecting the privacy of others when using smart devices like Nest products:

1. When it comes to privacy, remember the Golden Rule: treat others the way you would want to be treated.
2. When it comes to cameras or video doorbells:
  - You control where you place your cameras or video doorbell, and you’re responsible for making sure that you’re using them appropriately.
  - Some places have specific laws that where it is permitted to place a camera or video doorbell, whether you can record

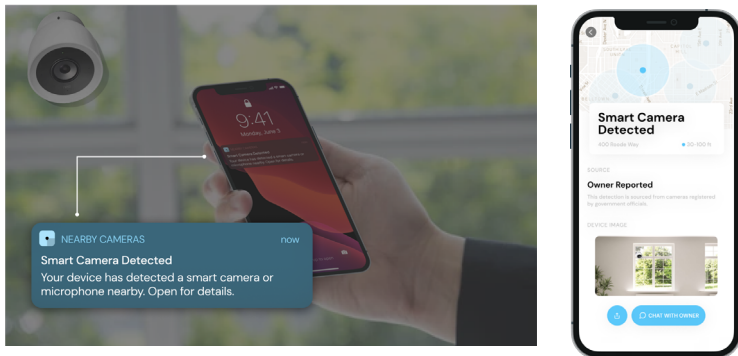
# Nearby Cameras

**Nearby Cameras** is a smartphone app that sends notifications when a nearby smart camera or microphone is detected.

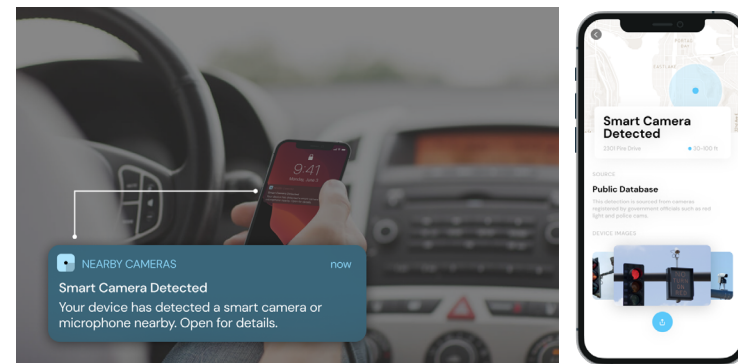


We consider several main detection scenarios. For each, we consider a potential source of data that might feasibly support each type of detection.

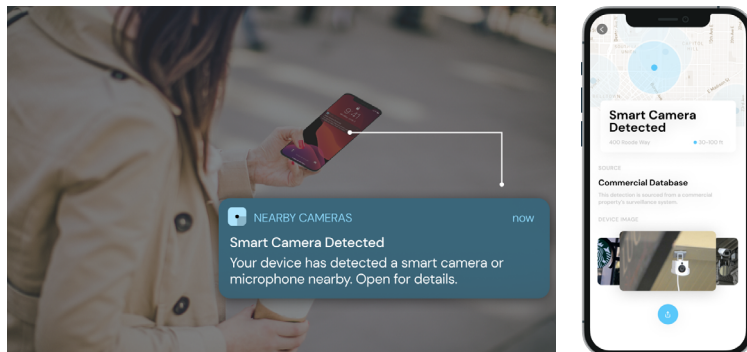
You're visiting someone's home.  
***Indoor home camera detected.***



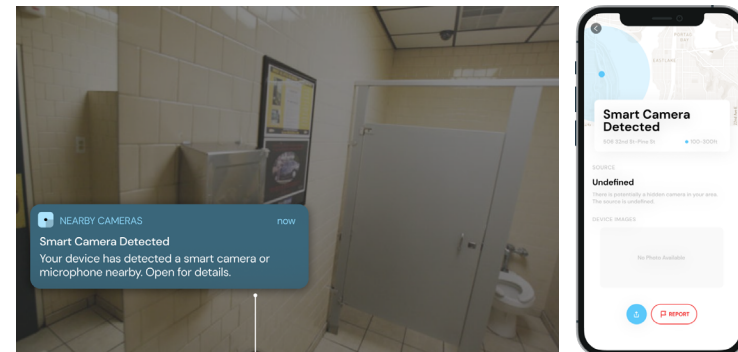
You're driving around.  
***Police camera detected.***



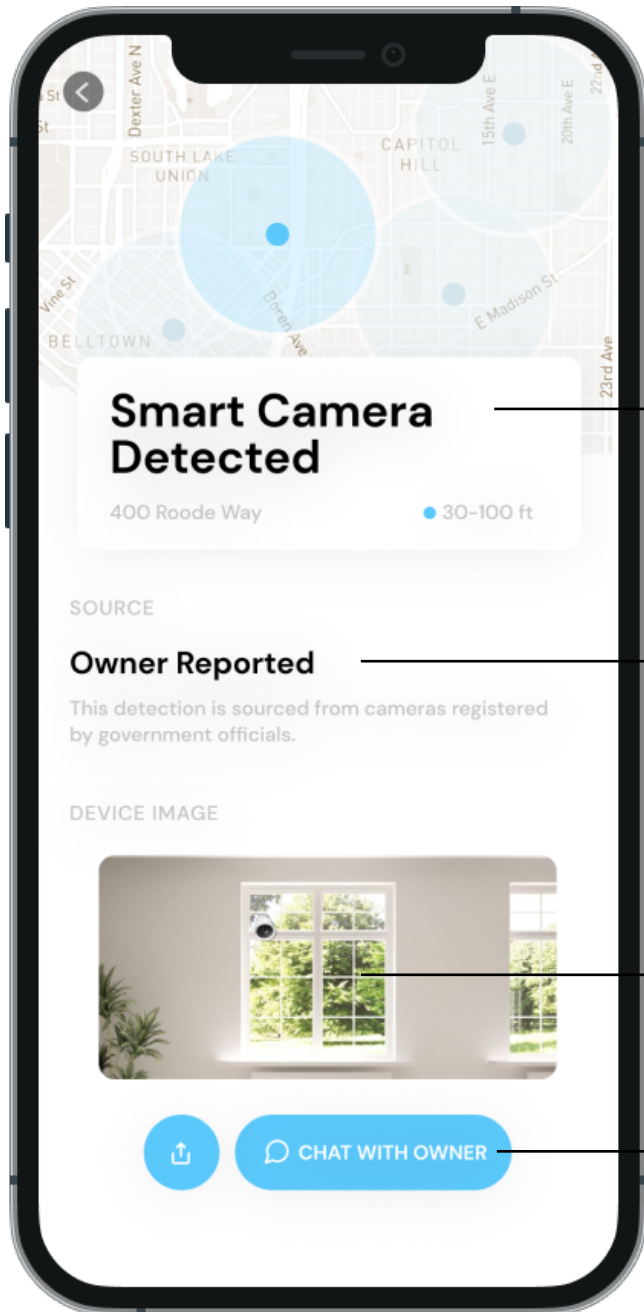
You're walking around.  
***Store camera detected.***



You're in a private space.  
***Possible hidden camera detected.***



You're visiting someone's home.  
***Indoor home camera detected.***



**Camera location**

**Data source:** Camera is registered by owner

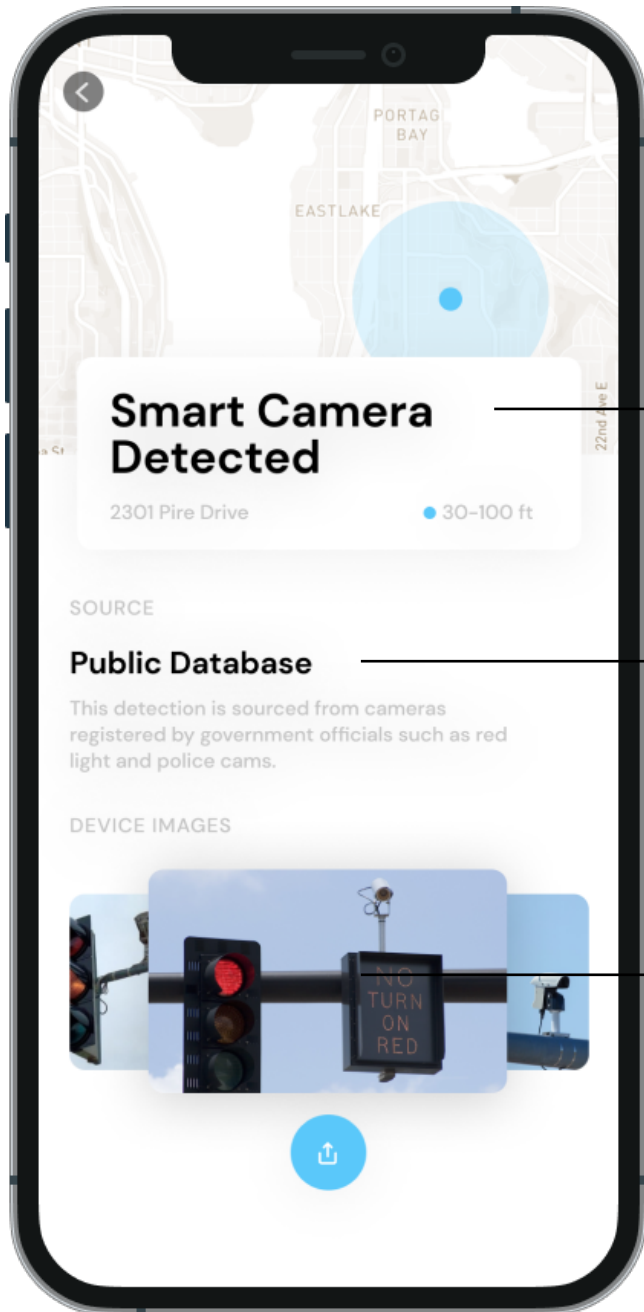
Could also be reported by a neighbor or random citizen.

**Device image:** Uploaded by camera owner

Could also be uploaded by a neighbor or random citizen.

**Chat with owner:** Verified users can message the camera owner.





You're driving around.  
***Police camera detected.***

**Camera location**

SOURCE

**Public Database**

This detection is sourced from cameras registered by government officials such as red light and police cams.

**Data source:** Camera is registered by local police.

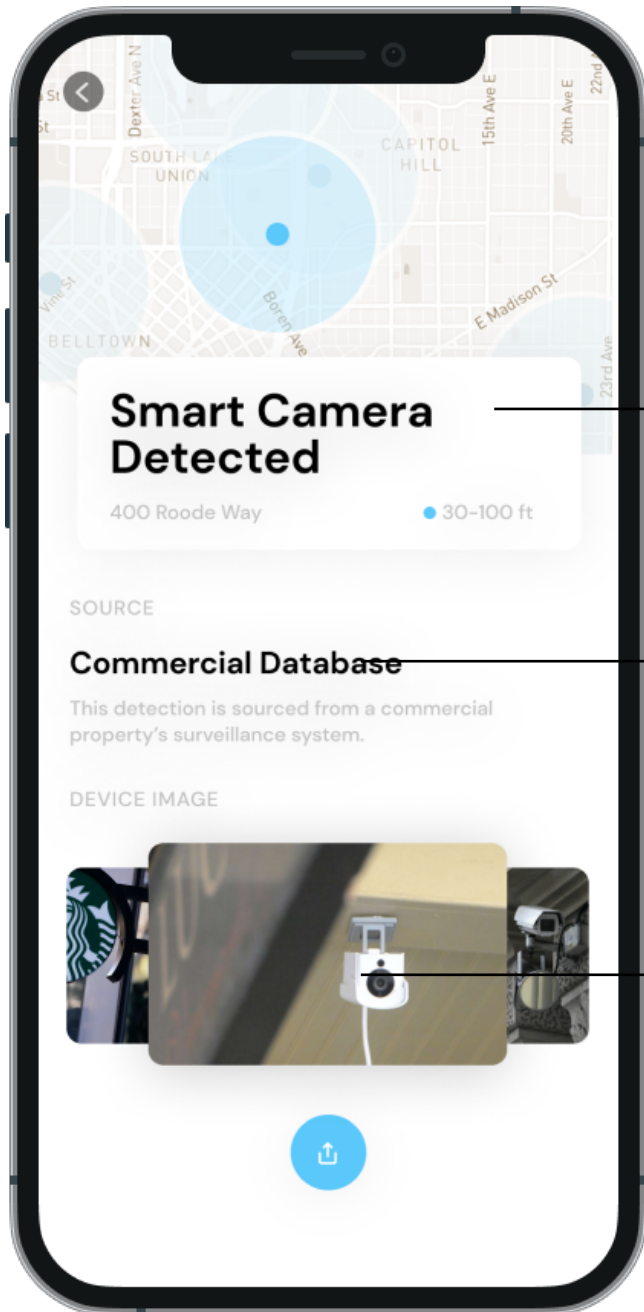
Could also be database of citizen reported cameras.

DEVICE IMAGES



**Device image:** Uploaded by local police.

Could also be uploaded by a random citizen.



You're walking around.  
***Store camera detected.***

**Camera location**

SOURCE

**Commercial Database**

This detection is sourced from a commercial property's surveillance system.

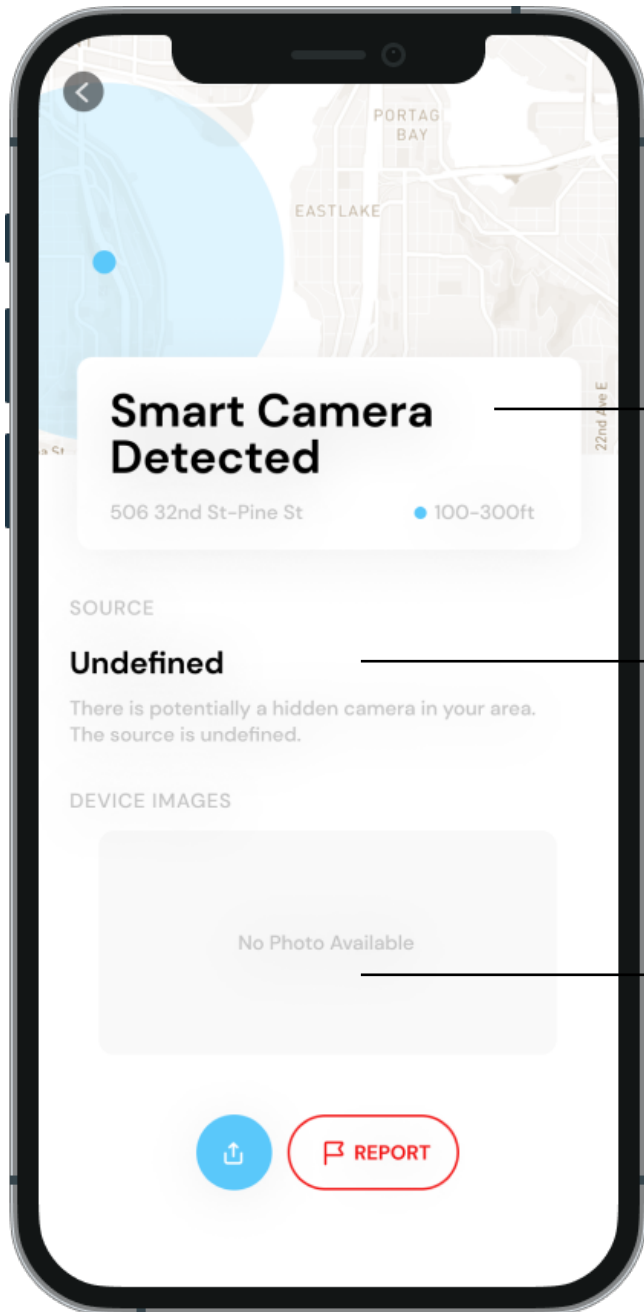
**Data source:** Camera is registered by local retailer.  
Could also be a property manger, building owner, etc.

DEVICE IMAGE



**Device image:** Uploaded by camera owner  
Could also be uploaded by a andom citizen.





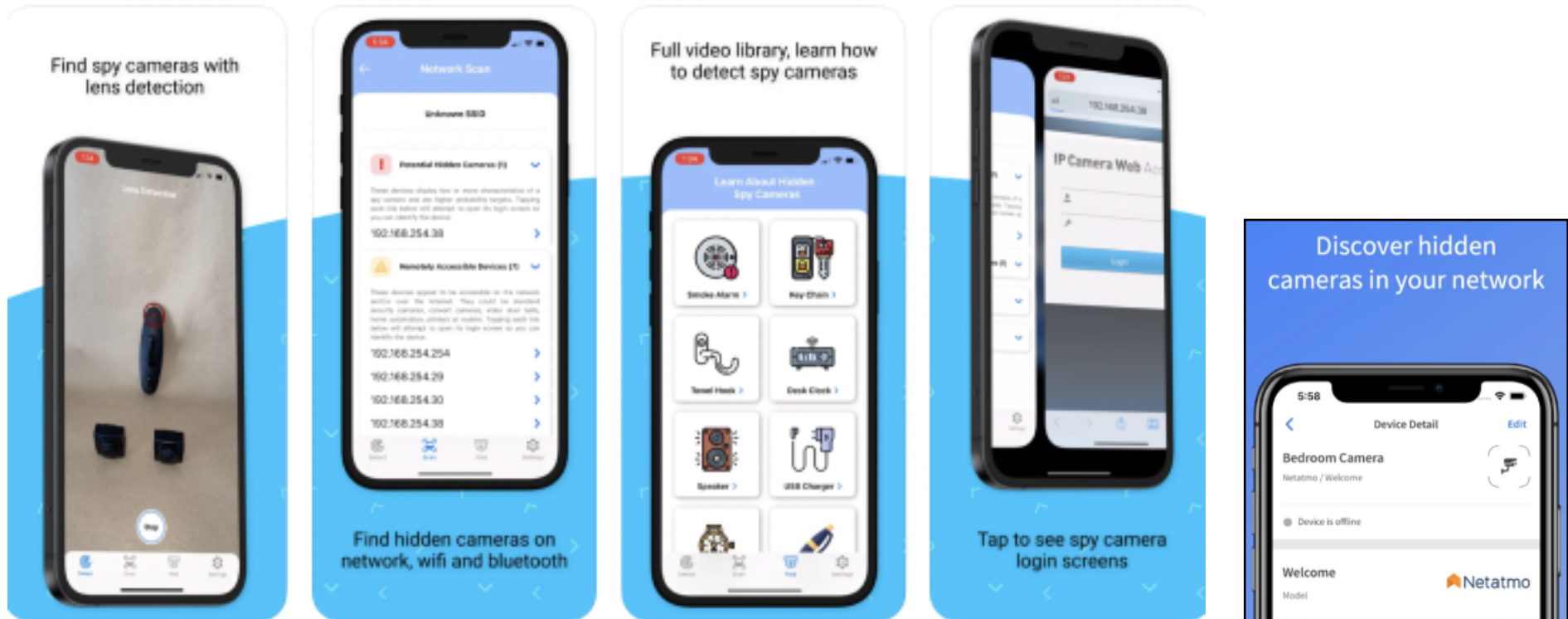
You're in a private space.  
***Possible hidden camera detected.***

**Camera location**

**Data source:** Camera detected by network traffic.

**Device image:** none available.

The hidden camera detection detection is similar to apps that attempt to identify cameras from network analysis. They can only detect Wifi cameras, and only if the user has access to the network.



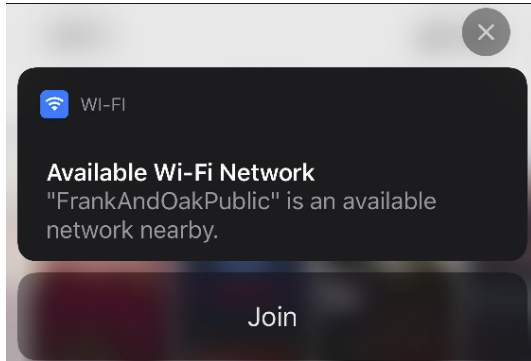
*Fing - Network Scanner*

<https://apps.apple.com/us/app/fing-network-scanner/id430921107#?platform=iphone>

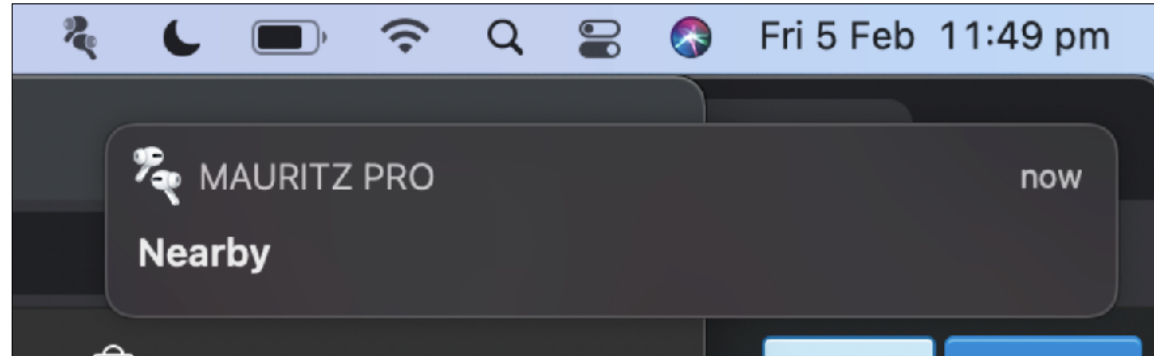
*Hidden Camera Detector :*

<https://apps.apple.com/us/app/hidden-camera-detector/id532882360>

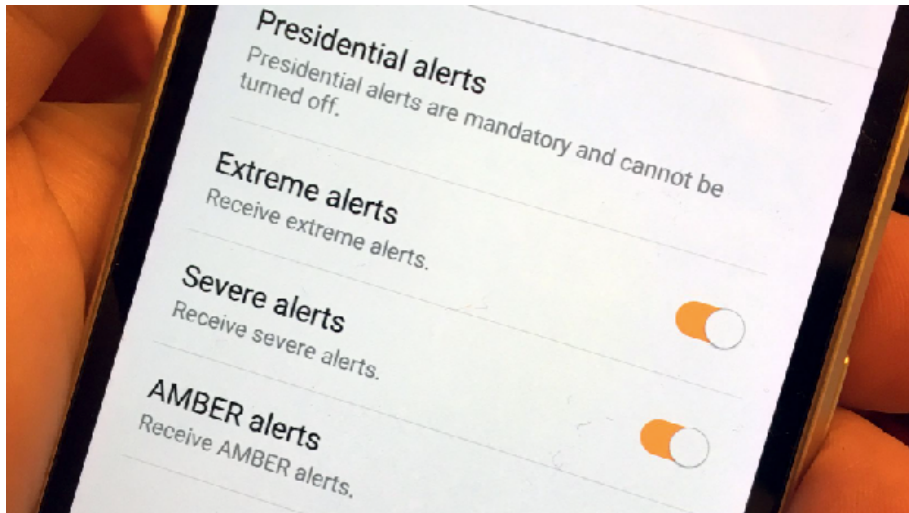
Nearby Cameras is similar to the ability to opt-in to nearby wifi network notifications on iOS or receive Amber alerts or view traffic cameras on google maps.



