

Designing an Informative and Usable Security and Privacy Label for IoT Devices

Pardis Emami-Naeini

Assistant Professor
Computer Science Department at Duke University



Toilets Are Getting Smarter and More Invasive

This \$7,000 smart toilet has built-in speakers, mood lighting and Amazon Alexa voice controls

PUBLISHED TUE, JAN 8 2019 7:25 PM EST UPDATED TUE, JAN 8 2019 7:25 PM EST



Andrew Evers
@ANDEVERSG



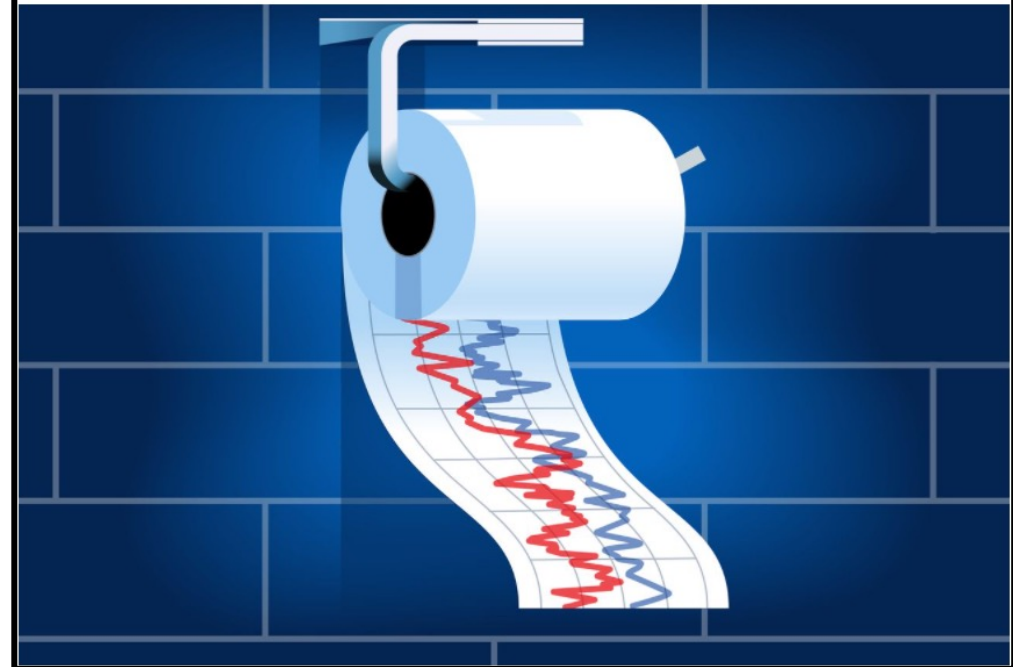
Erin Black

SHARE



SMARTWATCHES TRACK OUR HEALTH. SMART TOILETS AREN'T TOO FAR BEHIND.

Commodities that measure vital signs, screen for chronic illnesses and might even diagnose Covid-19 are in the works



People Are **Concerned** About Their Privacy and Security

People say they care about privacy but they continue to buy devices that can spy on them

Experts explain why people are giving mixed signals about smart tech.

By Rani Molla | @ranimolla | May 13, 2019, 5:40pm EDT



 Help Net Security
October 14, 2019

Share    

Consumers concerned about connected home privacy, still few implement safety practices

Smart devices spark privacy concerns among consumers: study



Sibile Marcellus
Reporter

Yahoo Finance December 14, 2018



Information Is **Not Available** at the Point of Sale



Echo Dot (3rd Gen) - Smart speaker with Alexa - Charcoal
by Amazon
★★★★☆ 29,879 customer reviews | 1000+ answered questions
Amazon's Choice for "alexa"

Get the Best Deal

List Price: \$49.99
With Deal: **\$29.99** & **FREE Shipping**. Details
You Save: \$20.00 (40%)

In Stock.
Want it Friday, May 3? Order within **1 hr 59 mins** and choose **Two-Day Shipping** at checkout. Details
Ships from and sold by Amazon Digital Services LLC. Gift-wrap available.

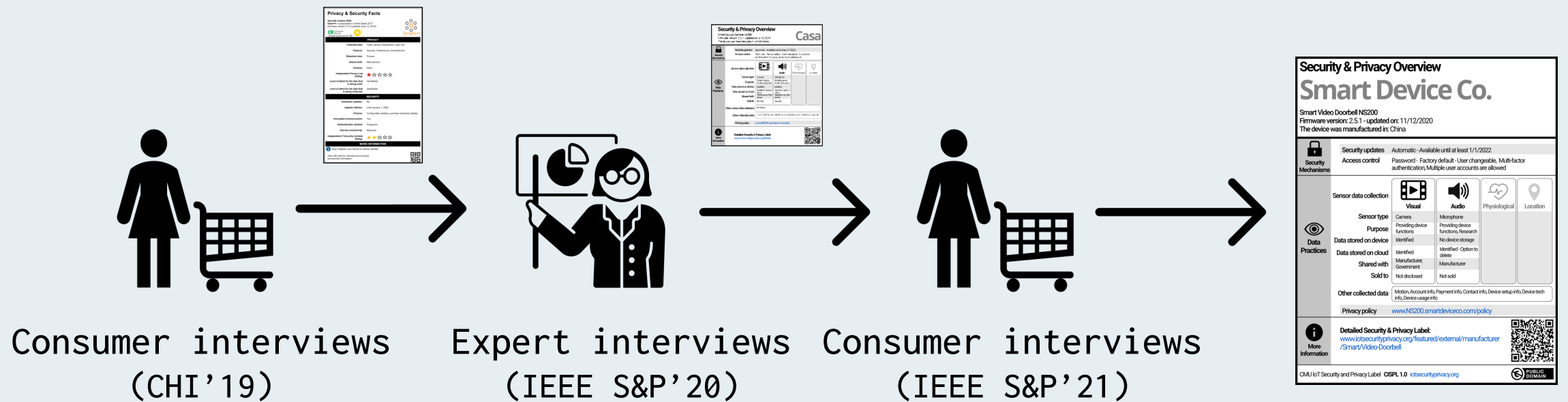
Color: Charcoal

Configuration: **Echo Dot**
 Echo Dot With \$15 TP-Link Smart Plug With \$20 Smart Lighting Kit