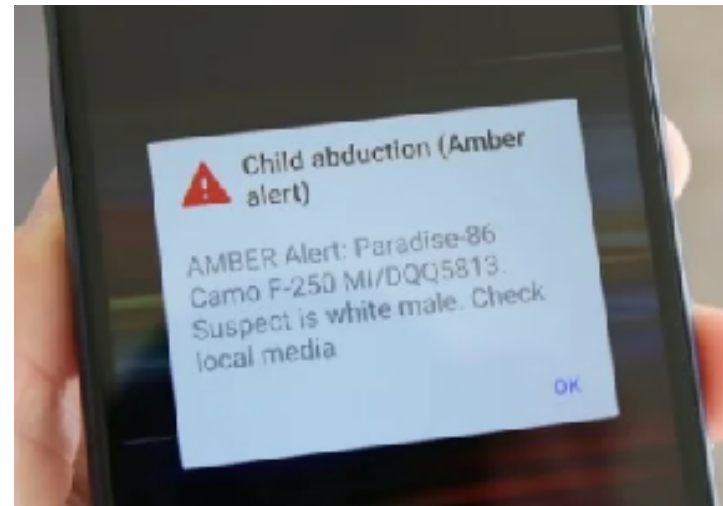
Nearby Wifi



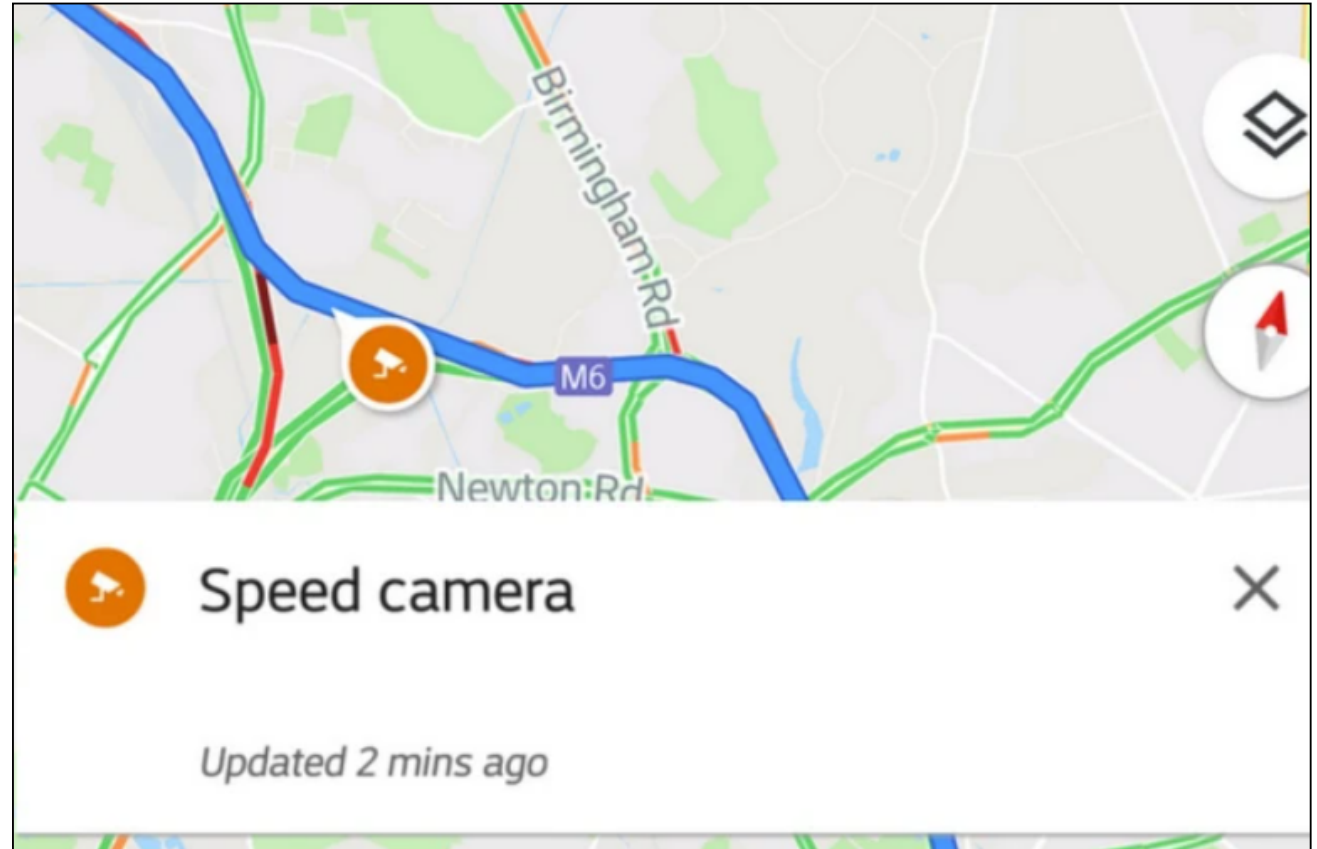
Nearby Headphones



Emergency Alerts



Nearby Cameras is similar to the speed camera location feature embedded into Google Maps.



**Closed Mode**

**Closed Mode** clearly communicates to those nearby that the camera is not actively capturing video. The central feature is a lenslid that closes over the camera lens. Enhanced light and sound indicators provide additional feedback.



### When and Where It's Used

Closed mode is primarily designed for indoor smart home cameras. Closed Mode is useful in situations where owners want to keep cameras setup in a specific place such as entryways, kids rooms, or areas where pets are active, but they don't always want them to be sensing. Applicable scenarios include:

- Friends or family are visiting and you want them to know the cameras are off.
- A nanny, caregiver, petsitter, or other domestic worker is over and you want them to know when cameras are on or off, or be able to turn it off themselves.
- One or more household members is home and wants to know for certain whether the cameras are sensing or not.

### How it Works

Closed Mode is a remotely controlled webcam camera for smart home cameras. When guests are over or household members are home, camera owners can visibly close the cameras and put everyone at ease.

Closed Mode can also be used with more advanced features to improve trust and transparency for those nearby. For example, **still sensing reminders** visibly and vocally awaken the cameras when someone enters a room to remind them it's on. Camera owners can configure **closing rules** to visibly deactivate the camera when events such as "my face," "family is home," or "nudity" is detected.



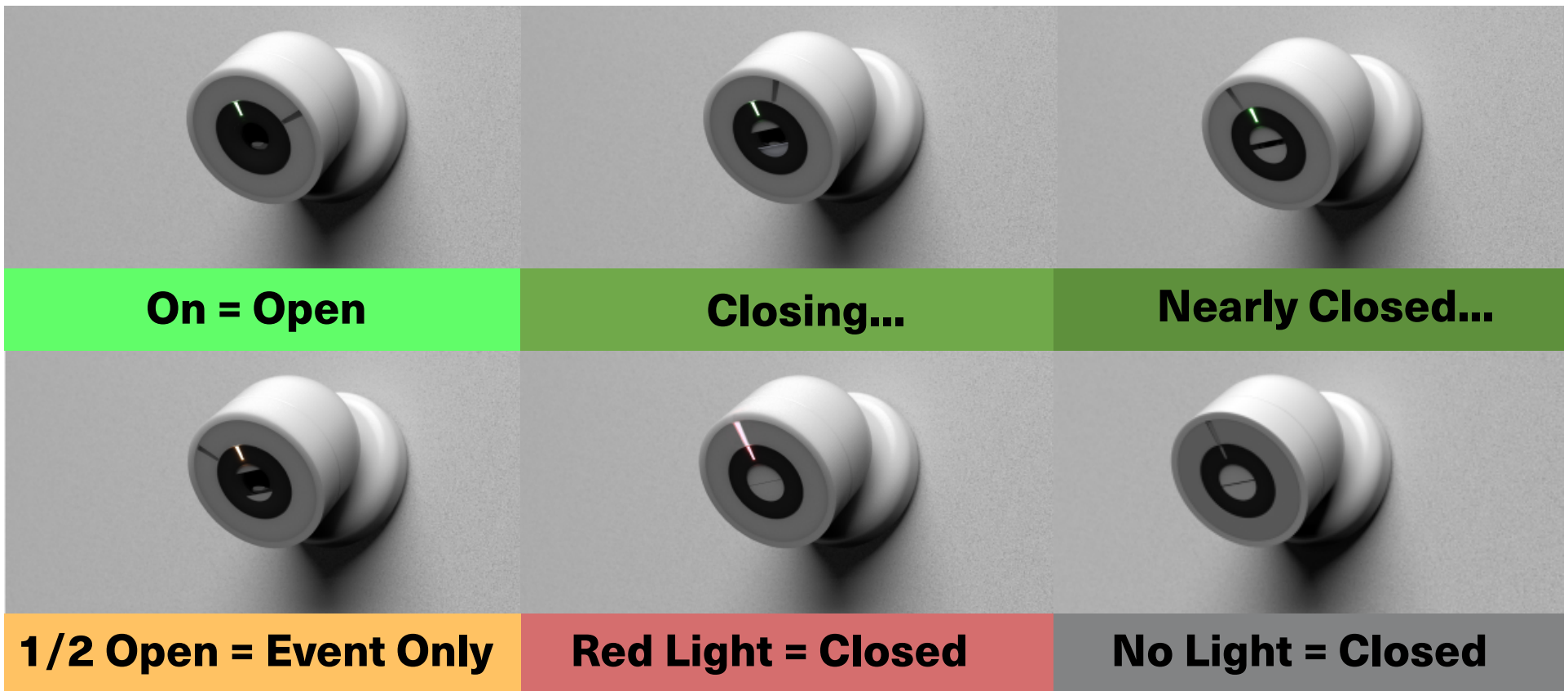
## The core idea motivating Closed Mode is to provide enhanced status indicators and reliable overrides.

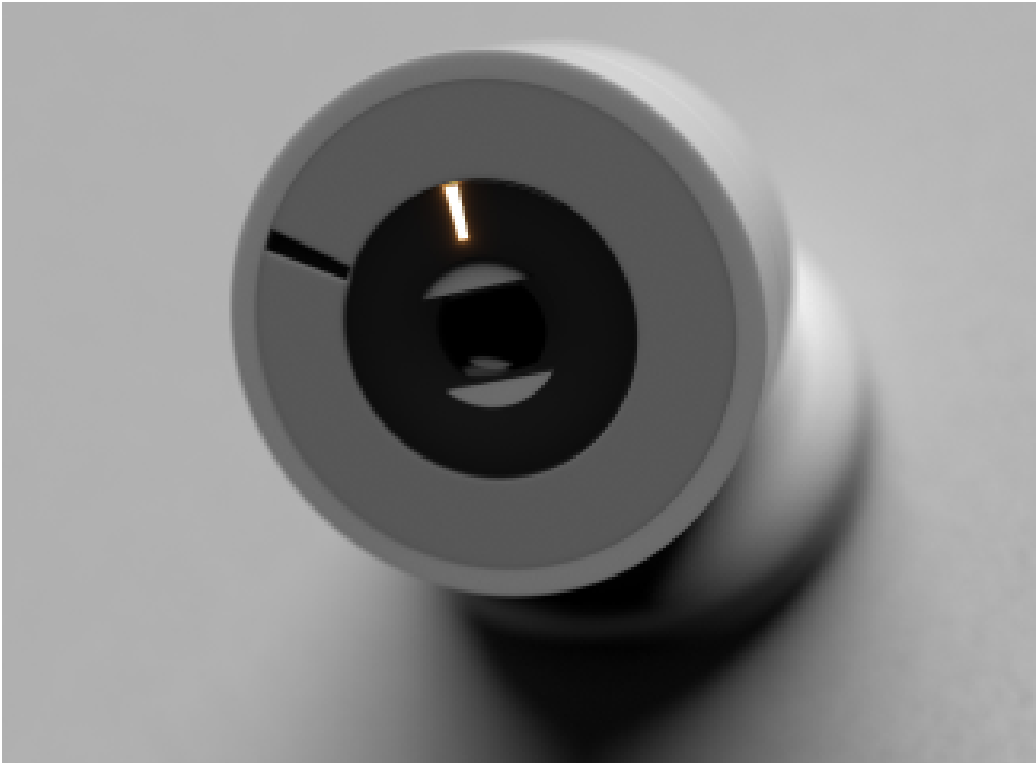
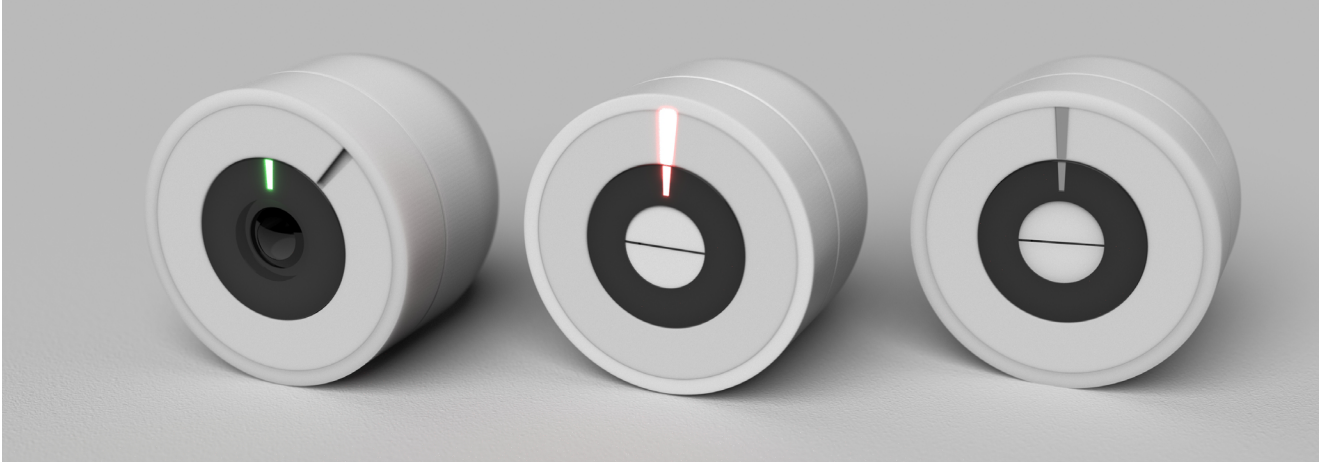
### Tri-Modal Feedback: Trust Via Redundancy

*Enhanced light indicators* and *auditory indicators* clearly communicate the camera status. The centerpiece feature is a *lenslid* shutter mechanism that physically closes to cover the camera lens, much like a webcam cover. This *tri-modal feedback* provides helpful redundancy, in case a nearby user doesn't notice one mode of feedback. The lenslid functions as a visible and intuitive override that provides an important layer of trust for guests or users who question the reliability of indicators. Together, these features aim to eliminate ambiguity, improve accessibility, and send a subtle signal that privacy and trust are paramount for owners, visitors, and bystanders alike.

### Electromechanical Lenslid

The *lenslid* is controlled by a small motor that protracts and retracts the shutters, similar to eyelids. This motion (and sound of the motor) provides visual and auditory feedback. The physical cover also provides latent tactile feedback. The user can touch the opaque plastic shutters to intuitively verify the camera lens is blocked, should they question the reliability of LED indicators and the honesty of camera owners or companies. The lenslid also includes an integrated visual indicator. When open, the lens appears dark. In Closed Mode, the protracted shutter displays a contrasting white. At a glance, the white shutter shows the camera is closed. The lenslid further serves as an accessible indicator to support color blind users.





## Closed Mode Basic Controls

There are 3 main ways to close or open the camera: manually, remotely via the app, and intelligently with open and close rules.

### (1) Remote Control via App Interface.

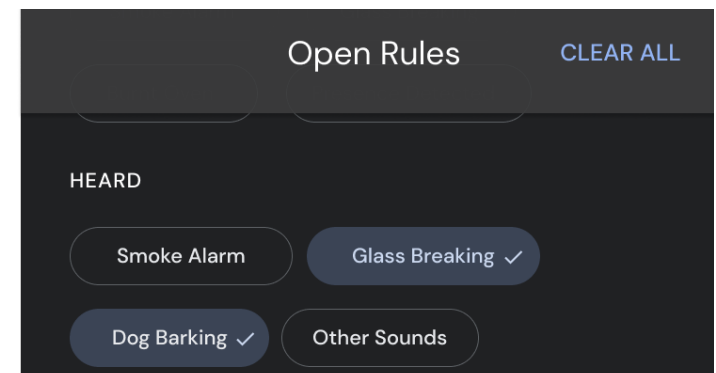
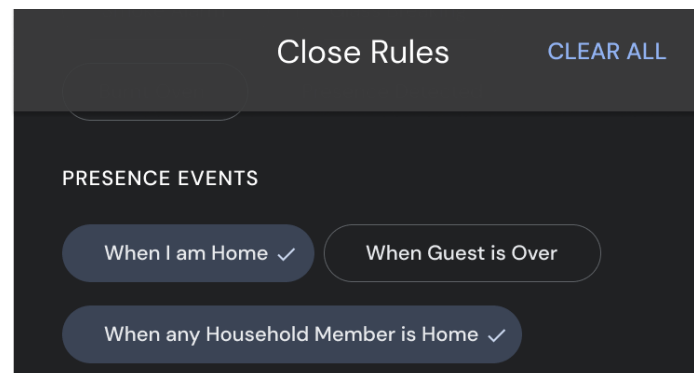
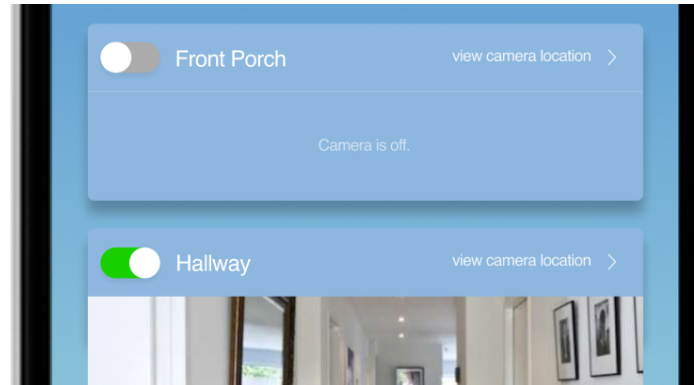
Camera owners or invited guests can open and close the camera remotely via the app interface.

### (2) Manually via Physical Device Control.

If enabled by the camera owner, a nearby user can touch the rim of the camera to close it. Camera owners can explain this hidden closing affordance to guests and household members.

### (3) Automatically via Intelligent Closing and Opening Rules.

Owners can configure advanced rules to automatically schedule or intelligently trigger opening and closing based on events. For example, users can configure cameras to close when a household members face is detected, close when nudity is detected, or open when smoke or breaking glass is detected.

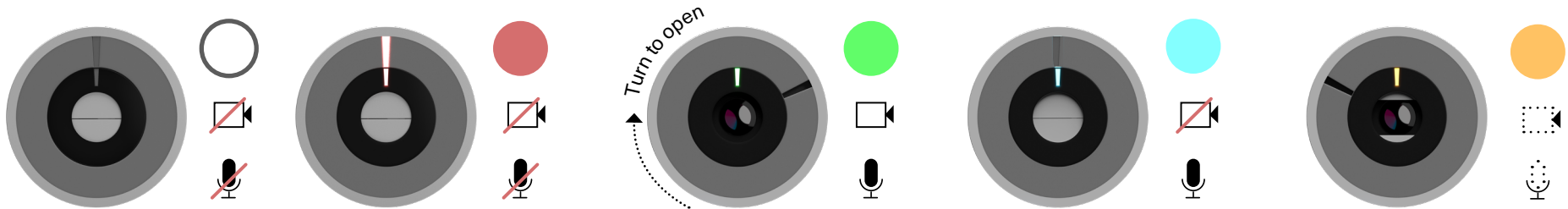


# Enhanced LED indicators improve communication of system status.

## Light Indicators

Current smart cameras typically use small LEDs to show 3 main states: no lights = video/audio disabled, solid green light = video/audio enabled, pulsing green light = owner is live viewing video. Our camera employs more prominent light and sound indicators, and displays additional states.

Our camera shows an additional state that some smart cameras offer: a battery-saving (and, in some contexts, tacitly privacy-enhancing) mode that intelligently monitors for user-specified events such as animals, smoke, or unfamiliar faces. Recordings and live view activate when an event is detected.



Closed State.

Camera and mic are deactivated.  
White lenslid shutter confirms off status to adjacent actors.  
Option 1: Red LED lit. Option 2: No LED (Red fades out)

Open State.

Camera is active.  
Live and recorded video.  
Green LED lit.

Mic Only State.

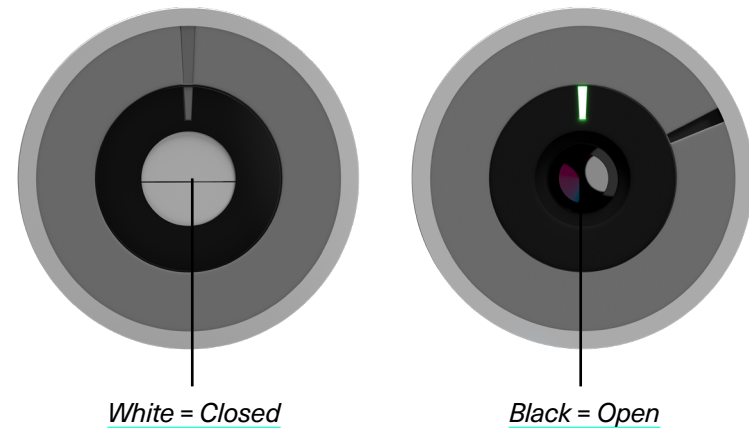
Video deactivated  
But mic is sensing.  
Blue LED lit.

Half Open State.

Event monitoring only.  
No live or recorded video.  
Orange LED lit. Slightly closed.

# The contrasting white surface of the lenslids provides a secondary visual indicator.

When open, the lens appears dark. In Closed Mode, the protracted shutter displays a contrasting white. At a glance, the white shutter shows the camera is closed. The lenslid further serves as an accessible indicator to support color blind users.



White = Closed

Black = Open

# Enhanced audio indicators create added awareness and improved accessibility.

## **Auditory Indicators**

Camera owners can configure up to three auditory indicator options: Tone, Basic Voice, and Advanced Voice. The volume of each can be adjusted independently. Tone: An ascending tone is played when Opening, and a descending tone is played while Closing. An oscillating tonal progression is played to indicate a Half Open State. Basic Voice Indicators provide an abbreviated description of changes in camera status, such as "Camera is now closed," "Camera is now open," and "Camera is now partially open." Advanced Voice Indicators offer additional description of camera status for guests or bystanders unfamiliar with the device. For example, "The microphone has been turned on by guest user Sasha."