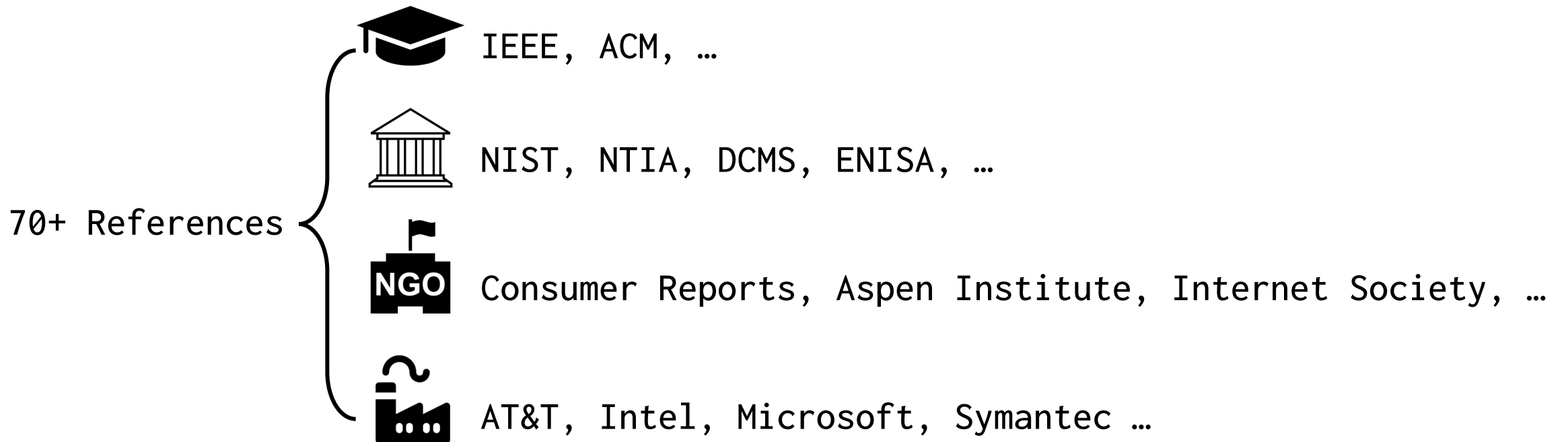
- Our most popular smart speaker - Now with a fabric design and improved speaker for richer and louder sound.
- Voice control your music - Stream songs from Amazon Music, Apple Music, Spotify, Sirius XM, and others. You can also listen to audiobooks from Audible.
- Bigger, better sound - Pair with a second Echo Dot (3rd gen) for rich, stereo sound. Fill your home with music with compatible Echo devices in different rooms.
- Ready to help - Ask Alexa to play music, answer questions, read the news, check the weather, set alarms, control compatible smart home devices, and more.
- Connect with others - Call almost anyone hands-free. Instantly drop in on other rooms in your home or make an announcement to every room with a compatible Echo device.
- Use another speaker - Connect to your own speakers over Bluetooth or with a 3.5 mm audio cable.
- Alexa has skills - With 50,000+ skills, Alexa is always getting smarter and adding new skills like tracking fitness, playing games, and more.
- Voice control your smart home - Turn on lights, adjust thermostats, lock doors, and more with compatible connected devices

Jump to: Compare devices | Technical details
Used & new (2) from \$26.39 & FREE shipping. Details

We Took a **Multi-Step** Path to Label Design



We Conducted an Extensive Literature Review



We Designed the **First Version** of Our IoT Label

General information

Privacy information

Security information

General information

Privacy & Security Facts

Security Camera S200
Smart++, incorporated in United States 2017
Firmware version 3.1.6 (updated June 12, 2018)

CR Consumer Reports
Overall score out of 100 **55**

Smart++

PRIVACY

Collected data: Video, device configuration, login info

Purpose: Security, maintenance, advertisement

Retention time: Forever

Shared with: Manufacturer

Choices: None

Independent Privacy Lab Rating: ★☆☆☆☆

Level of detail for the data that is being used: Identifiable

Level of detail for the data that is being collected: Identifiable

SECURITY

Automatic updates: No

Updates lifetime: Until January 1, 2020

Choices: Configurable updates, purchase extended updates

Encrypted communication: Yes

Authentication method: Fingerprint

Internet connectivity: Required

Independent IT Security Institute Rating: ★★☆☆☆

MORE INFORMATION

i Tip(s): Register your device to receive updates

Scan QR code for manufacturer's privacy and security information

Participants Were **Interested** in Having IoT Labels



Almost all wanted to know about and were willing to pay a premium for privacy and security information at the time of purchase.

“

As opposed to those long policy documents that you usually need to read, I think this is a very efficient way and I cannot think of a better way than this.