## Advanced Closing Rules and Situational Indicators

Several additional features allow even greater control.

### (4) Repositioning Rules and Alerts

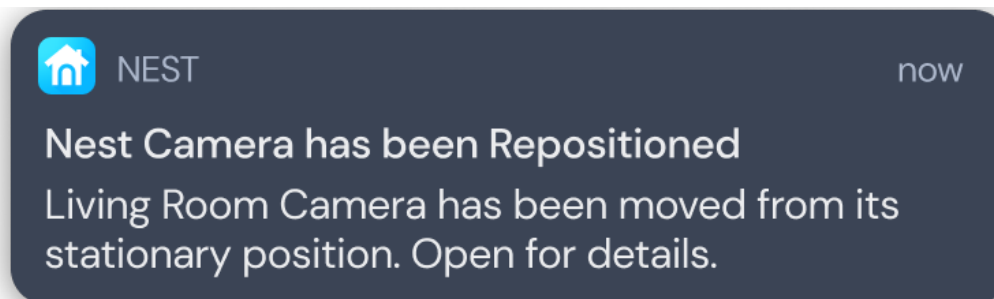
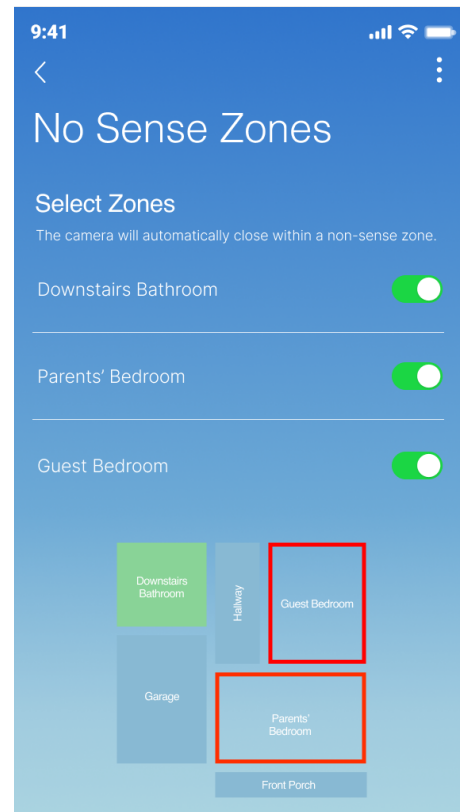
Cameras can be configured to close and/or notify users if moved or repositioned.

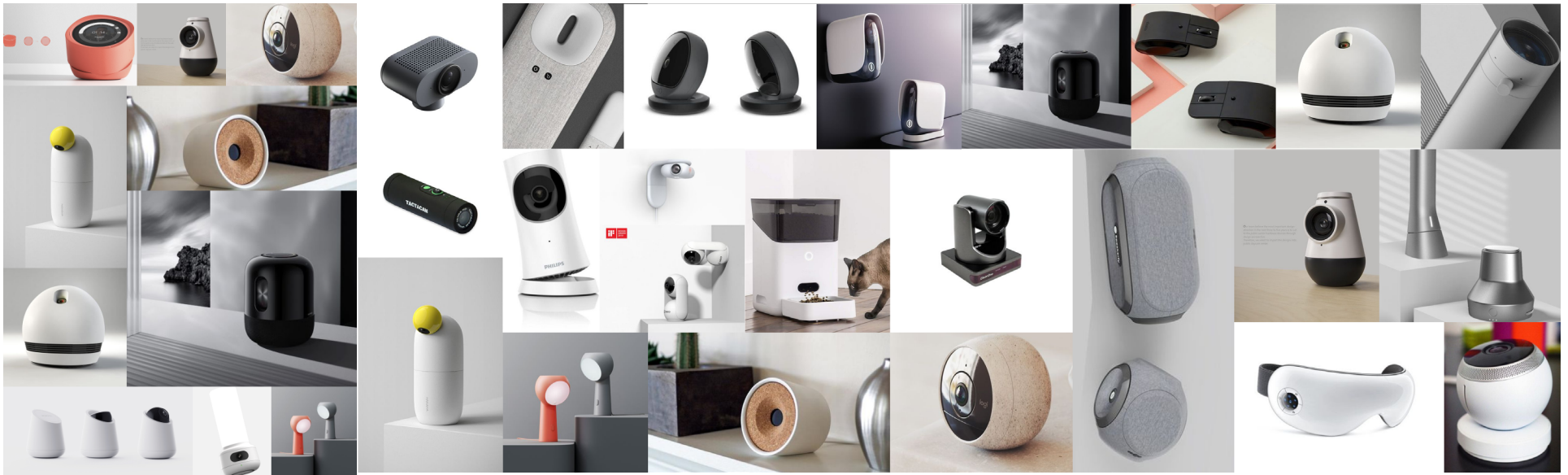
### (4) No-Sense Zones

No-Sense Zones automatically activate closed mode when a camera enters an off-limits area. Owners can configure geofenced No-Sense Zones around sensitive areas such as bedrooms, bathrooms, and guest rooms. This feature is especially useful for managing mobile battery-powered smart cameras. It may also be useful for integrated mobile (Group 2), autonomous (Group 3), and wearable (Group 4) cameras.

### (6) Still Sensing Reminders

Even with lenslids and LEDs, people may still forget or not realize that a camera is active. Still Sensing Reminders audibly chirp and visibly flicker to announce to those nearby that there's a live camera. For example, an owner may configure a camera to trigger a Still Sensing Reminder when a household member first arrives home. This can help household members remember to turn a camera off, and help guests or domestic workers locate cameras the owners have invited them to disable.





Integrated webcam covers.



Add-on, after-market webcam covers.

**HDoorLink<sup>®</sup>**





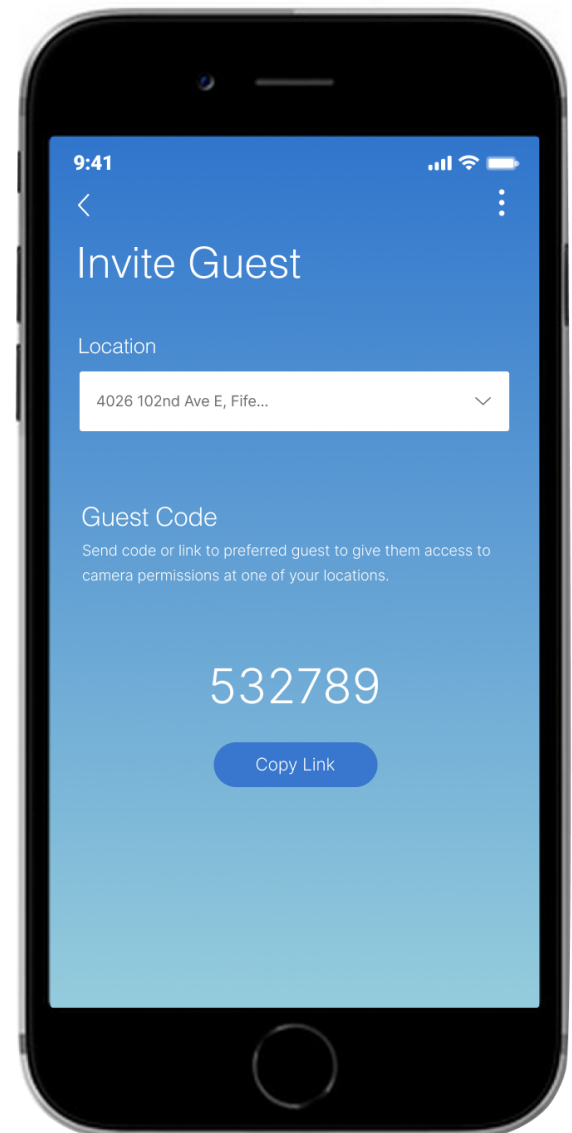
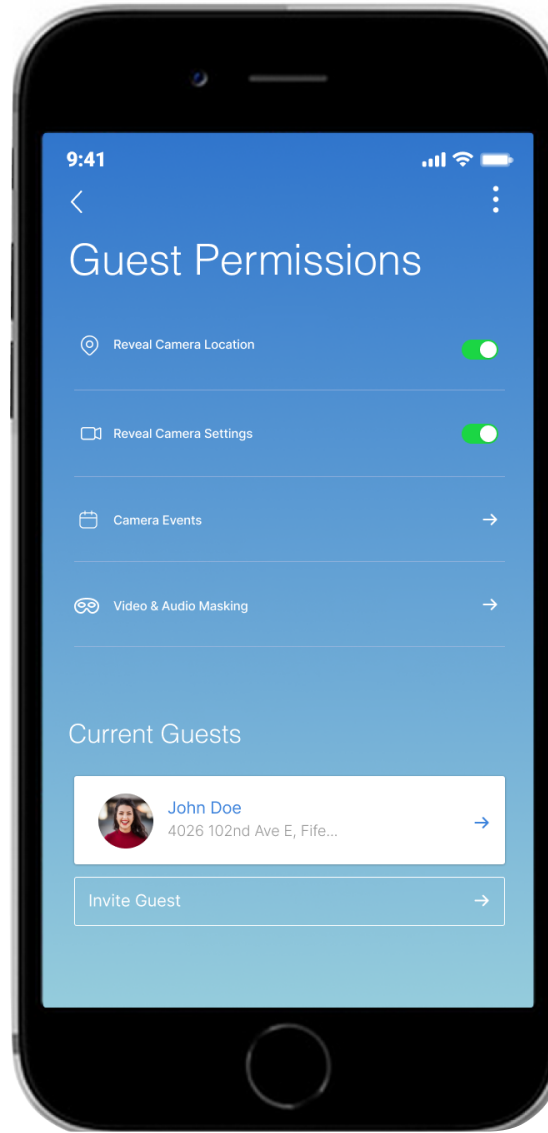
Still-sensing reminder are inspired by the Apple Watch automatic “end workout?” notifications. The device intelligently infers if users may have stopped the workout they logging they had initiated, and asks them if they want to end or change their workout.



# Guest Access

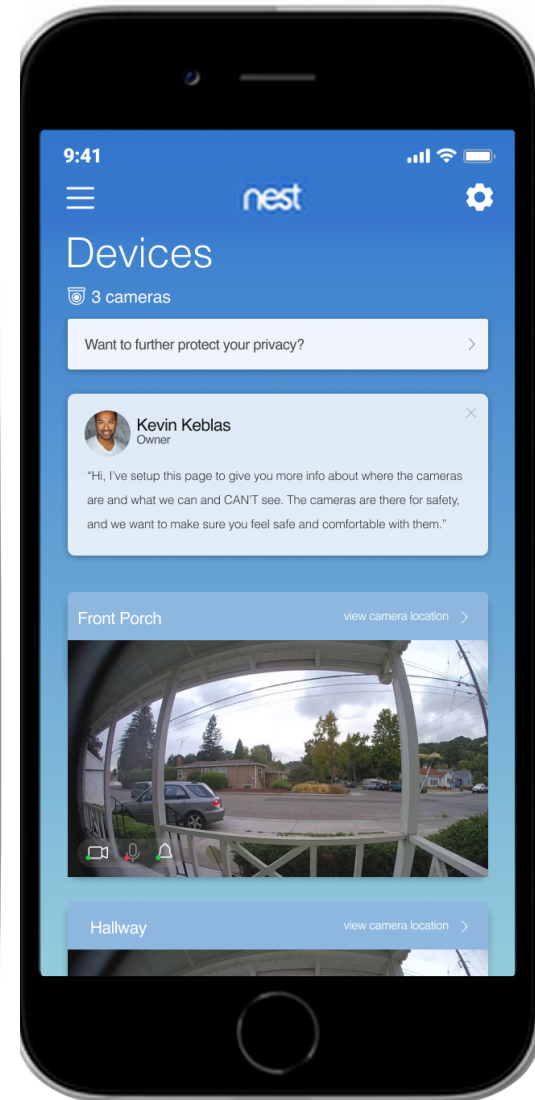
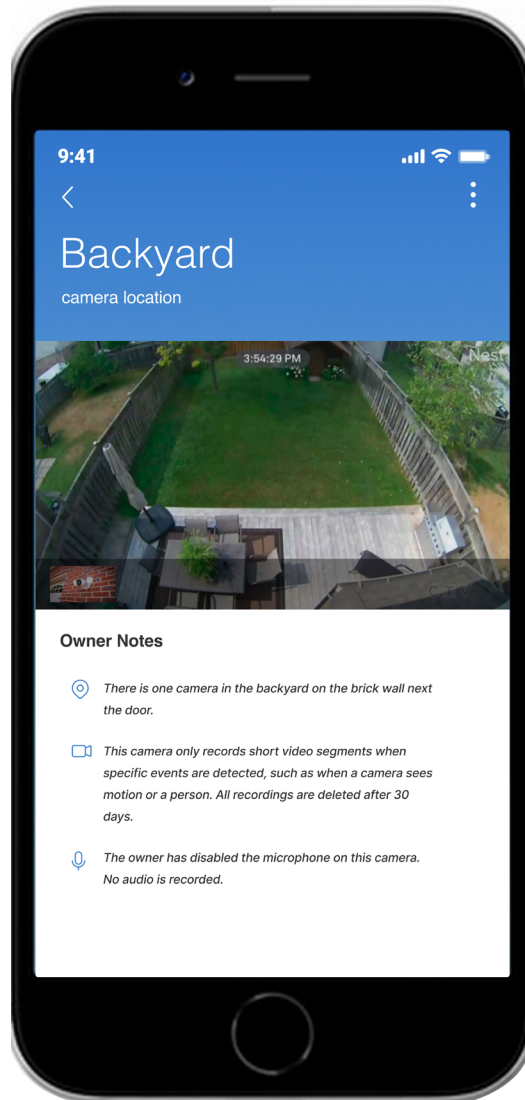
**Owner Setup of Guest Permissions**

The owner decides what features the guest can access, and when the guest account expires. The invited guest then decides which, if any, features to use.



**Shared Camera Location and Status**

Owners may share the location and status of the cameras to clarify precisely what the camera owner can and cannot see.

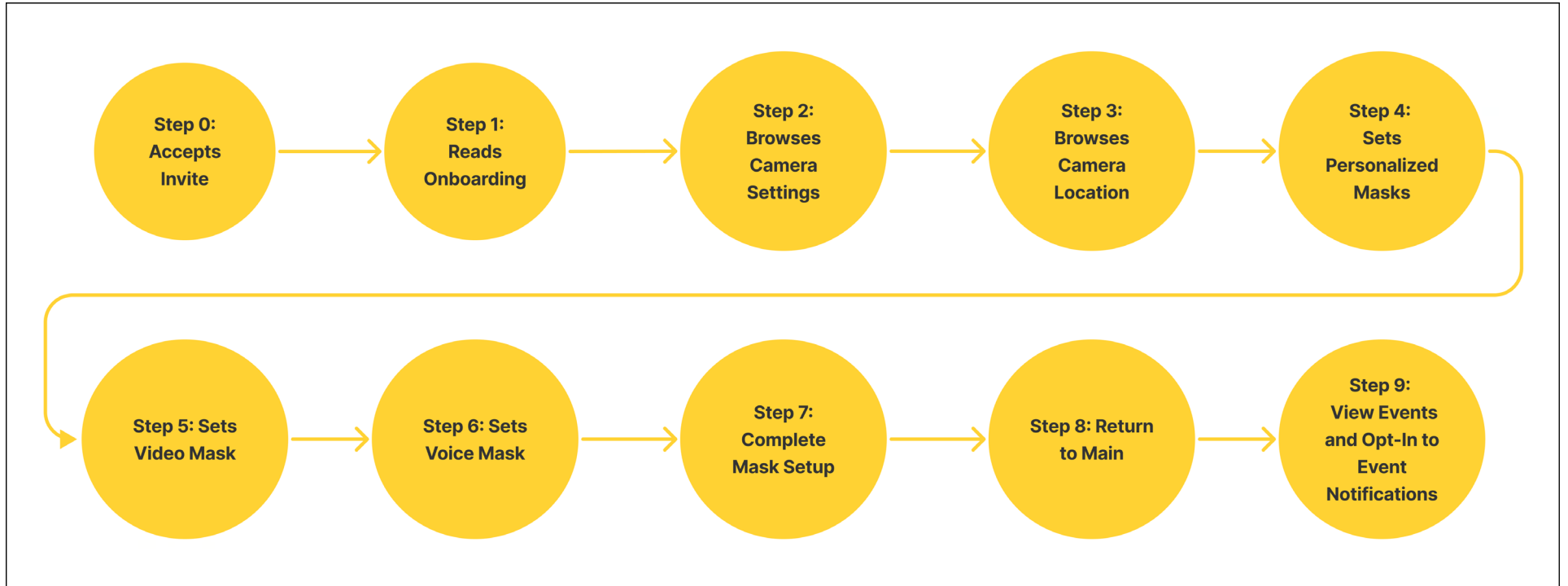


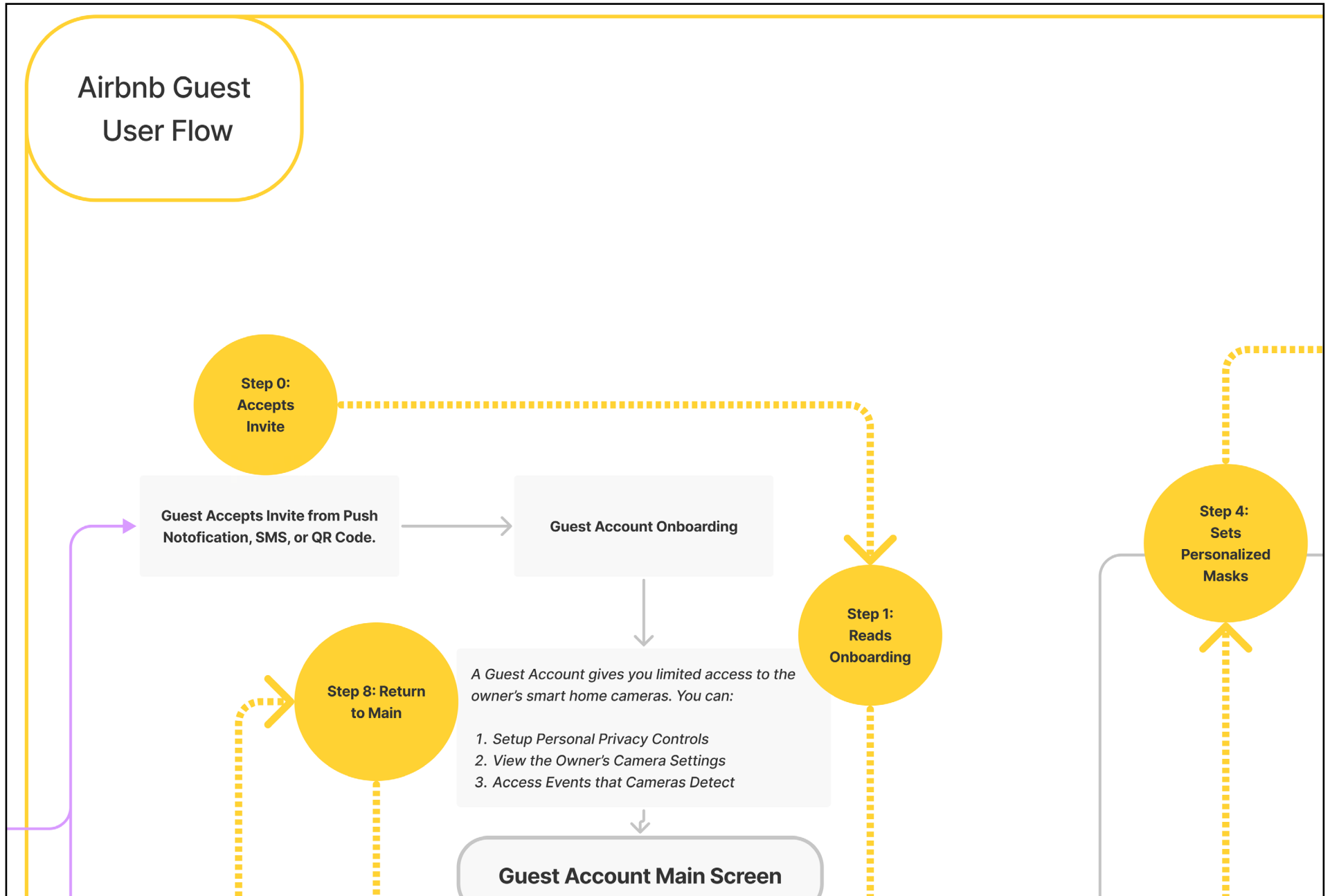
**Video and Audio Masks**

If enabled, guests can mask their faces, bodies, and voices from detection.

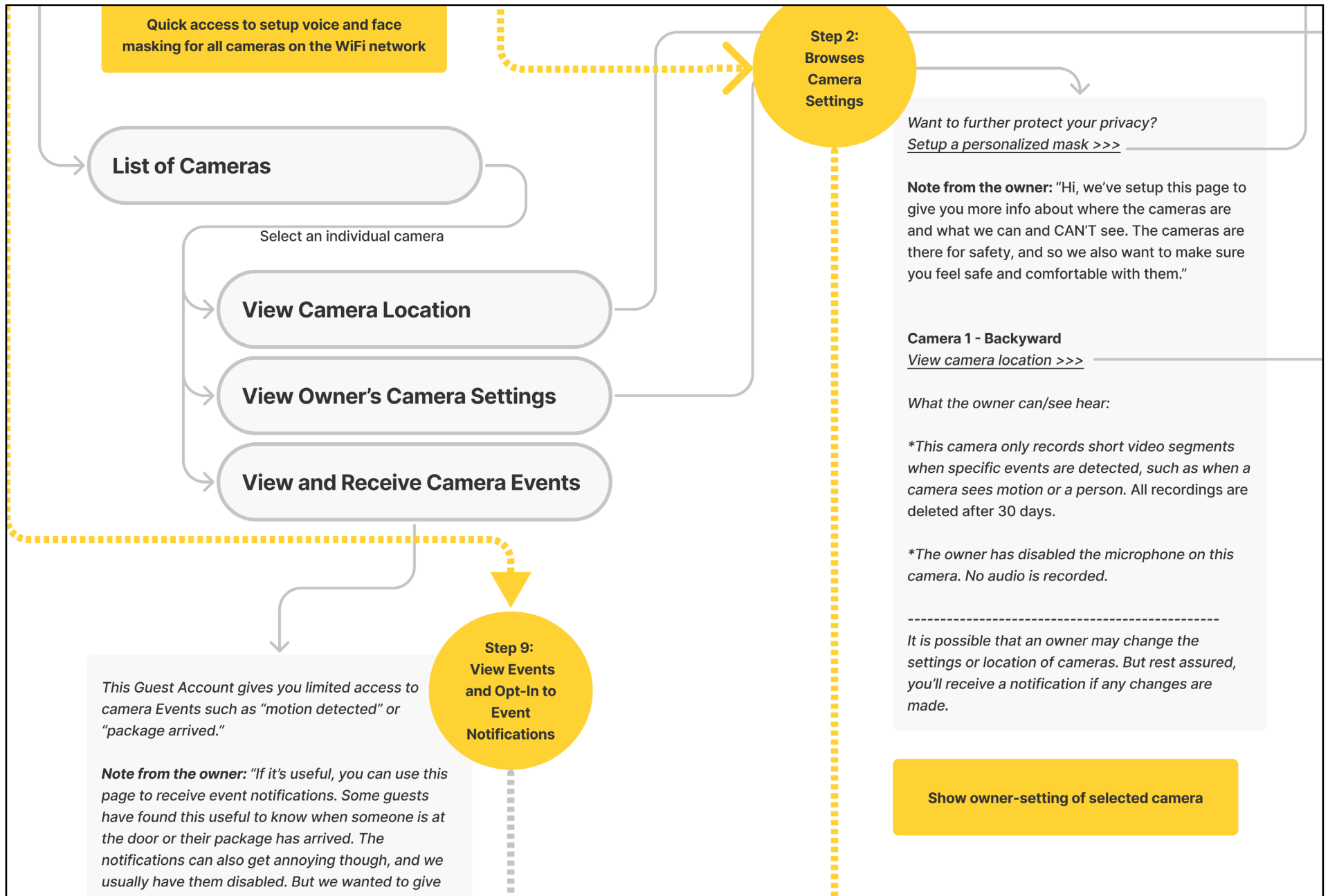


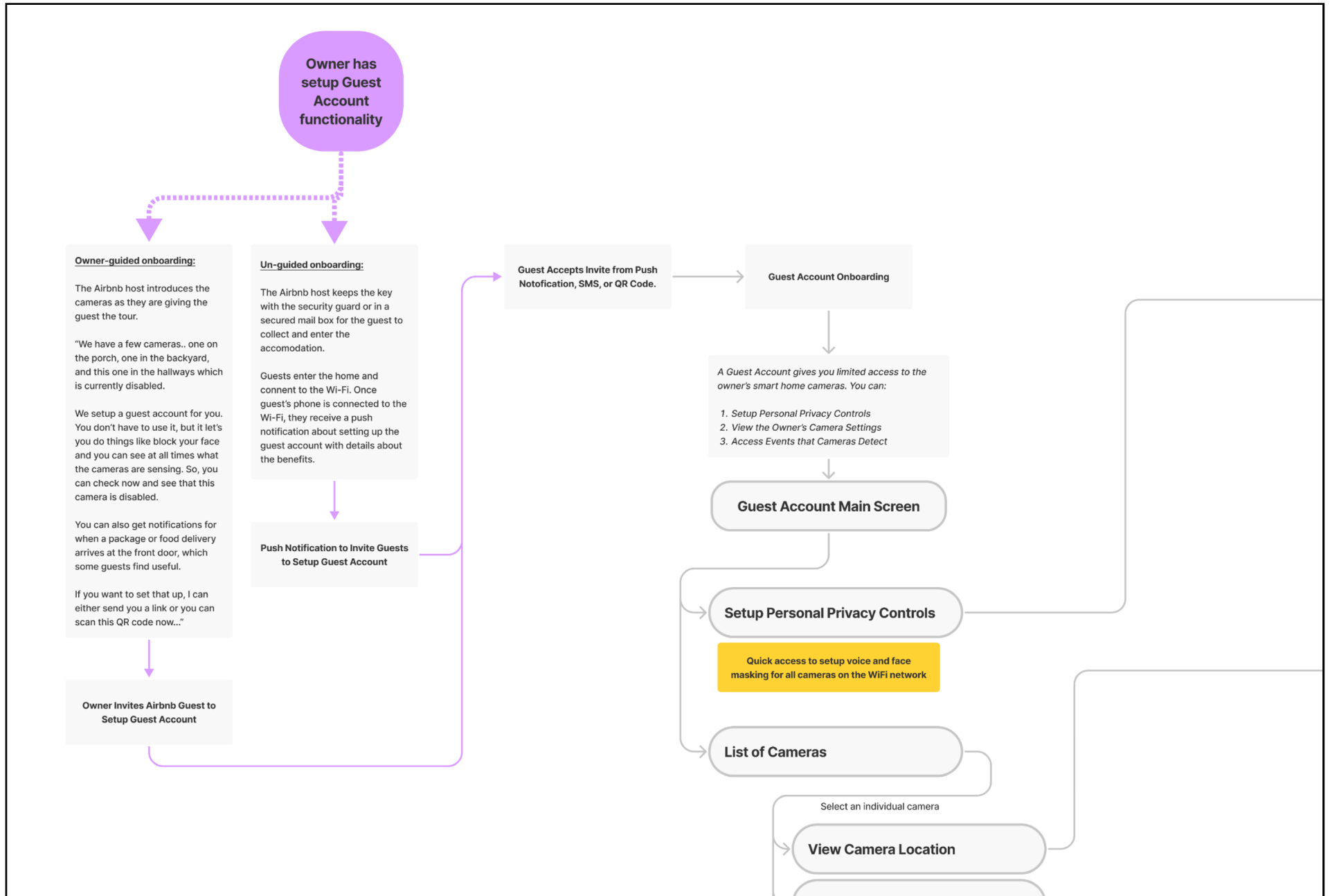






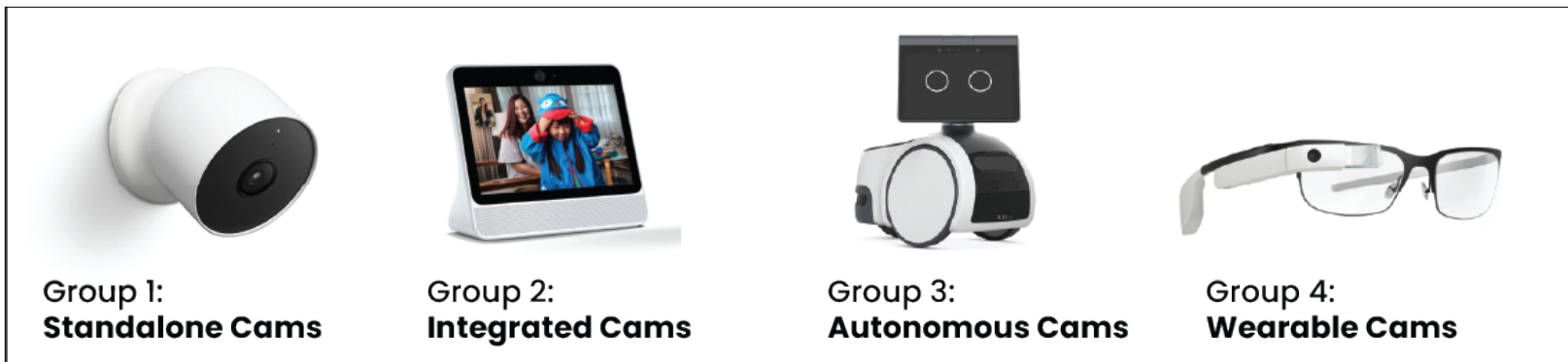
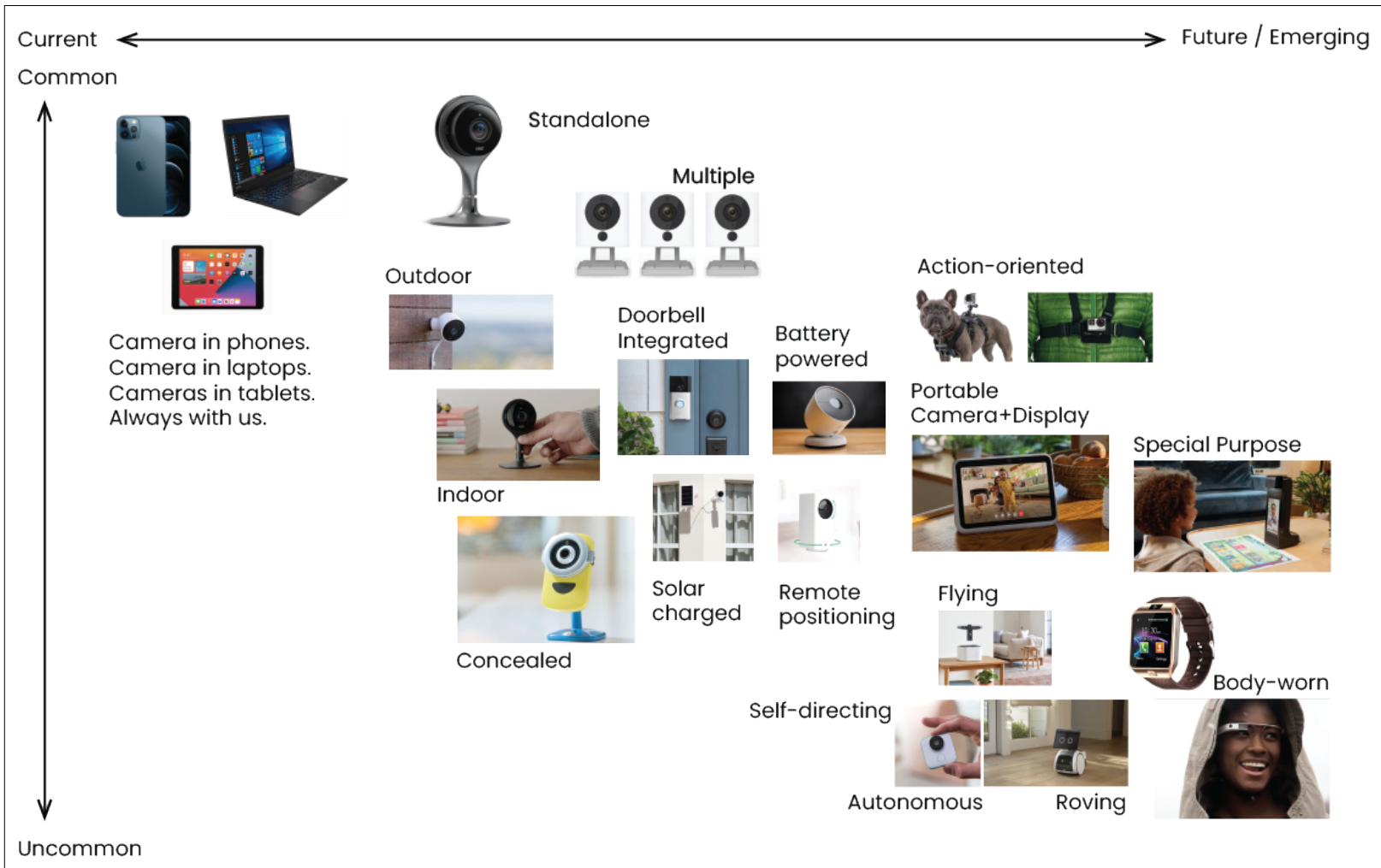






# **LANDSCAPE ANALYSIS AND DESIGN FRAMEWORKS**

Sample Process  
Diagrams and Activities



**Space:** Where does the device sense?



Inside



Outside



Beside



Accross



Between

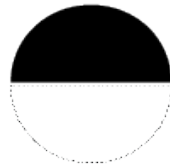
**Duration:** How often is it sensing?



Always-On



Often-On

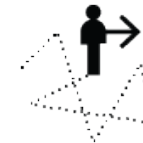


On-And-Off

**Location:** Does it stay or move?



Fixed

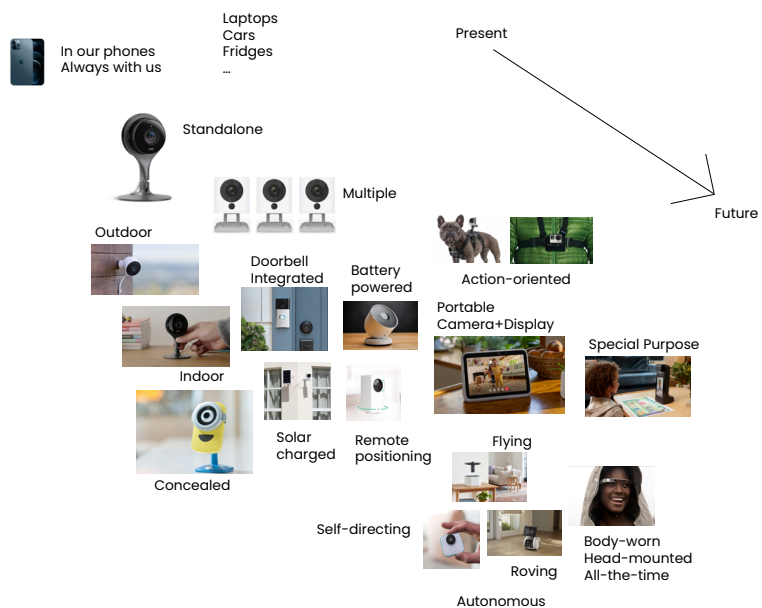


Mobile

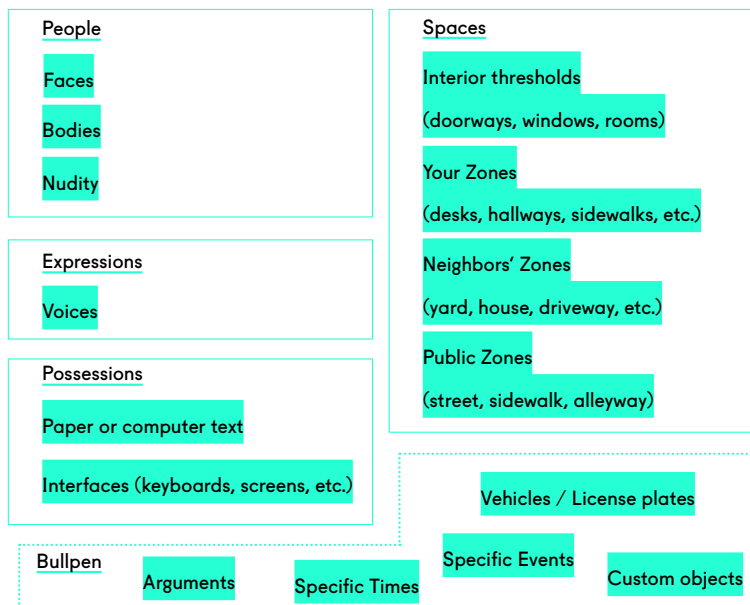


Autonomous

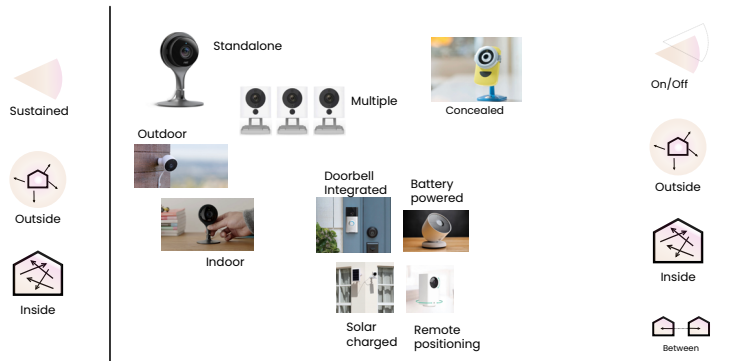
# What cameras are involved?



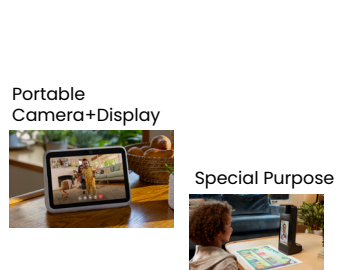
# What should it block?



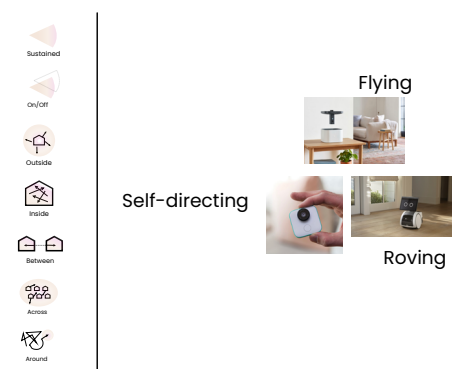
## Group 1 Cameras: Stationary & Often On



## Group 2 Cameras: Portable and Task-Oriented



## Group 3 Cameras: Autonomous & Mobile



# What should it block?

## People

Faces

Bodies

Nudity

## Expressions

Voices

## Possessions

Paper or computer text

Interfaces (keyboards, screens, etc.)

## Spaces

Interior thresholds

(doorways, windows, rooms)

Your Zones

(desks, hallways, sidewalks, etc.)

Neighbors' Zones

(yard, house, driveway, etc.)

Public Zones

(street, sidewalk, alleyway)

Vehicles / License plates

## Bullpen

Arguments

Specific Times

Specific Events

Custom objects

## Question Set #1

What could it block? What should it block?

Design tasks: Create 1-2 pages of sketches/diagrams with annotations that answer this question.

## Question Set #2

Who might want to block what?  
When? Where? Why?

What type of camera(s) are involved?

Design tasks: Write 5 short use case scenarios that answer this question.

## Question Set #3

How does the user set up the blocking?

Can they adjust or fine-tune it? How?

Does the systems suggest or recommend?

Can they adjust the scope or intensity? How?

Can blocking be overridden?

What if multiple users have access?

How do they know it's working?

How does blocking appear (blur, spot, pixelate)?

What are some ways it might NOT work?

What data is actually blocked? Livestream?

Recording? Logged events? Data sent to the Cloud?

How/Is this communicated to the user?

Design tasks: Create a detailed interface and user flow for 1 of your scenarios and try to answer as many of these questions as you can.



## Synchronous Communication Cameras

POV: HOUSEHOLD MEMBER

*I don't want them to see accidentally private or intimate information.*

- \* extremely sensitive scenes: nudity
- \* mildly sensitive scenes: other member enters frame
- \* sensitive situations: screaming, arguments, commotion
- \* sensitive rooms: bathrooms, bedrooms
- \* sensitive surfaces: keyboards, desks, computer screens

Portable  
Camera+Display



Special Purpose



# Pet Sitter and Owner

## Background

Theo lives alone and has 3 cats. He travels often for work and fun. He hires a petsitter from Rover to help take care of his cats when he's away for longer than a few days. He has one person he likes best—Ellie—but sometimes she's not available so he takes whoever he can book. Theo has a few cameras setup around the house to watch his cats. But he cares about personal privacy, and doesn't want the pet sitter to feel like they're being surveilled. So he specifically purchased a smart camera system with a Closed Mode to help him provide his pet sitters and other guests the opportunity to disable the cameras.



## Typical Use Case

Before he leaves town, Theo carefully sets up his 4 cameras: one covering the whole living room, one near the food and water bowl, and one over the bed where they like to nap, and one covering the kitchen windows they like to perch in. Theo also has a doorbell camera setup so he knows when the pet sitter arrives and leaves.

Before Ellie the pet sitter arrives, Theo reminds her that he has the cameras setup. “There are 4 inside, and I just sent you a photo of where each one is. Just gently tap the button on top of each camera to close them when you arrive. I have them set up just right, so please just tap gently—it doesn't take much. I'll turn them back on after you leave.”

When Ellie arrives she disables the camera in the living room and it visibly closes. She ends up leaving the other cameras on, because she doesn't spend much time in the other areas.

When Ellie leaves, Theo receives a notification from the doorbell camera. He turns the living room camera back, and quickly checks the video from the other cams to see that all is well.

## Camera Types and Layout

**Type:** multiple Indoor smart cams

**Space:** Inside the home

**Duration:** Often-on

**Location:** Stationary

## Actors Involved

Primary users: pet owner

Co-users: pet owners spouse

Incidental user: pet sitter

Surveilled subject: pet sitter

## Social and Power Dynamics

Pet sitter is an employee of the owner. Pet sitter does not have any clear worker protections granted by law or platform policy.

Owner is mostly trusting of the pet sitter because they have good reviews. Owner doesn't want to spy on the pet sitter, but does want to know that they showed up on time and confirm how long they stayed.

## Cooperation

Low ————— High

## Face-to-face interaction

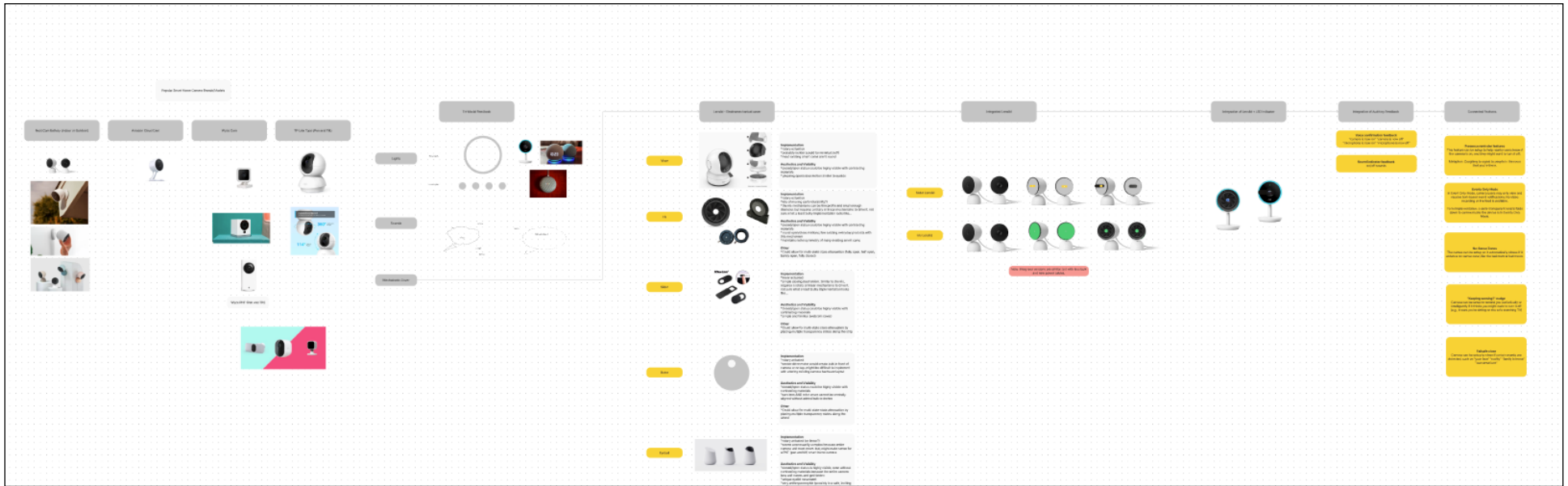
Low ————— High

## Preexisting trust

Low ————— High

# **DESIGN PROCESS**

## Sample Sketches



### Lenslid - Electromechanical cover

**Visor**

**Implementation**  
 \*rotary actuation  
 \*probably bulkier (could be miniaturized?)  
 \*most existing smart cams aren't round

**Aesthetics and Visibility**  
 \*closed/open status could be highly visible with contrasting materials  
 \*pleasing open/close motion similar to eyelids

**Iris**

**Implementation**  
 \*rotary actuation  
 \*lots of moving parts (durability?)  
 \*the iris mechanisms can be thin profile and small enough diameter, but requires a rotary or linear mechanisms to drive it, not sure what a least bulky implementation looks like...