Legislations Mentioned IoT Labels with No Specifics

“Cyber Shield Act” Calling for IoT Device Certification Reintroduced in Congress

By Micaela McMurrough, Jayne Ponder & Julia Oksasoglu on March 26, 2021

Executive Order on Improving the Nation’s Cybersecurity

MAY 12, 2021 • PRESIDENTIAL ACTIONS

UK government proposes mandatory 'security' labels for smart devices

By Sharmishta Sarkar April 30, 2019

So consumers can make an informed decision

Singapore Launches IoT Cybersecurity Labelling

Labels Will Indicate What Security Standards Products Meet

Jeremy Kirk (🐦jeremy_kirk) · October 16, 2020

Finland launches cybersecurity label for IoT devices

Catherine Chapman 27 November 2019 at 12:20 UTC

Updated: 18 May 2021 at 08:33 UTC

We Asked **22** Privacy and Security **Experts**



Faculty member in the field of privacy and security



10+ years of research or practice in privacy, security, or policy



Author of notable books in the field of privacy and security

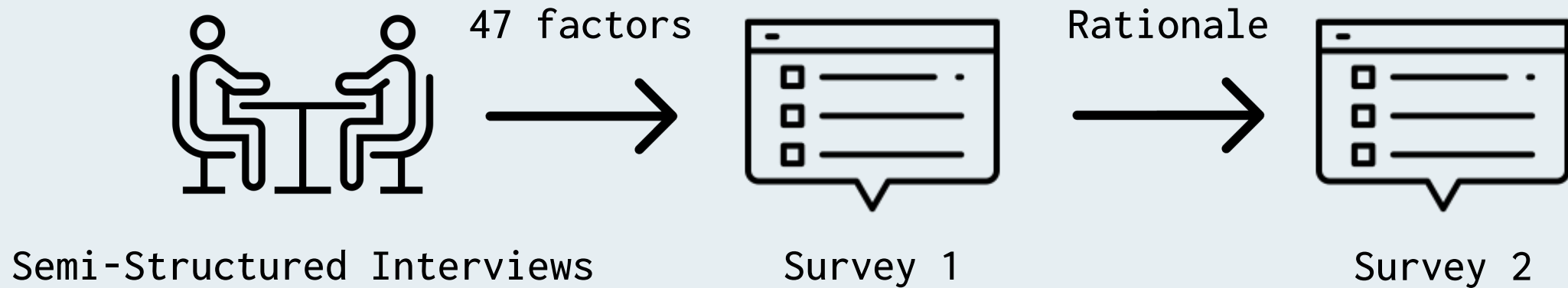


Active involvement in cybersecurity standardization



Leading a corporate IoT product team

A **Three-Round Delphi** Method Helped Reach Consensus



We Conducted **Thematic Analysis** to Find the Themes

- 1 Reading interview scripts and taking notes
- 2 Creating the initial codebook by examining the interview notes
- 3 Merging smaller codes into broader themes
- 4 Discussing the themes with research group and resolving disagreements
- 5 Moving the revised themes to the final codebook

Labels Inform Consumers' Purchase Behavior

“

What's good about a label is that it empowers the consumer to make a more active decision about cybersecurity rather than just being completely helpless as to what the security of her device might be. The average consumer doesn't have a privacy, security, or a legal department to review this stuff before they buy it. Enterprises do, but consumers do not, so someone's gotta be looking out for consumers and giving the consumers this information.



Labels Incentivize Security and Privacy Competition

“


There is value in forcing the company to write a list down, even if the consumer doesn't understand it. If you said, 'list your open ports,' there would be an incentive to make them few.




We Designed a Layered Label

Security & Privacy


Smart Security Camera, NS200
Firmware version 2.5.3: updated on 9/15/2019




Security Mechanisms

Security certification level gold Security updates will be available until 1/1/2030

Automatic security updates 😊 No factory-set default password 😊



Data Practices

Privacy certification level silver


Device is equipped with	camera	microphone	presence sensor
That collects	video	voice	motion
For the purpose of	streaming	streaming	detecting activities
Will be stored at	cloud	cloud	cloud
Will be processed at	cloud	cloud	cloud
Level of detail	Identifiable	identifiable	anonymous

Other sensors to detect: temperature, carbon monoxide

Privacy Statement: www.NS200privacypolicy.com


More Information

Scan the QR code or type in the URL to see more information on security mechanisms and data practices.