**Aesthetics and Visibility**  
 \*closed/open status could be highly visible with contrasting materials  
 \*novel open/close motions, few existing everyday products with this mechanism  
 \*maintains radial symmetry of many existing smart cams

**Other**  
 \*Could allow for multi-state state attenuation (fully open, half open, barely open, fully closed)

**Slider**

**Implementation**  
 \*linear actuated  
 \*simple closing mechanism. Similar to the iris, requires a rotary or linear mechanisms to drive it, not sure what a least bulky implementation looks like...

**Aesthetics and Visibility**  
 \*closed/open status could be highly visible with contrasting materials  
 \*simple and familiar (webcam cover)

**Other**  
 \*Could allow for multi-state state attenuation by placing multiple transparency states along the strip

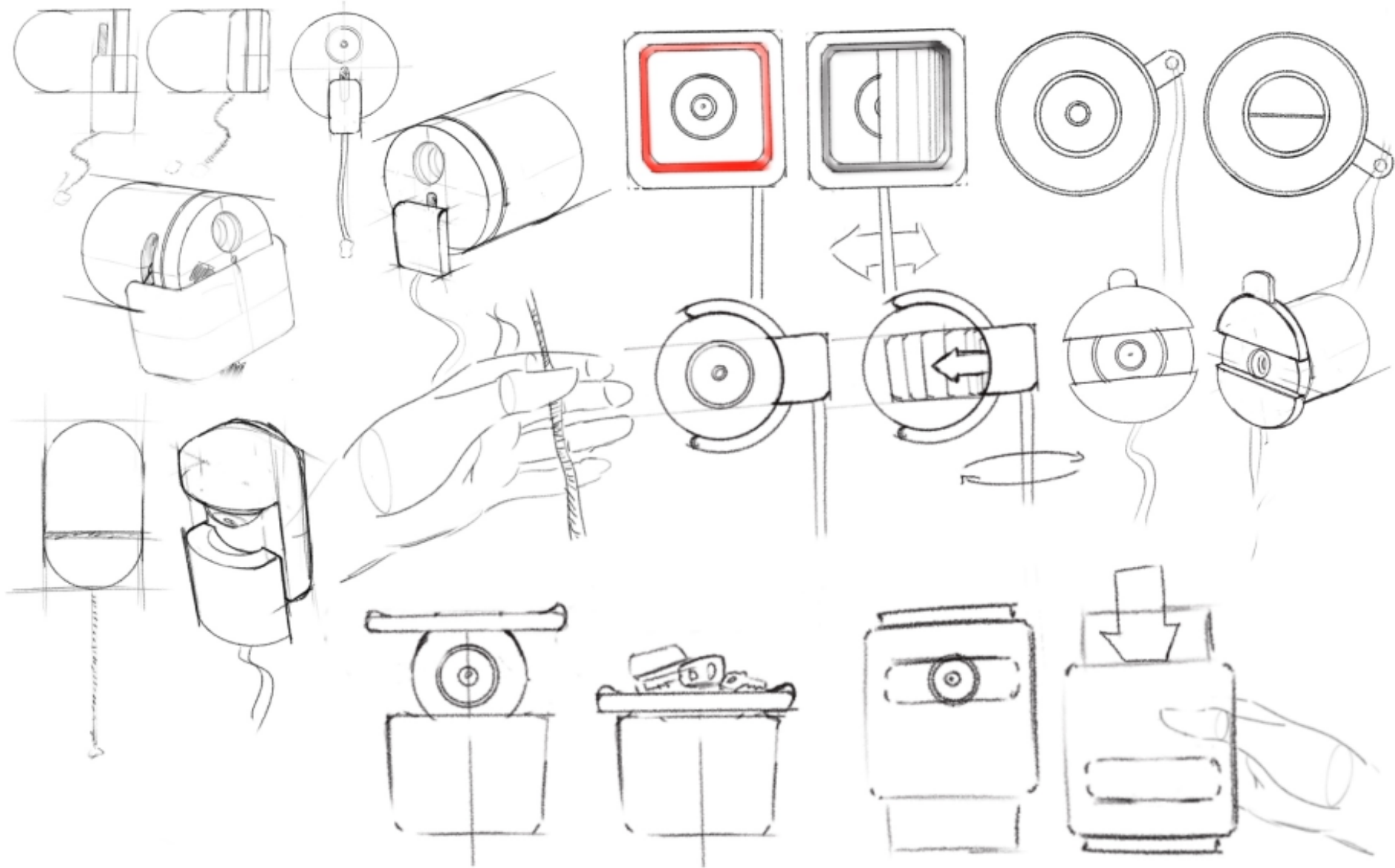
**Implementation**  
 \*rotary actuated  
 \*center-drive motor would create bulk in front of camera or on top, might be difficult to implement with altering existing camera hardware layout

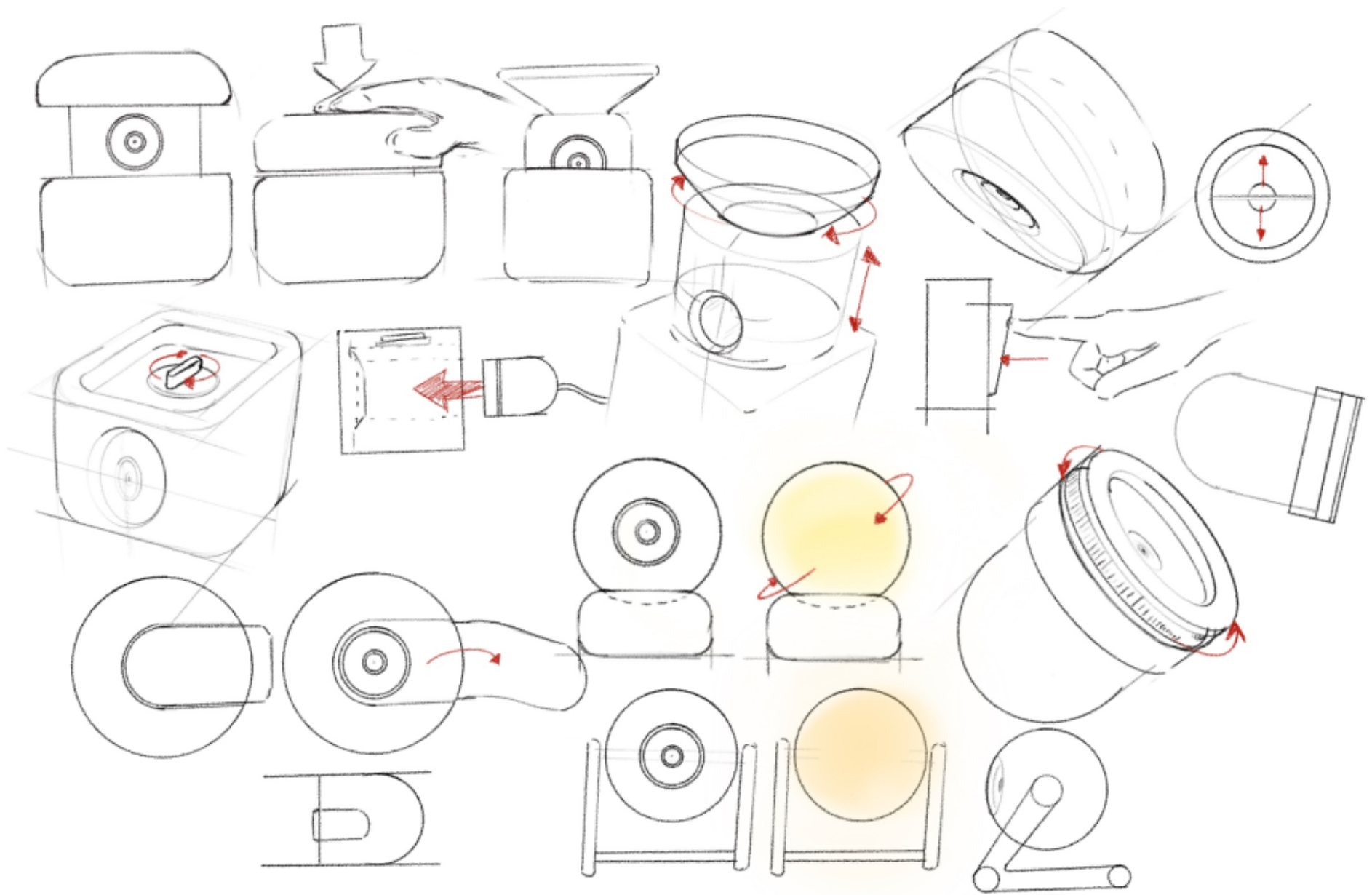
**Aesthetics and Visibility**  
 \*closed/open status could be highly visible with contrasting materials  
 \*cam lens AND rotor cover cannot be centrally aligned without added bulk to device

**Other**  
 \*Could allow for multi-state state attenuation by placing multiple transparency states along the wheel

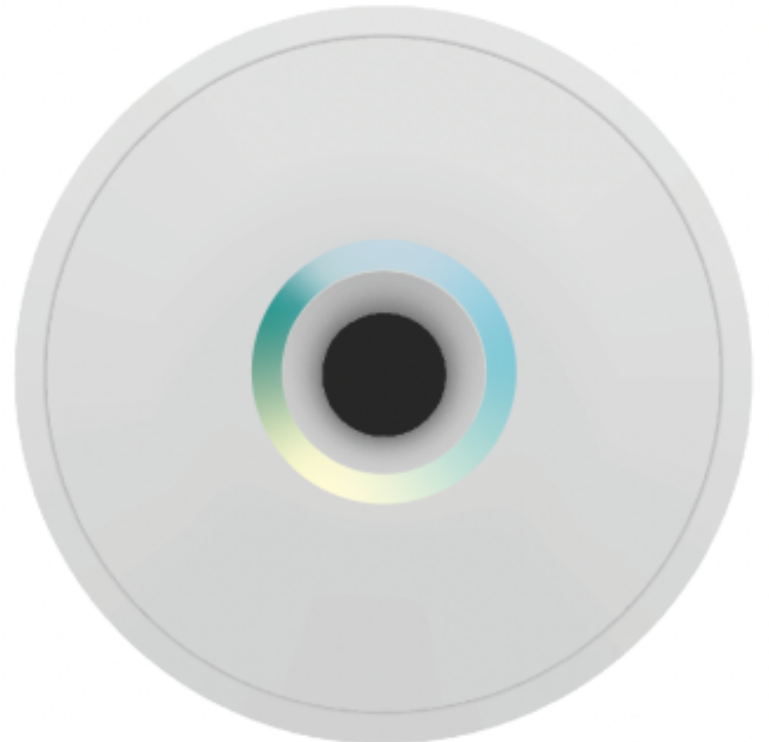
**Implementation**  
 \*rotary actuated (or linear?)  
 \*seems unnecessarily complex because entire camera unit must move, but, might make sense for a PNT (pan and tilt) smart home camera

**Aesthetics and Visibility**  
 \*closed/open status is highly visible, even without contrasting materials because the entire camera lens unit moves and get hidden  
 \*unique eyelid movement  
 \*very anthropomorphic (possibly in a safe, inviting way)

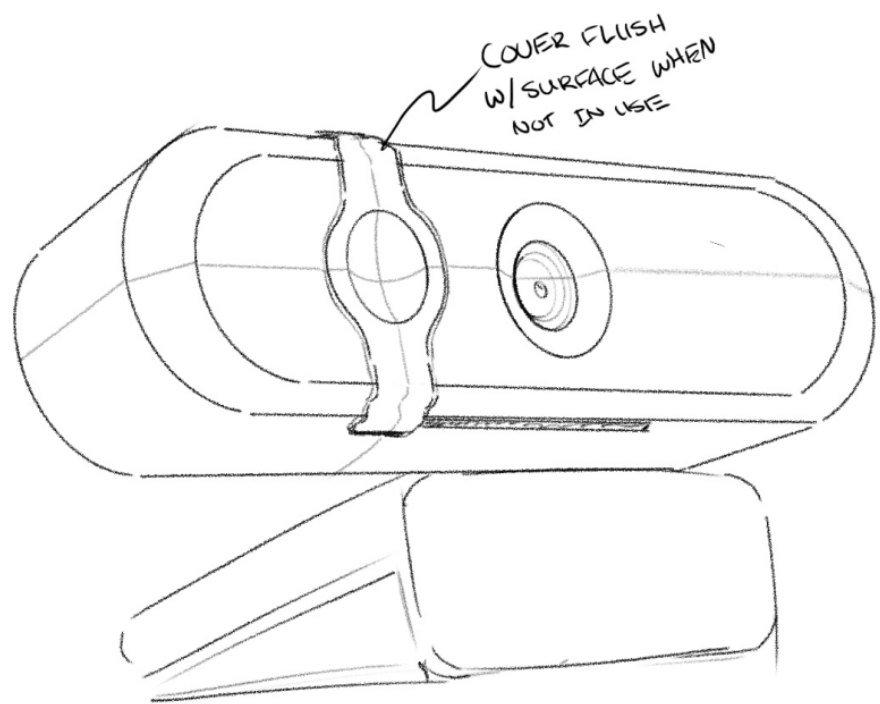


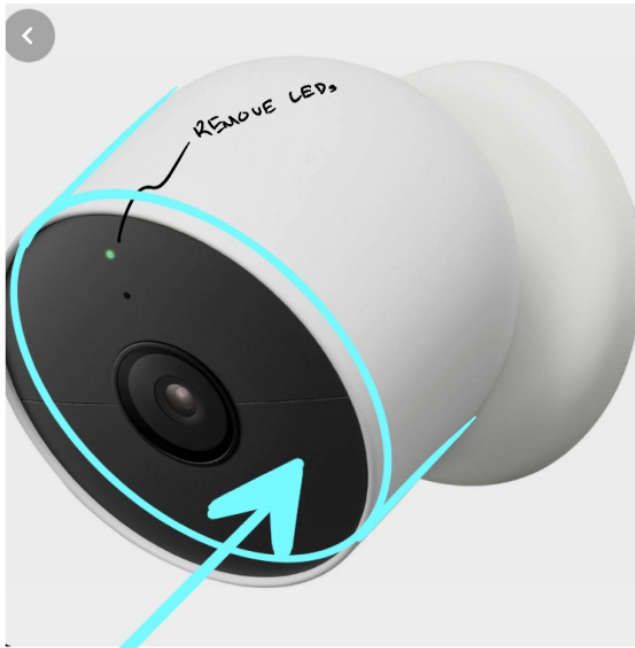






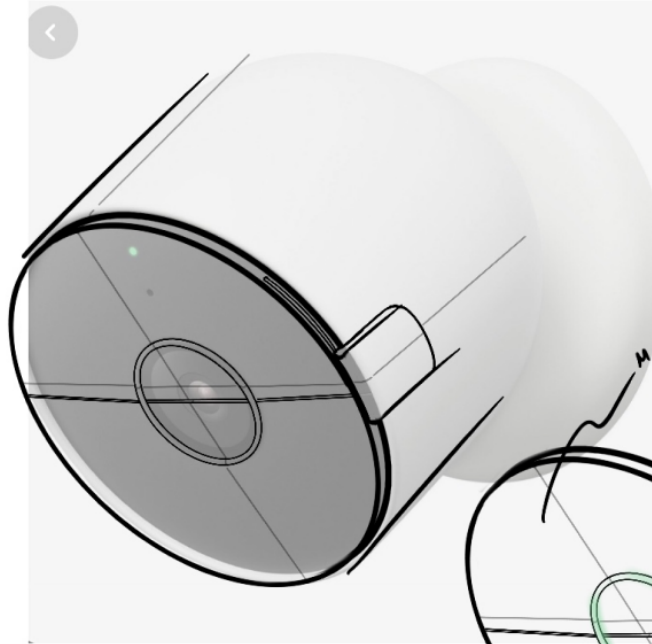
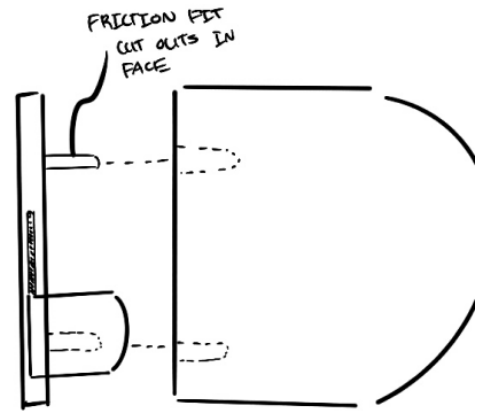






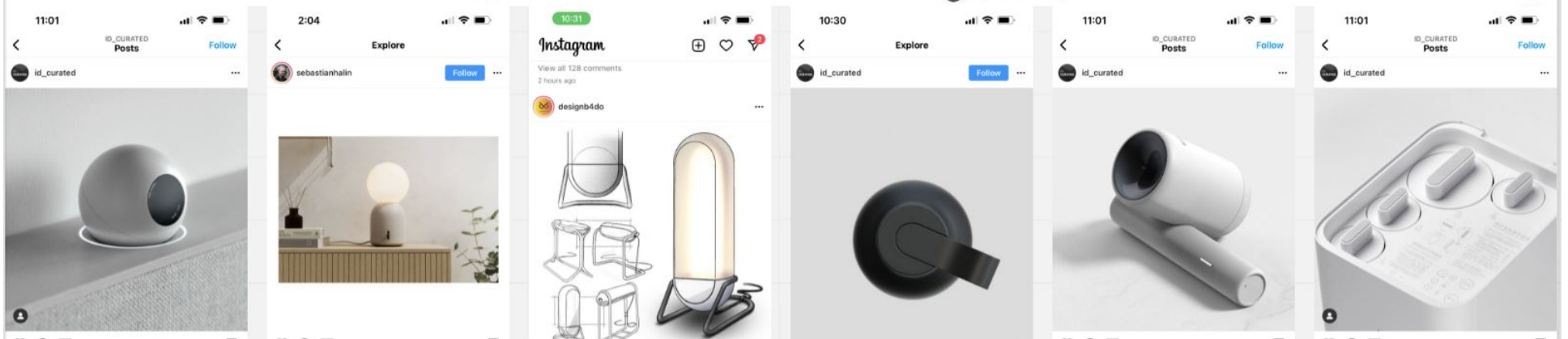
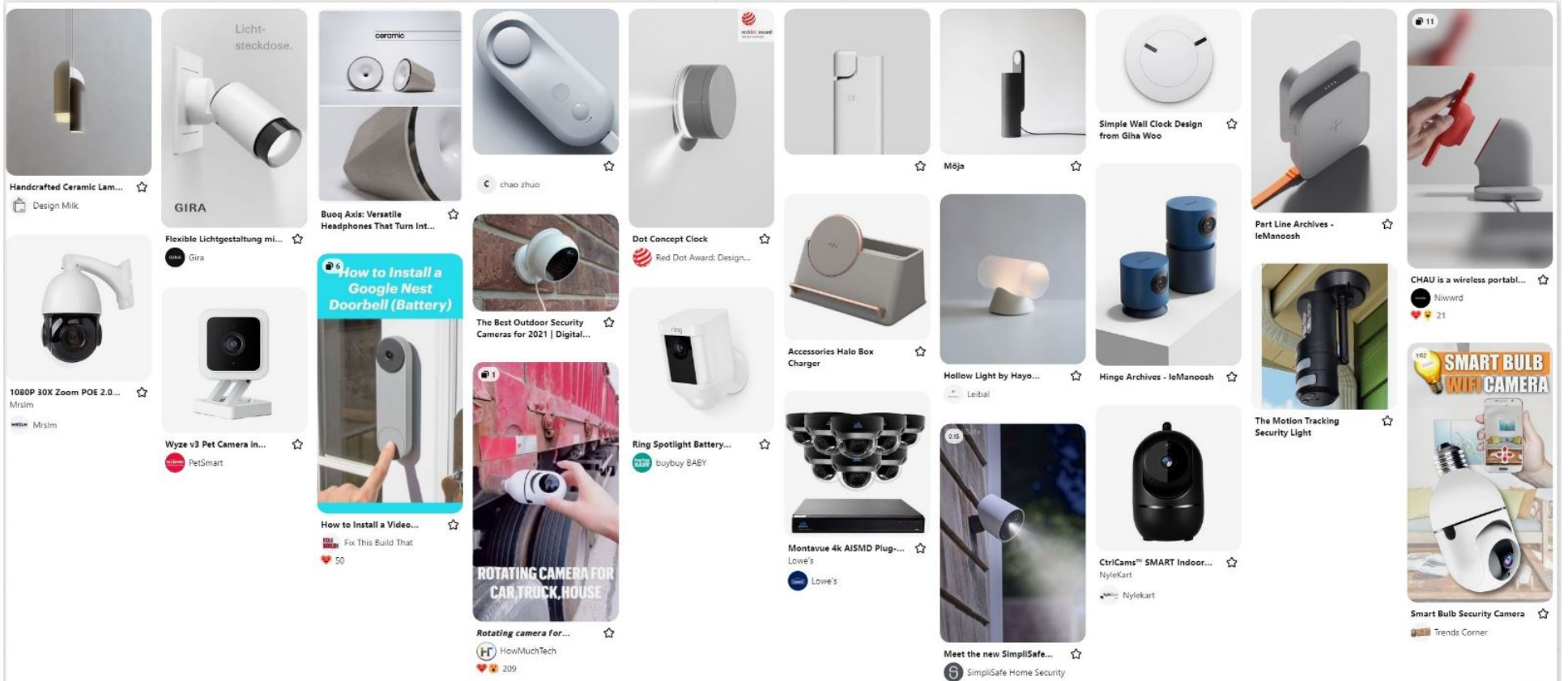
PUSH FACE INWARD  
FOR NEW CAMERA DESIGN  
(AS IF NEST IS MAKING  
NEW VERSION W/ INTEGRATED  
PRIVACY SHIELD)

PROBABLY NEEDS TO BE  
THICKER THAN SHOWN

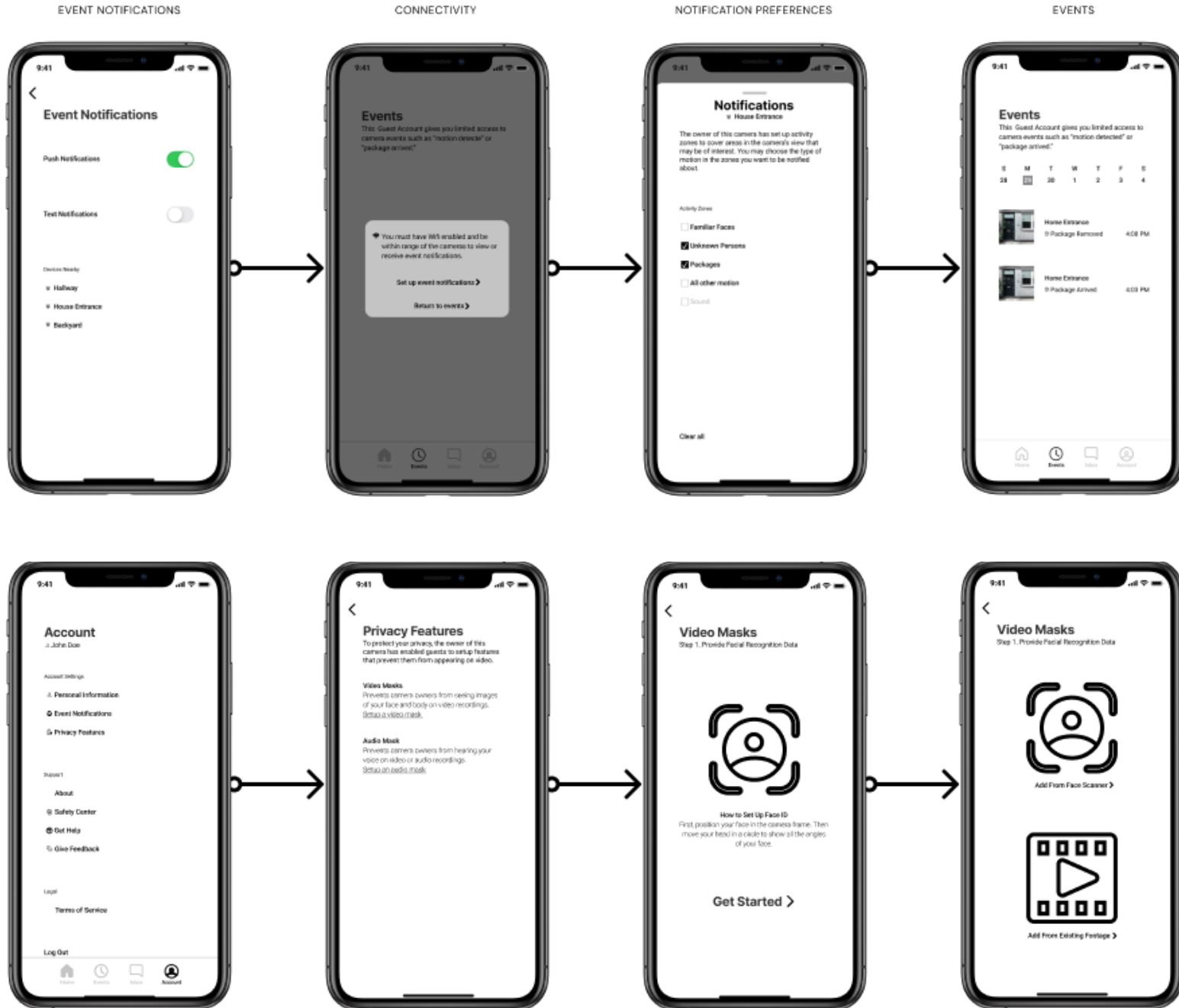


INTEGRATE LED INTO  
NEW COVER

MAGNETIC TO THE  
FACE OF CAM

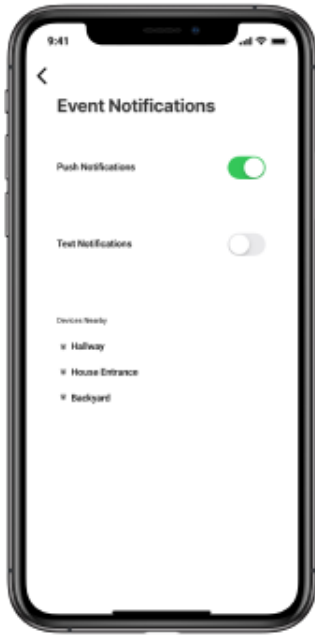


GUEST USER FLOW CONT.



GUEST USER FLOW CONT.

EVENT NOTIFICATIONS



CONNECTIVITY



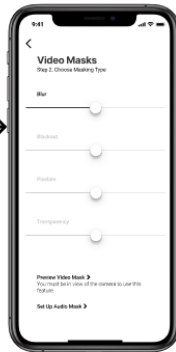
NOTIFICATION PREFERENCES



EVENTS

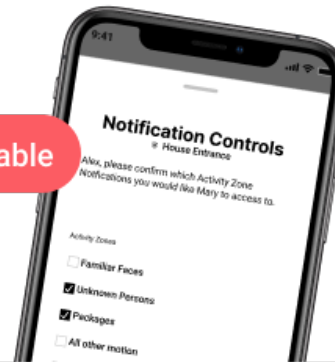


OWNER USER FLOW



Hey Alex, this is Mary. I love your Oregon property, and want to stay there from May 1st to July 1st if that works with you.

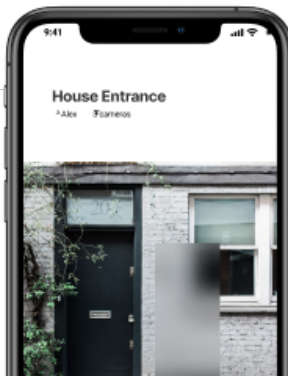
★ Available



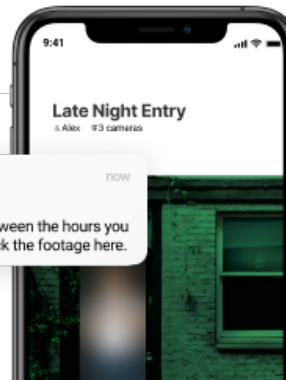
Alex receives a notification that Mary is interested in renting his Airbnb property from May 1st to July 1st.

Seeing that the property has availability, he accepts her request. He selects the type of controls and notifications he wishes Mary to have.

After confirming, he receives a code for Mary to use with the app that is active from May 1st to July 1st. He sends it to Mary.



APP NAME  
Late Night Entry  
We detected a property entry between the hours you have wished to be notified. Check the footage here.

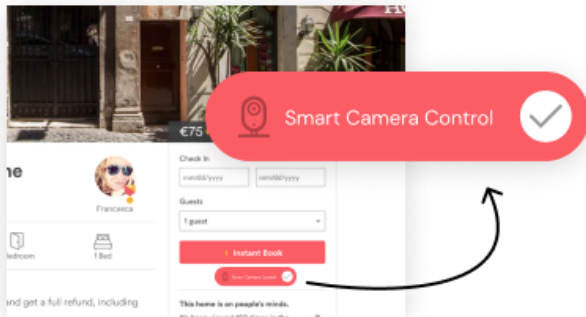


Hey Mary, yeah no worries! I will be out there with an electrician Monday if that works? See you then.

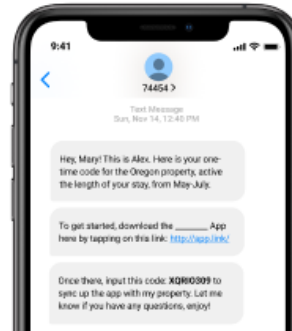
Once Mary has checked-in, he later in the week does his routine check of the property through the cameras. He notices that Mary has activated body blur.

So, when late in the night he is alerted of a property entry, he is not alarmed because he sees the body is blurred and knows Mary is just getting home late.

The next week, Alex notices that another one of the property's cameras is not functioning. Mary messages him about it as well. He makes a plan with her to come check it out.



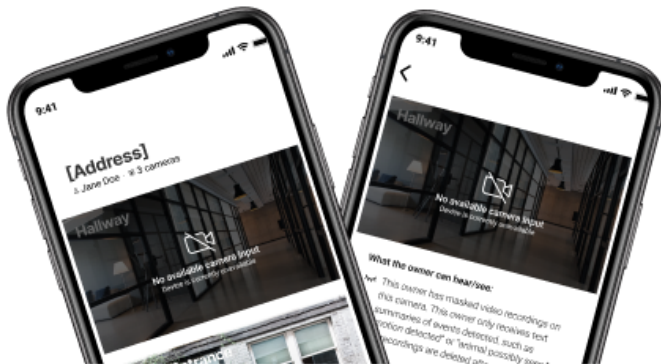
Mary is looking for an Airbnb for her extended stay in Oregon. She finds Alex's listing, and is delighted to see the \_\_\_ tag, indicating the property has smart camera monitoring where she can control her privacy.



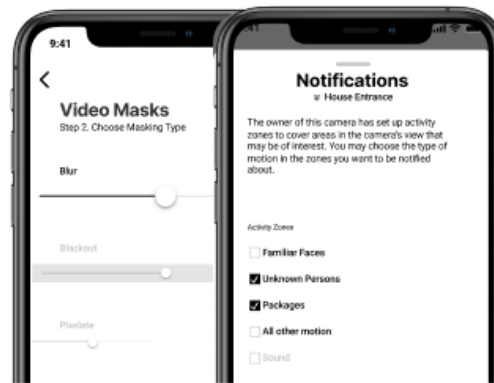
After Alex accepts her stay request through Airbnb, he sends her a one-time use code for the \_\_ app.



She enters the code into her app, and sees she now has privacy control for the length of stay indicated on Airbnb.



She notices that Alex has granted her control over viewing camera footage, seeing which cameras are inactive, and receiving package notifications.



She sets her preferred privacy settings, and becomes excited to start her stay.



Once there, she messages Alex through the app, as she notices another security camera is no longer functioning. She hopes he can fix it.

**SIMPLIFIED DESIGN  
PROPOSALS  
(FOR PARTICIPANTS)**  
Complete Set



# 1

---

## Closed Mode

Closed Mode is a privacy feature that's integrated into a smart home camera.

## 1.1

### DEFINING CLOSED MODE

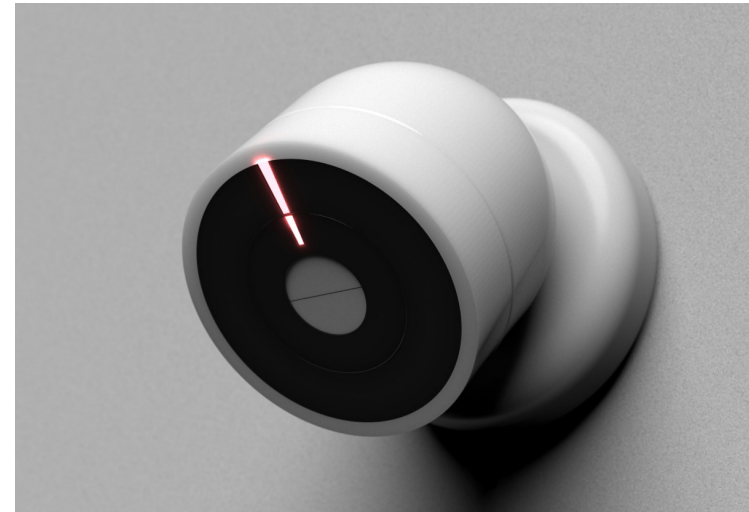
Closed Mode shows people nearby that the camera is not actively capturing video.

A lenslid closes over the camera lens. The lenslid is like a remote controlled webcam cover.

Indicators provide additional light and sound feedback.



**Figure 1.1 :** Open = on.



**Figure 1.2 :** Closed = off.

## 1.2

### ACTIVATION METHODS

There are three ways of activating closed mode:

- I. Press a button on the app to remotely close the camera.
- II. Automatically trigger closed mode (e.g., when it detects a member of the household).
- III. Owner-enabled Option: Twist the camera to manually close it. (see *figure 1.3*)



**Figure 1.3** : Manual twist activation.

## 1.3

### ADVANCED CONTROLS

#### Still Sensing Reminders

When the presence of a new person is detected, the camera subtly “wakes up” with an auditory chirp and visual flicker of light. This functions as an unobtrusive, timely reminder that the camera is on and prompts the user to turn it off if privacy is required.

#### Closing Rules

Owners can configure Closed Mode to automatically activate when certain events are detected, such as nudity or specific faces (e.g., the babysitter).

#### No-Sense Zones

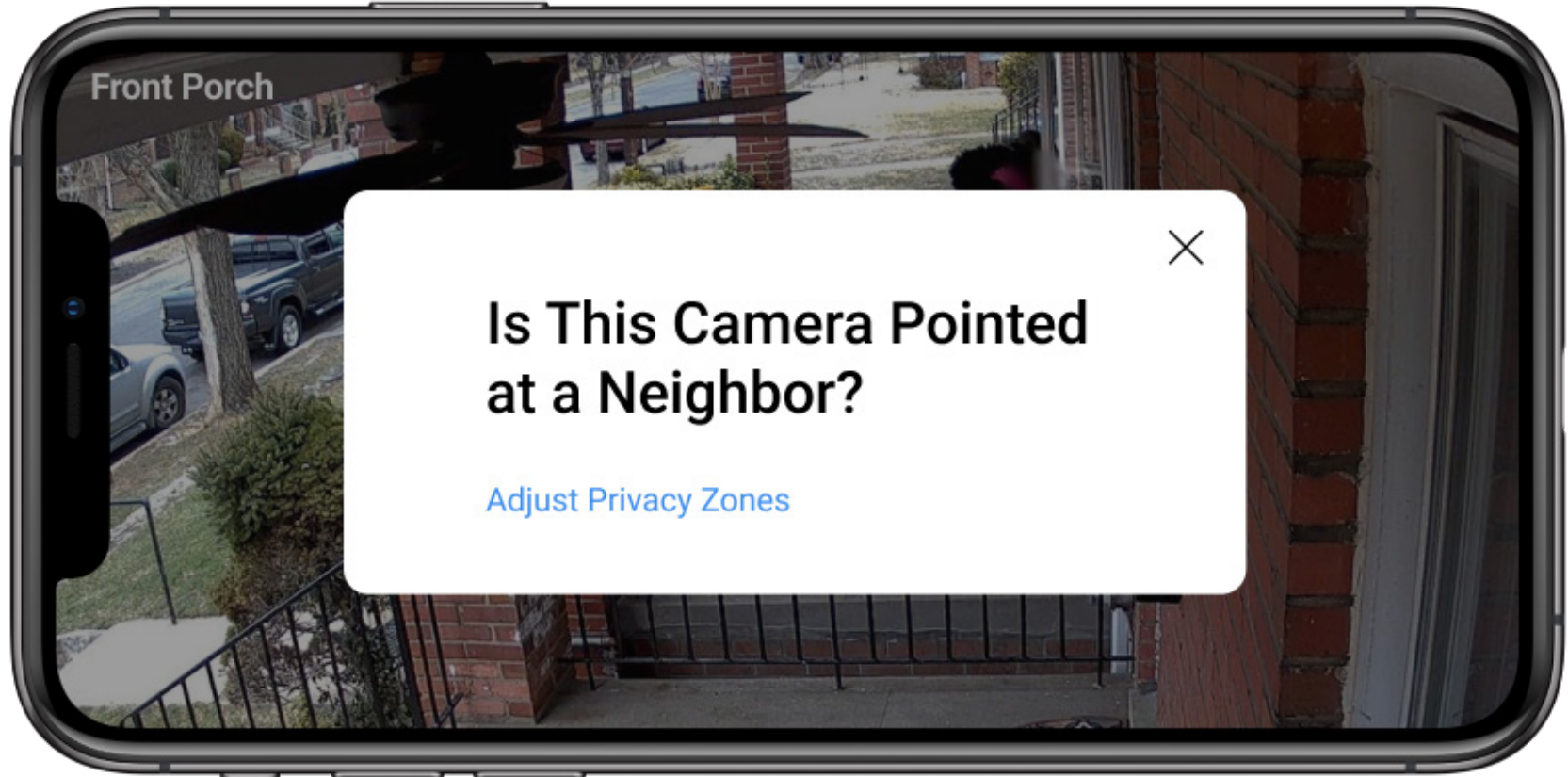
Owners can configure virtual perimeters, referred to as No-Sense Zones, around areas where the camera isn't allowed (i.e. areas where privacy is expected such as bedrooms and bathrooms.) No-Sense Zones automatically activate Closed Mode.

# 2

---

## Neighborly Settings

Neighborly Settings help camera users practice the Golden Rule—treat others as one wants to be treated—by blocking views of their neighbor’s property (e.g., windows and doorways).



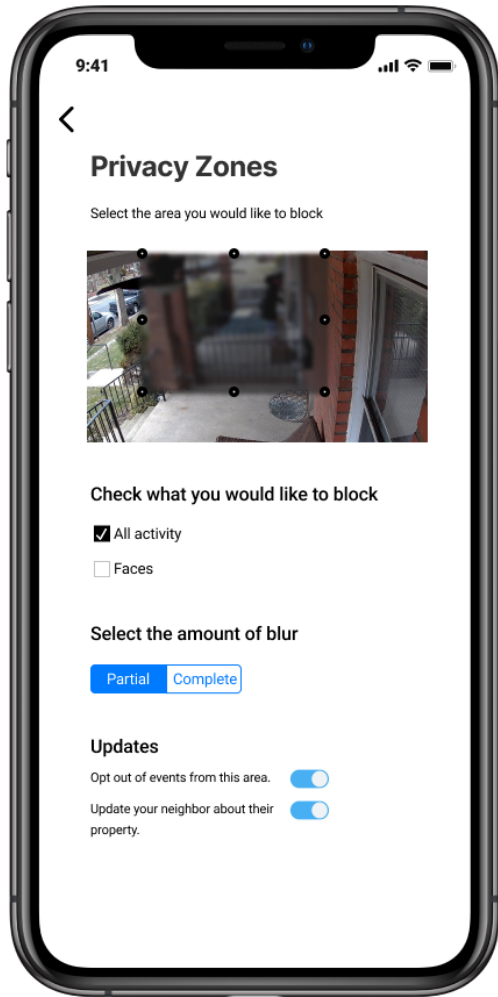
Front Porch

**Is This Camera Pointed  
at a Neighbor?**

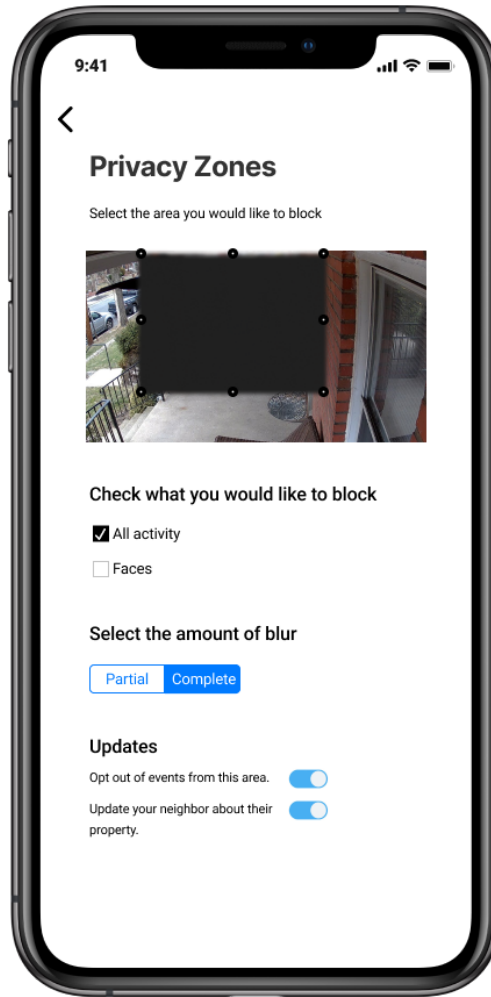


[Adjust Privacy Zones](#)

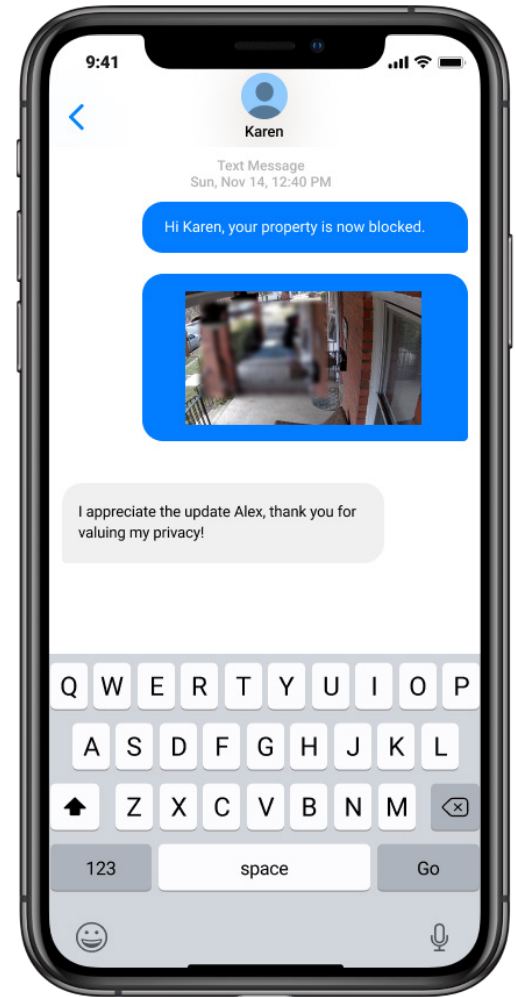
## 2.1 FEATURES



**Figure 2.1 :** Partially blur your neighbor's property.



**Figure 2.2 :** Fully block your neighbor's property.



**Figure 2.3 :** Show them you are a good neighbor.

# 3

---

## Nearby Cameras

Nearby Cameras is a smartphone application that sends notifications when a nearby smart camera or microphone is detected.