Primary Layer
(July '19)




Secondary Layer
(July '19)

Security & Privacy

Smart Security Camera, NS200
Firmware version 2.5.3: updated on 9/15/2019
The device was manufactured in United States




Security Mechanisms

Security certification level gold

Automatic security updates 😊

No factory-set default password 😊

Security updates will be available until 1/1/2030

User account for the device: Option to set multiple user accounts

Anti-tampering practice(s): www.NS200antitamper.com

Authentication method(s): Password

Average response time to patch: 10 days (since 1/1/2017)

Available encryption protocol(s): For communications between device to cloud

History of known vulnerabilities: www.NS200vulnhistory.com


Key management protocol(s): www.NS200key.com

MUD compliant: Yes

Open network port(s): TCP 11095, UDP 53

Periodic internal or external audits: Available

Vulnerability disclosure program: www.NS200vulndisclosure.com


Data Practices

Privacy certification level silver

Device is equipped with	camera	microphone	presence sensor
That collects	video	voice	motion
For the purpose of	streaming	streaming	detecting activities
Will be stored at	cloud	cloud	cloud
Will be processed at	cloud	cloud	cloud
Level of detail	Identifiable	Identifiable	anonymous

Other sensors to detect: temperature, carbon monoxide

Privacy Statement: www.NS200privacypolicy.com

Data handling practices for children: Available

Data will be linked with other data sources: Internal sources, external sources

Frequency of data collection: Every 30 days

Frequency of data sharing: Daily

In compliance with: GDPR, ISO27001


Inferred information from data: Location, identity

Retention time: Data will be deleted after 30 days

Your rights and controls: Data collection, sharing, targeted ad

Who the data is shared with: smartNet, other companies

Who the data is sold to: Third-party companies


General Information

Contact smartNet with your questions at: 412-313-2793 (24/7 support)

Device can function with no internet: Limited functionality on offline mode

Device can function with no smart features: Limited functionality on dumb mode

Hardware and software bill of material: www.NS200billmaterial.com

Physical actuations and triggers: Device blinks when motion is detected

The device supports: Wi-Fi

Primary Layer Is the Short Version of the Label



Security update lifetime



Type of collected data




Availability of automatic security updates




Availability of default passwords



Security & Privacy

Smart Security Camera, NS200
Firmware version 2.5.3: updated on 9/15/2019




Security Mechanisms

Security certification level  Security updates will be available until 1/1/2030

Automatic security updates  No factory-set default password 

Data Practices

Privacy certification level 

Device is equipped with	<u>camera</u>	<u>microphone</u>	<u>presence sensor</u>
That collects	video	voice	motion
For the purpose of	streaming	streaming	detecting activities
Will be stored at	cloud	cloud	cloud
Will be processed at	cloud	cloud	cloud
Level of detail	Identifiable	identifiable	anonymous


Other sensors to detect: temperature, carbon monoxide

Privacy Statement: www.NS200privacypolicy.com

More Information

Scan the QR code or type in the URL to see more information on security mechanisms and data practices.

<URL>



Secondary Layer Includes More Detailed Information



Retention time



Data inference



Data storage



Data handling practices for children's data

Security & Privacy

Smart Security Camera, NS200
Firmware version 2.5.3, updated on 9/15/2019
The device was manufactured in United States

Security Mechanisms

- Security certification level: **gold**
- Automatic security updates: **on**
- No factory-set default password: **on**
- Security updates will be available until: 1/1/2030
- User account for the device: Option to set multiple user accounts
- Anti-tampering practice(s): [www.NS200antitamper.com](#)
- Authentication method(s): Password
- Average response time to patch: 10 days (since 1/1/2017)
- Available encryption protocol(s): For communications between device to cloud
- History of known vulnerabilities: [www.NS200vulnhistory.com](#)
- Key management protocol(s): [www.NS200key.com](#)
- MUD compliant: Yes
- Open network port(s): TCP 11095, UDP 53
- Periodic internal or external audits: Available
- Vulnerability disclosure program: [www.NS200vulndislosure.com](#)