### 3.1 USE CASES

#### Visiting Someone's Home

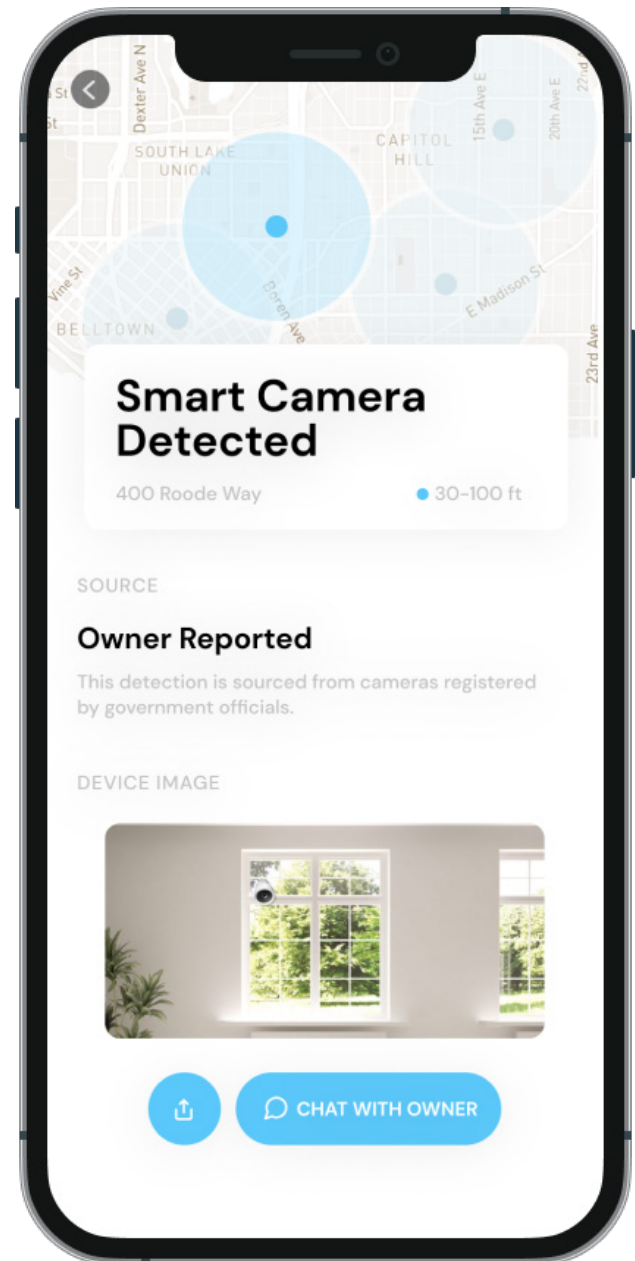
Indoor home camera detected.



 NEARBY CAMERAS now

**Smart Camera Detected**

Your device has detected a smart camera or microphone nearby. Open for details.

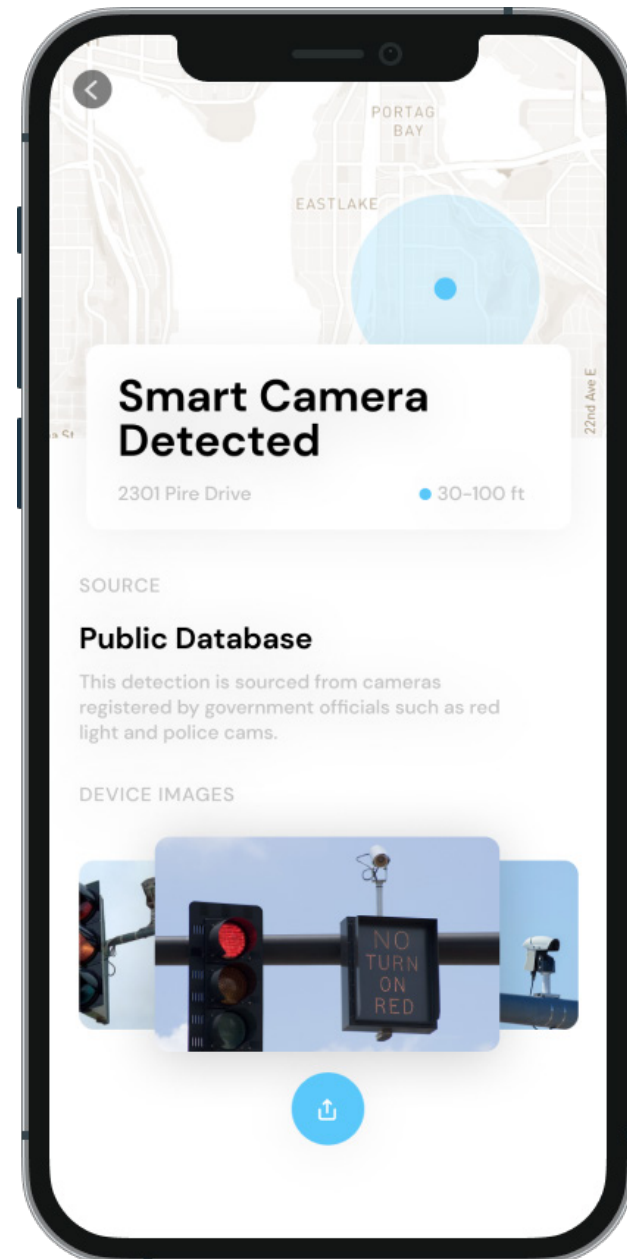
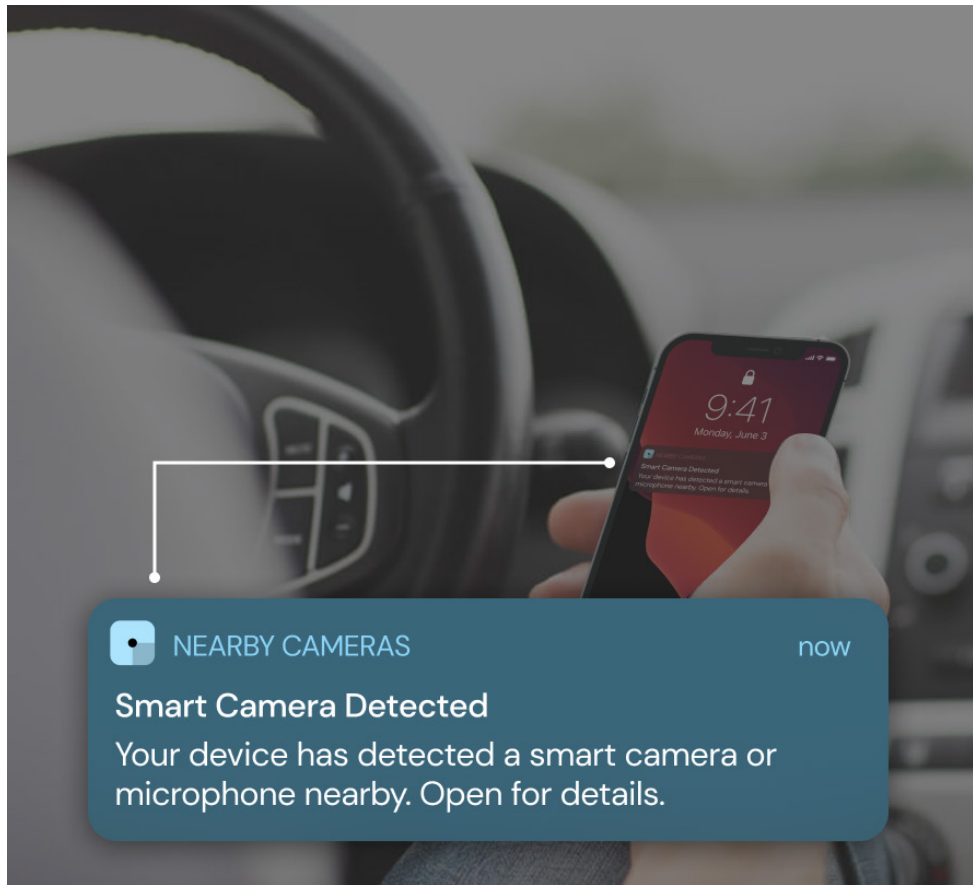


### 3.1

## USE CASES (Cont.)

### Driving Around

Police camera detected.

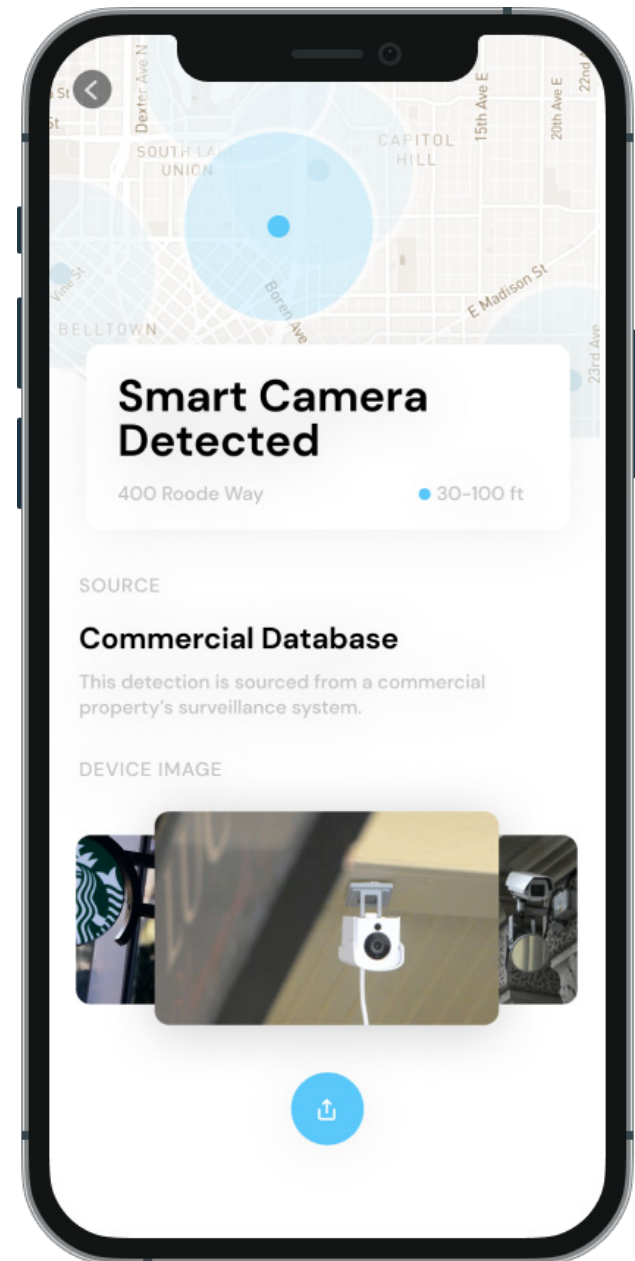
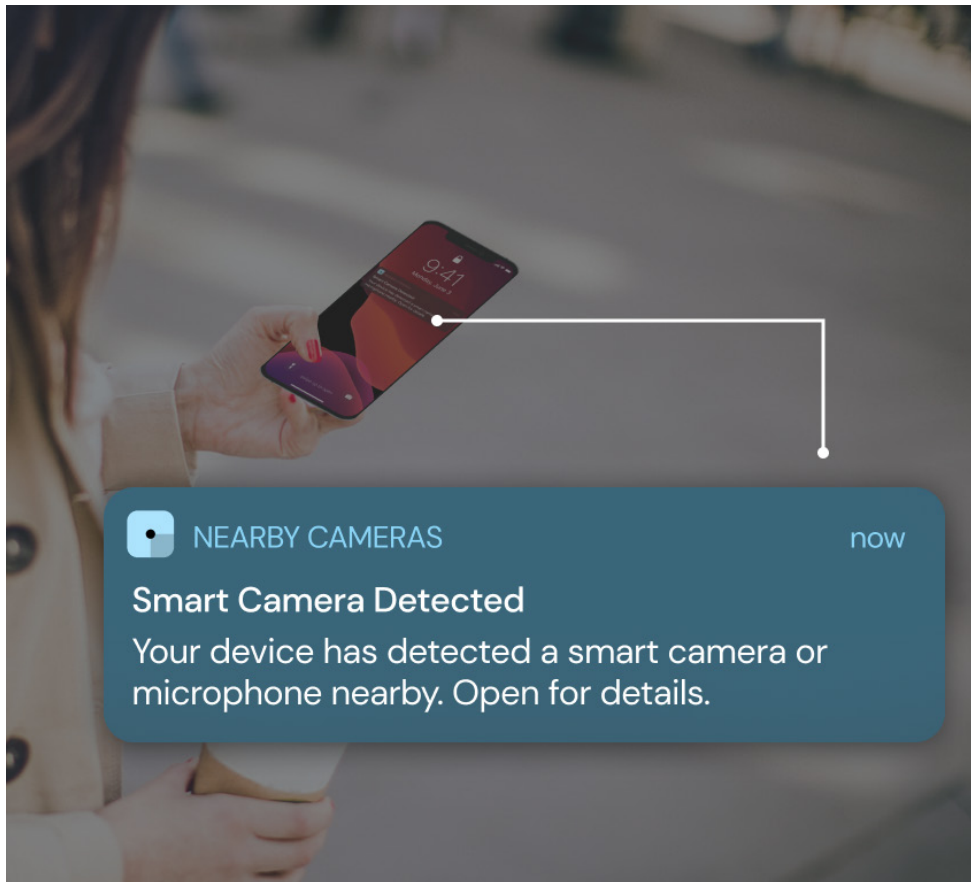


### 3.1

## USE CASES (Cont.)

### Walking Around

Store camera detected.

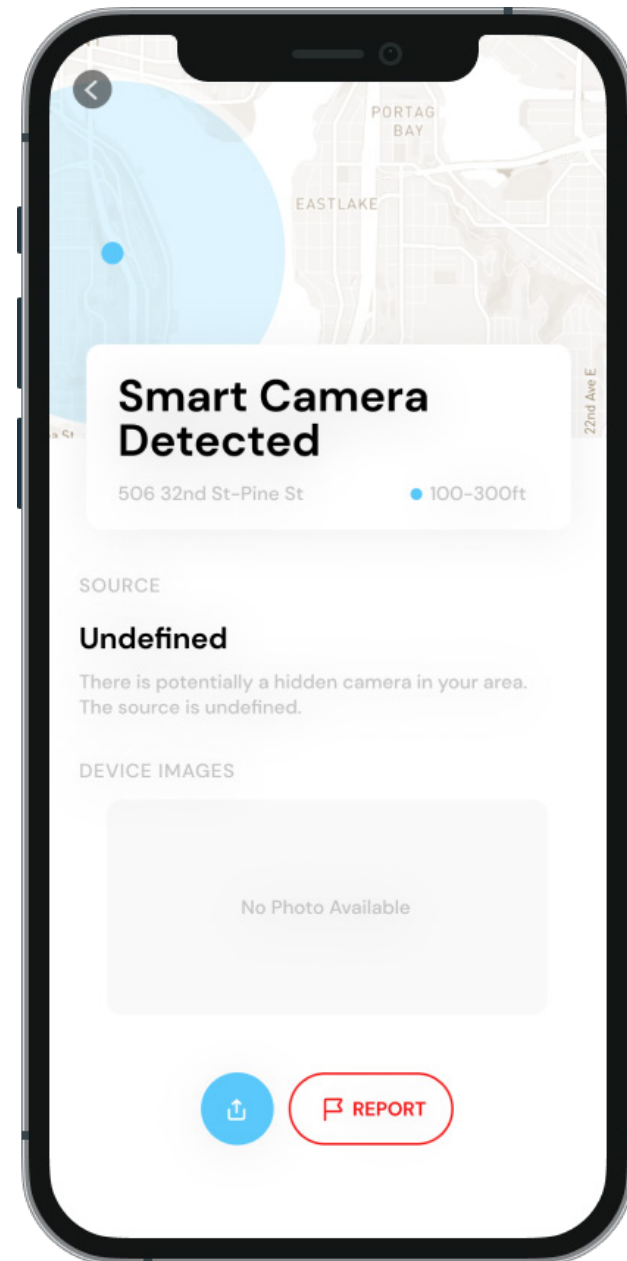
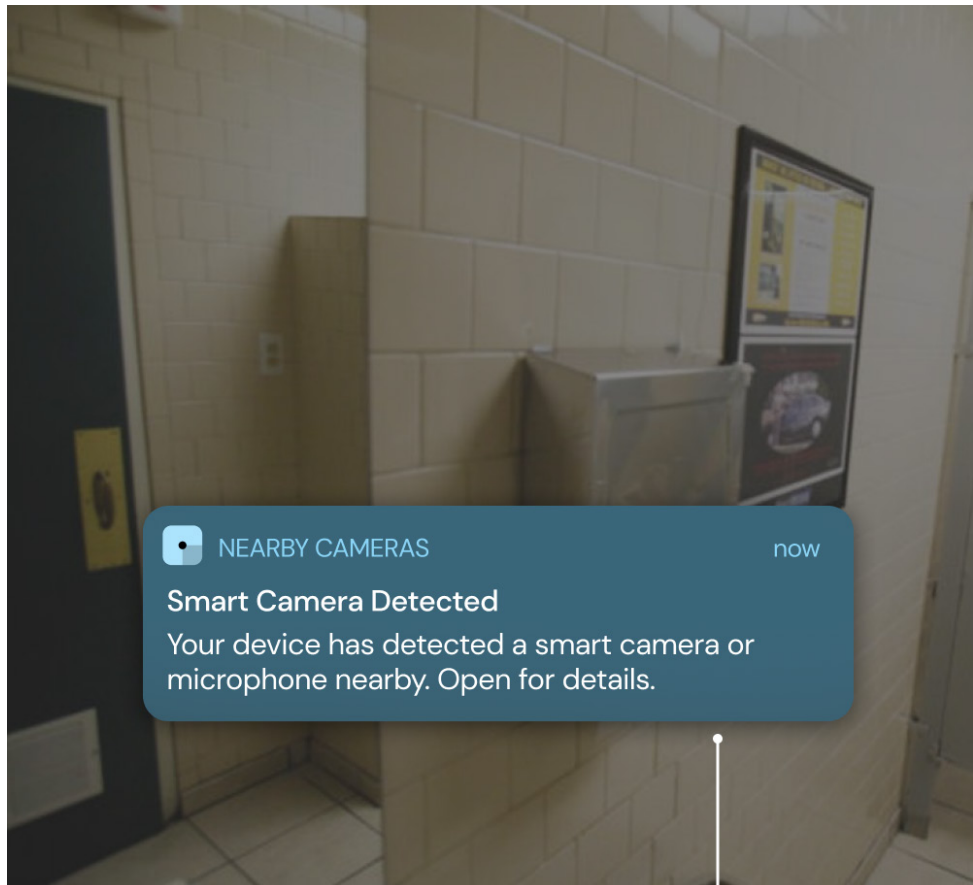


### 3.1

## USE CASES (Cont.)

### Private Spaces

Possible hidden camera detected.



# 4

---

## Do Not Facetrack Me

Do Not Facetrack is a setting that allows people to require that their faces are automatically blurred on other people's surveillance cameras.

## 4.1

### HOW IT WORKS

As a person approaches a camera, this feature will immediately blur out and distort the individual's face in the footage (see *figure 4.1*). Individuals use this feature to make sure that their identities are protected and unrecognized by a camera system. Individuals manually enable this feature on their own smart devices in order to blur out their faces for future encounters with smart cameras.



**Figure 4.1:** Tablet and mobile views of Do Not Facetrack Me.

# 5

---

## Guest Access

Guest Access is a smart home security camera feature that enables owners to give others partial access and control of their cameras to improve guest's privacy, trust, and experience.

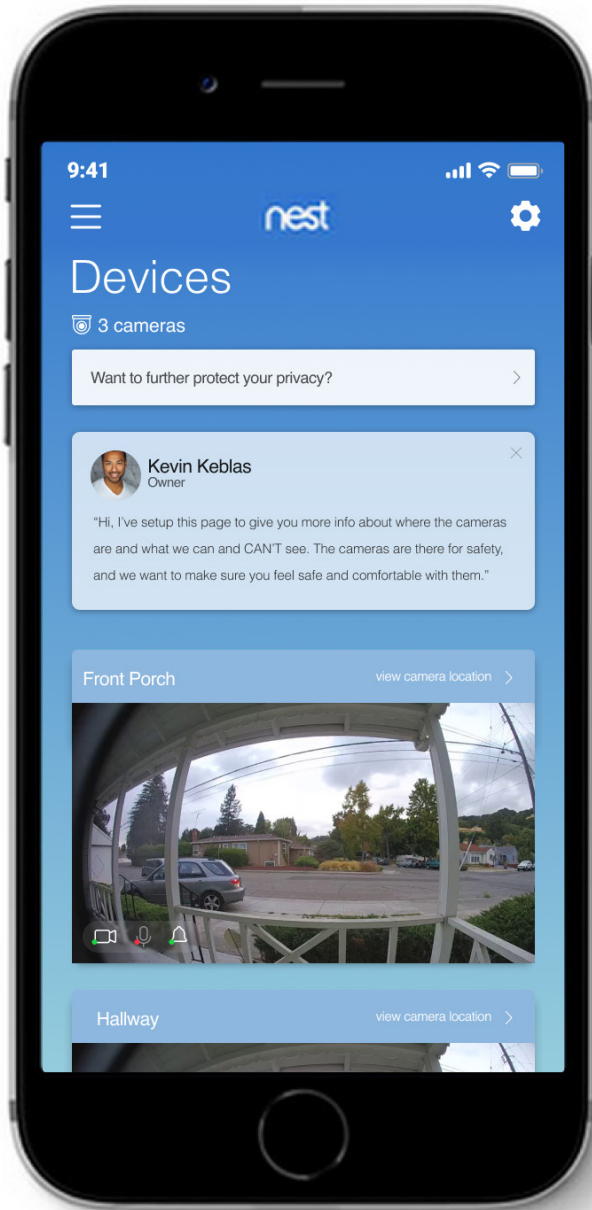


Figure 5.1 : Personal notes from camera owner.

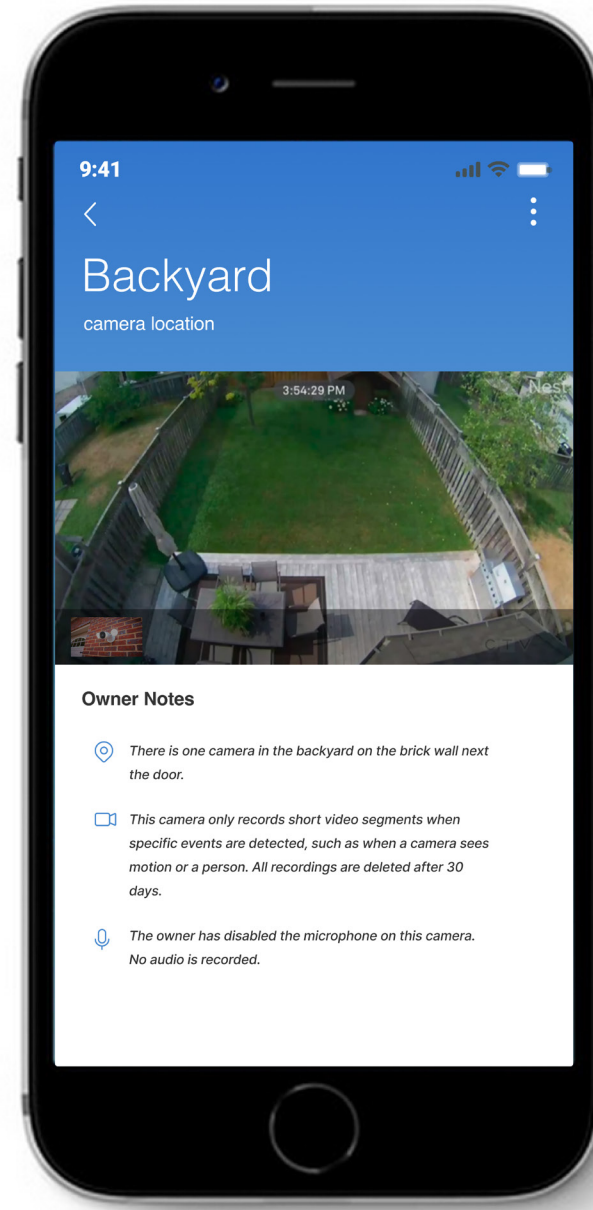


Figure 5.2 : Status and location of cameras.