Data Practices

Privacy certification level: **silver**

Device is equipped with	camera	microphone	presence sensor
That collects	video	voice	motion
For the purpose of	streaming	streaming	detecting activities
Will be stored at	cloud	cloud	cloud
Will be processed at	cloud	cloud	cloud
Level of detail	identifiable	identifiable	anonymous

Other sensors to detect: temperature, carbon monoxide

Privacy Statement: [www.NS200privacypolicy.com](#)

Data handling practices for children: Available

Data will be linked with other data sources: Internal sources, external sources

Frequency of data collection: Every 30 days

Frequency of data sharing: Daily

In compliance with: GDPR, ISO27001

Inferred information from data: Location, identity

Retention time: Data will be deleted after 30 days

Your rights and controls: Data collection, sharing, targeted ad

Who the data is shared with: smartNet, other companies

Who the data is sold to: Third-party companies

Contact smartNet with your questions at: 412-313-2793 (24/7 support)

Device can function with no internet: Limited functionality on offline mode

Device can function with no smart features: Limited functionality on dumb mode

Hardware and software bill of material: [www.NS200billofmaterial.com](#)

Physical actuations and triggers: Device blinks when motion is detected

The device supports: Wi-Fi

Semi-Structured Interviews with 15 IoT Consumers

- Recruited from Pittsburgh, PA, using Craigslist and Reddit
- Included only those who have at least one smart home device
- Conducted 1-hour interview with each participant
- Compensated with \$25 Amazon gift card
- Iteratively improved the design of the label



We Captured Consumers' Perceptions of the Label



We Used **Structural Coding** to Categorize Responses

- Question-based method to label the data
- Appropriate for coding semi-structured interviews
- Applies content-based or conceptual phrase to segments of data
- Four main structural codes and 13 subcodes
- Each interview was independently coded by two researchers
- Cohen's Kappa (κ) agreement of 0.84

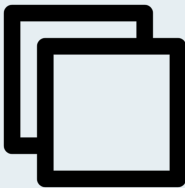


Mixed Attitudes Toward the Layered Design



A few participants preferred single-layer label

- Inconvenience of using the phone or scanning the QR code
- Feeling of not being shown the whole picture



Most participants expressed positive attitudes toward layered design

- More useful information could fit on the layered label
- Easily get insight into additional security and privacy information

Label Helps Consumers Find **More Information**

“

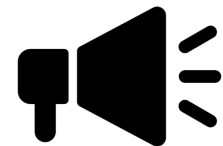
I don't know what TCP and UDP are. But it's interesting to have this here, because then I could go to Reddit and ask on there what that means and what the capabilities are.



Labels Should Work for Both Consumers and Experts

“

Labels are both for customers and experts such as tech journalists and consumer advocacy groups. If they see something that is questionable, they will raise it in the public press or will raise it with regulatory authorities. The label is not just for the consumer, but there's another feedback process that works through experts.



We Iteratively Improved the Label

Primary Layer (September '19)

Security & Privacy Overview

Smart Security Camera, NS200
Firmware version 2.5.1; updated on: 6/15/2019
The device was manufactured in: United States

Security Mechanisms	Security updates	Automatic (available until 1/1/2022)
	Access control	Password, Factory default, User-changeable, Multiple user accounts are allowed

Data Practices	Sensor data collection	
	Video	Audio
Purpose	Providing device functions, research	Providing device functions, research
Data stored on device	Identified	Identified
Data stored on cloud	Identified, Option to delete	Identified, Option to delete
Shared with	Manufacturer	Manufacturer
Sold to	Not sold	Not sold

Other collected data: Presence, Temperature, Carbon monoxide, Usage information, User-entered information