## 5.1

### OWNER SETTINGS

#### Guest Permissions

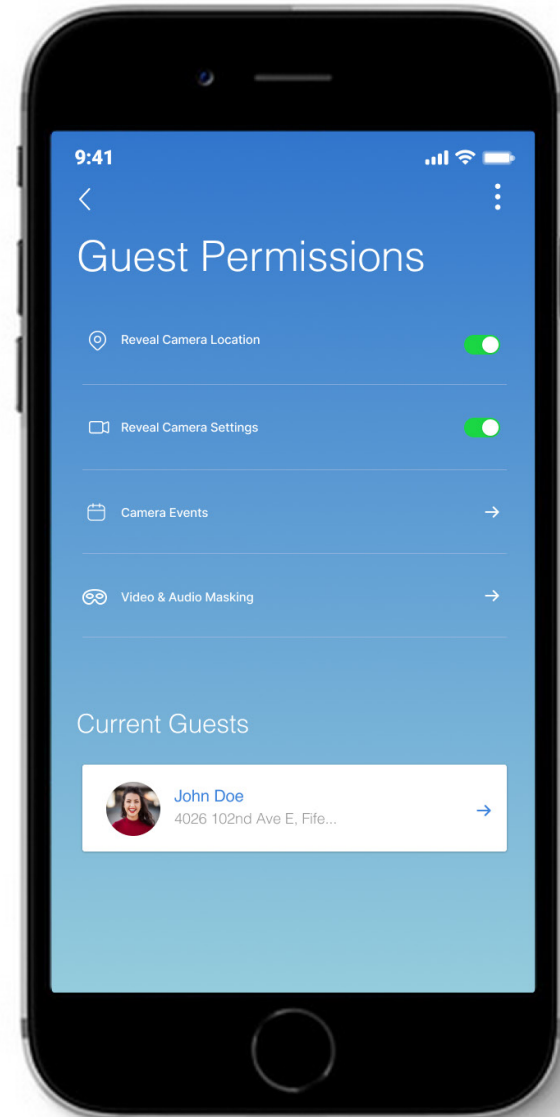
Owners decide what each invited guest can access and when their access expires. (see *figure 5.3*)

#### Guest Notifications

If enabled, guests can opt-in to receive event notifications (e.g., alerts when their packages have arrived or someone is at the door). (see *figure 5.4*)

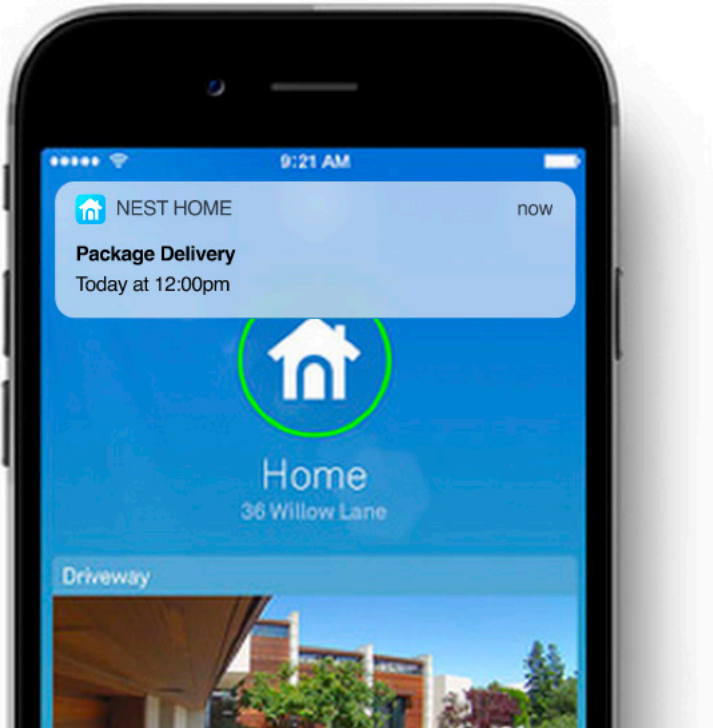
#### Video and Audio Masks

If enabled, guests can setup video and audio masks to block their faces and voices from appearing on the owner's camera view. (see *figure 5.5*)

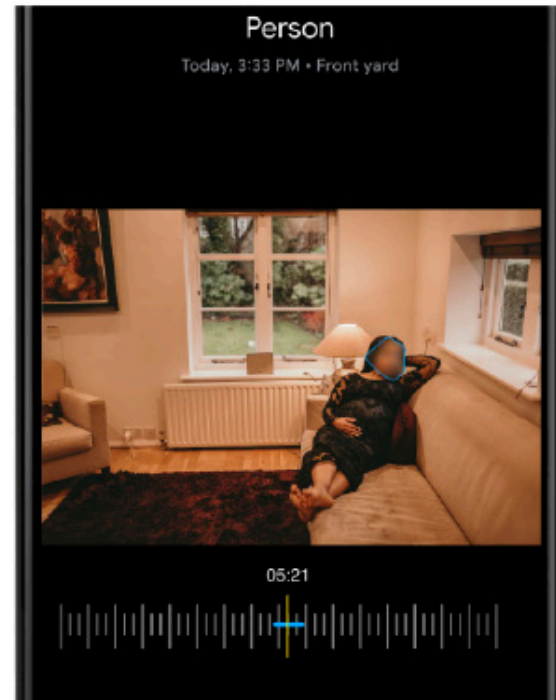


**Figure 5.3** : Guest permissions.

## 5.1 OWNER SETTINGS (Cont.)



**Figure 5.4 :** Guest notifications.



**Figure 5.5 :** Video and audio masks.

# 6

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## Webcam Failsafe Filters

Webcam Failsafe Filters allow a user to automatically block distracting, embarrassing, or sensitive activity from entering into the frame of a video call.

## 6.1

### DEFINING WEBCAM FAILSAFE FILTERS

Webcam Failsafe Filters automatically block activity you don't want in the background of your Zoom or Skype call. This feature allows clear and simple controls so users can easily toggle to a private, failsafe mode (e.g., during an important work call) and then turn it off to the default mode in less formal settings (e.g., when talking to a family member). (see *figures 6.1 and 6.2*)

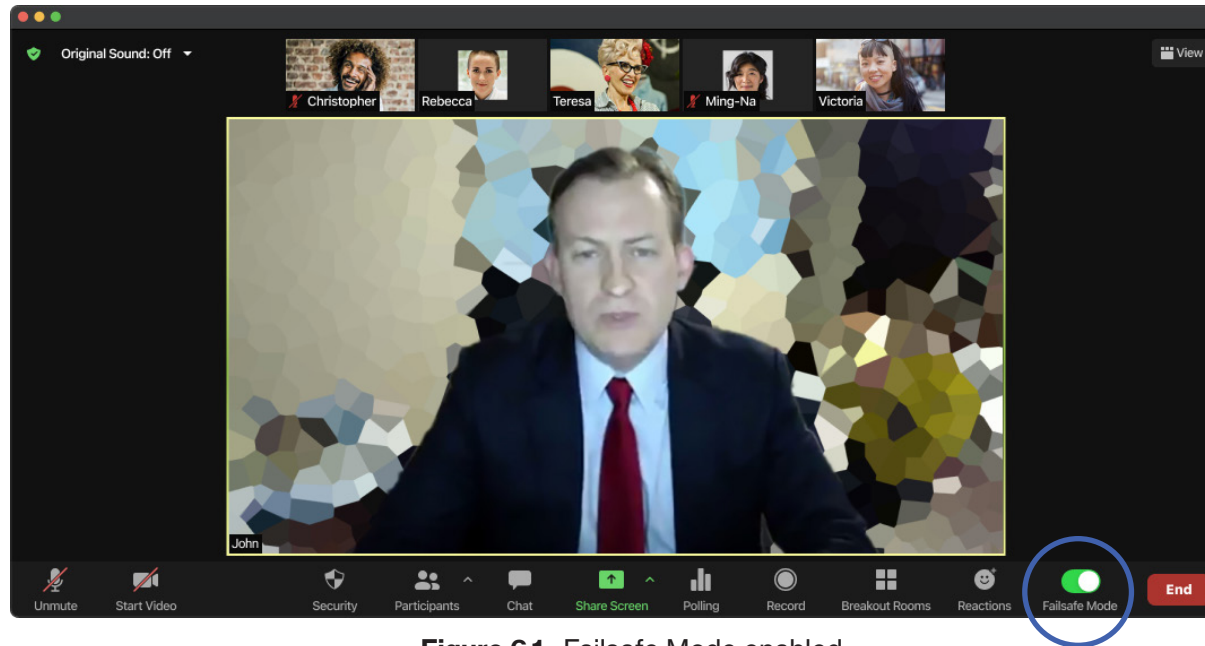


Figure 6.1 : Failsafe Mode enabled.



Figure 6.2 : Without Failsafe Mode enabled.

## 6.2

### USE CASES

#### Mildly Embarrassing Events (see figure 6.3)

- + Partner doing something in the background.
- + Kids fighting.
- + Screen is reflected in the window behind you.

#### Catastrophic Events (see figure 6.4)

- + Accidental nudity.
- + Camera mistakenly left on in private areas e.g., bathroom.
- + Accidentally screenshare inappropriate content.



Figure 6.3 : Partner doing something in the background.



(© Yakobchuk Olena - stock.adobe.com)

COVID-19, SOCIAL MEDIA, SOCIETY & CULTURE, WORKPLACE

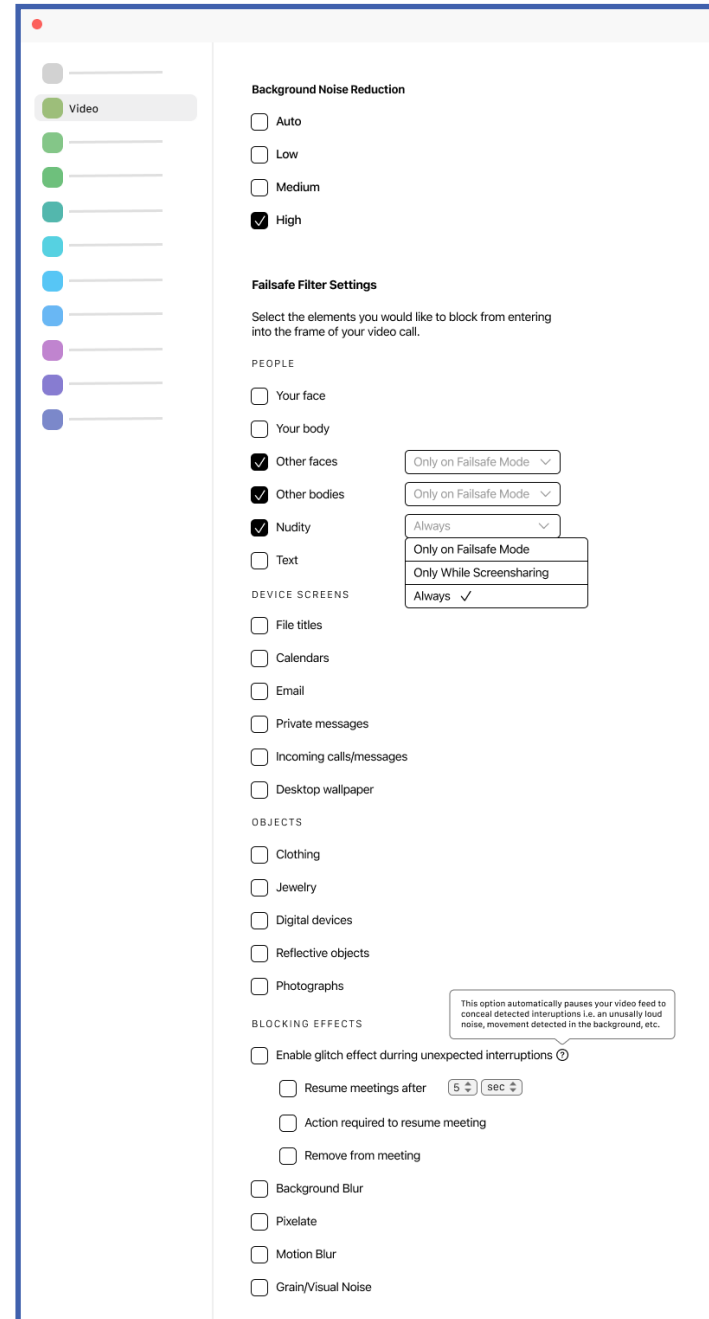
**Bathroom business: 1 in 6 participating in work conference calls from the toilet!**

Figure 6.4 : Camera mistakenly left on in bathroom.

## 6.3 SETTINGS

You can select a range of events to block, including “other people,” “reflective objects,” “other device screens,” and “other faces.”

You can also select the type of Blocking Effect, including “blur,” “pixelate,” or “glitch.”  
(see figure 6.5)



**Figure 6.5 :** Webcam Filter setting options.

## 6.4 GLITCH EFFECT

The Glitch Effect setting blocks unwanted events by resembling a poor Internet connection.

Serious disruptions, such as extreme yelling or nudity, are blocked by resembling a disrupted Internet connection. (see *figure 6.6*)

Shorter and less serious disruptions, such as a person walking into the frame and speaking, are represented as momentary losses in connectivity. (see *figure 6.7*)

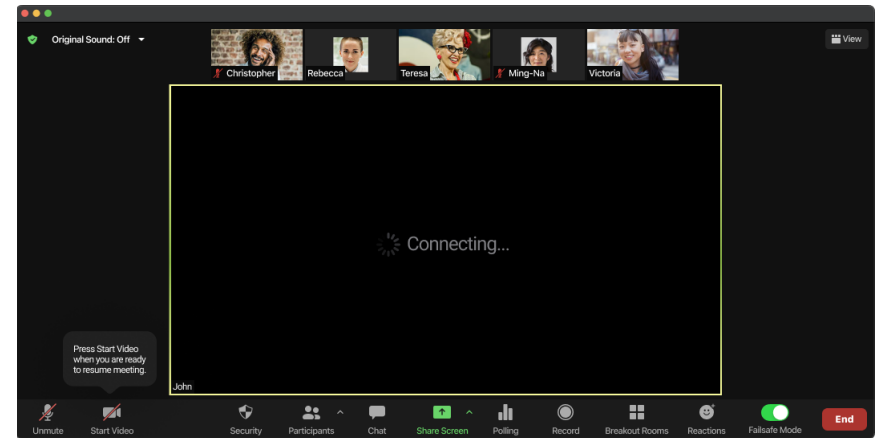


Figure 6.6 : Intentional connection error filter.

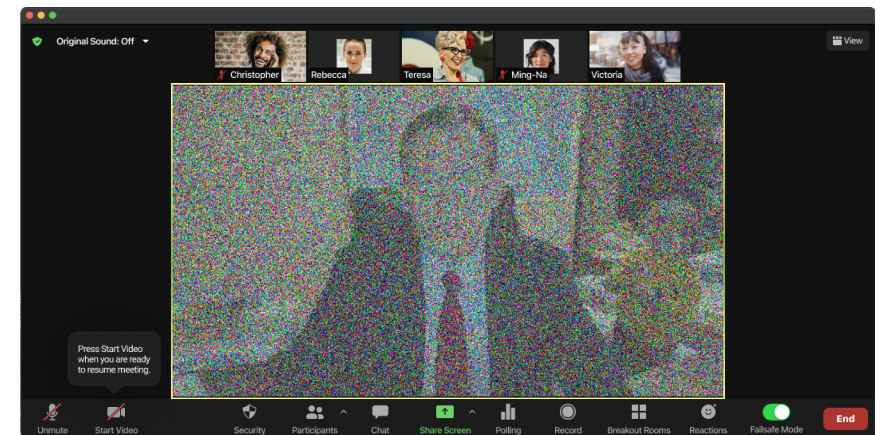


Figure 6.7 : Pixelated filter resembling momentary connectivity loss.



# 7

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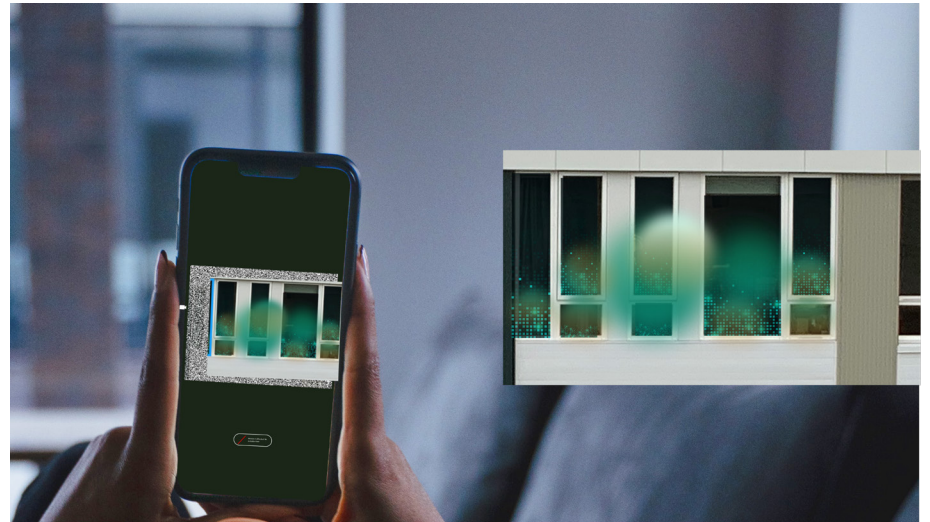
## Camera Shields

Camera Shields is a standalone device that a user places near their window to block cameras from peering inside.

## 7.1

### HOW IT WORKS

The device uses special lights that are invisible to the naked eye, but confuse digital camera sensors to create a blurry distorted image. (see figures 7.1 and 7.2)



**Figure 7.1 :** Neighbor's view of your property through their camera app.



**Figure 7.2 :** Neighbor's view of your property visible to the naked eye.

## 7.2

### ADDITIONAL FEATURES

#### Shield Styles

After initiating the anti-surveillance window, users can select their preferred window display. (see figure 7.3)

#### Hidden Messages

Users can also enter a message that is only viewable to people photographing or video surveilling their window. (see figure 7.4)



Figure 7.3 : Window display options.



Figure 7.4 : Hidden messages.

# **DISCUSSION GUIDE**

Semi-Structure Interview  
Protocol for Concept  
Evaluation Study

# Research Questions (RQs)

## **RQ1 - Are our design concepts promising as solutions?**

How do participants react to each concept? Positively or negatively? Do they find it useful or not? Relevant? Why or why not? Do they seem useful? Usable? Appropriate? Ethical?

## **RQ2 - What do participants think about smart cameras, privacy, and surveillance? What do they think about relationships, tensions, and power imbalances among different users and stakeholders?**

More generally, what are participants preferences, attitudes, values, and experiences with regard to smart home cameras, privacy, and power dynamics?

## **RQ3 - How effective are our design materials in eliciting values and prompting reflection?**

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## **Discussion Guide:**

### **Concept Evaluation and Nearby User Privacy Study**

#### **Introduction**

Hi I'm \_\_\_\_\_.

Thank you for meeting with me today, I am excited to hear about you and your perspectives and experiences with smart home cameras [or \_\_\_\_].

This interview will last 60-90 minutes, and you will be compensated \$50 for this interview.

Before we start the interview, I also want to remind you to please only share information you're comfortable with sharing. If you feel like you don't want to answer a question, let me know and we can move on. You can also let me know if you want to end the interview at any time or ask me questions anytime.

Is it ok to record this interview? This recording will only be shared with the research team, and you will be given a pseudonym when we review your responses.

#### **Warm-up (~5 minutes)**

Tell me a bit about yourself. Where are you from, work/occupation...

What is your experience with smart home/ smart home tech?

Do you own or use any of these products: [list]

Can you tell me a bit about your home and living situation?

Who is part of your home? How long have you lived here?

Who interacts with your home? (Examples can include care workers (childcare), cleaners, delivery drivers, etc.)

### **Profile Specific Questions (~5-10 minutes)**

[here is where we add some specific questions pertaining to the user's roles and experiences, e.g., pet sitter, smart cam enthusiast and power user, uber driver, etc.]

### **Design Concept**

Ok, next I'd like to show you some ideas for new products or features that might.

We refer to each of these as a design concept.

What are your initial reactions to this design concept?

Would *you personally* have a use for this or not? Why or why not? When and where? Example?

> Make sure to understand what role they are imagining themselves in, e.g., owner or bystander).

In your experience as a \_\_\_\_\_, what do you think about this design concept?

Try to imagine a scenario where you might actually use or interact with this concept, either as a user/owner, or as a bystander or someone nearby (guest, etc.). Try to think of something relevant to your own life situation. Can you describe this scenario, and explain how this design concept would be useful or not? I'm trying to understand more concretely how you think this idea might be beneficial or not beneficial to you personally.

[Go through each concept]

*Closed Mode*

*Nearby Cameras*

*Webcam Failsafe Filters*

Guest Account

Neighborly Settings

Do Not Facetrack Me

Camera Shields

## **Debrief**

[This is a period to ask questions about specific themes or issues.]

Do you have any ideas or recommendations about how to improve our designs?

Other problems or issues you've experienced that you'd like to see addressed?

Or other issues that you think might benefit from better privacy controls or other features?

## Possible Topics

- Tradeoffs between primary user and bystanders
- Privacy paradox (people say they want more privacy, but they don't act in accordance)
  
- Cameras everywhere (ubiquitous and normal).
  - What do you think about this situation?
  - Are they useful?
  - How concerned are you about privacy? How the data they collect is used?
  - Do you trust the companies that offer these products and services?
  
- Specific Contexts/Roles (As a pet sitter, as a parent, etc., can you talk more about....)

## **Conclusion**

Those are all the questions I had for this interview. Thank you for your time in talking to me! I learned a lot from our conversations today. Are there any questions you have for me, or thoughts about home cameras you'd like to share?

As you know, you'll be compensated \$50 for your time today. I'll be sending your information to our financial department for an e-gift card, though processing may take a couple of days (especially if this is on the weekend). If you have not received your payment within one week, please let me know.

Lastly, I wanted to ask if it would be ok to reach out to you for future conversations if we determine that there are things we need to follow up on. If there are things that warrant another interview, you'll be compensated at the same rate. Does that sound ok?

Before we close off, do you have any other questions for me about the logistics?  
That's it from me - thank you so much for your time today!