Privacy policy: www.NS200.example.com/privacypolicy

More Information

Detailed Security & Privacy Label:
www.iotsecurityprivacy.org/labels

Secondary Layer (September '19)

Security & Privacy Details

Smart Security Camera, NS200
Firmware version 2.5.1; updated on: 6/15/2019
The device was manufactured in: United States

Security Mechanisms	Security updates	Automatic (available until 1/1/2022)
	Access control	Password, Factory default, User-changeable, Multiple user accounts are allowed
	Security oversight	Audits performed by internal security auditors
	Ports and protocols	www.NS200.example.com/port
	Hardware safety	www.NS200.example.com/hwsafety
	Software safety	www.NS200.example.com/swsafety
	Personal safety	www.NS200.example.com/usersafety
	Vulnerability disclosure and management	www.NS200.example.com/vulreport
	Software and hardware composition list	www.NS200.example.com/BOM
	Encryption and key management	www.NS200.example.com/key

Data Practices	Sensor data collection				
	Video	Audio	Presence	Temperature	Carbon Monoxide
Collection frequency	When user requests it	Continuous, Adjustable	Periodic, Option to opt-out	Continuous, Option to opt-out	Continuous, Option to opt-out
Purpose	Providing device functions, research	Providing device functions, research	Providing device functions	Providing device functions	Providing device functions
Data stored on device	Identified	Identified	De-identified	De-identified	De-identified
Local data retention time	Up to a month	Up to a month	Up to a year	Up to a year	Up to a year
Data stored on cloud	Identified, Option to delete	Identified, Option to delete	No cloud storage	De-identified	De-identified
Cloud data retention time	Up to a month	Up to a month	No cloud storage	Up to a month	Up to a month
Shared with	Manufacturer	Manufacturer	Not shared	Manufacturer, Third party	Third party, option to opt-out
Sharing frequency	Periodic, Adjustable	Periodic, Adjustable	Not shared	Continuous	Continuous
Sold to	Not sold	Not sold	Not sold	Third party	Third party, Option to opt-out

Other collected data: Usage information, User-entered information

Data linkage	Data may be linked with internal and external data sources
What could be inferred from user's data	No data inference
Special data handling practices for children	Yes
In compliance with	GDPR, ISO27001
Privacy policy	www.NS200.example.com/privacypolicy

Call Casa with your questions at	412-313-2793 (24/7 support)
Functionality with no internet	Limited functionality on offline mode
Functionality with no data processing	Limited functionality on dumb mode
Physical actuations and triggers	Device blinks when motion is detected
Compatible platforms	Amazon Alexa

Perceived Behavior is Comparable to Actual Behavior



Factors impacting risk perception

- Risk target (Sjoberg, 2000)
- Familiarity with the technology (Friedman, 2002)
- Attitudes and concerns (Fortes, 2017)



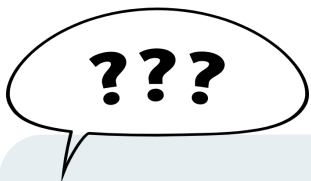
Factors impacting willingness to purchase

- Price, brand, usability (Karjaluoto, 2005; Ling, 2006)
- Privacy (Tsai et al., 2011; Kelley et al., 2010)

We Presented **Purchase Vignettes**

Imagine you are making a decision to purchase a [smart speaker with voice assistant] for [yourself]. This device has a [microphone] that will [listen and respond to your voice commands]. The price of the device is within your budget and the features are all what you would expect from a [smart speaker with voice assistant]. On the package of the device there is a label that indicates the following privacy and security practice:

[Purpose of data collection: Tailored advertising and monetization]





Asked to specify the changes on risk perception and willingness to purchase

We Selected Attributes with Concrete Values

Security & Privacy Details

Smart Security Camera, NS200
Firmware version 2.5.1, updated on: 6/15/2019
The device was manufactured in: United States

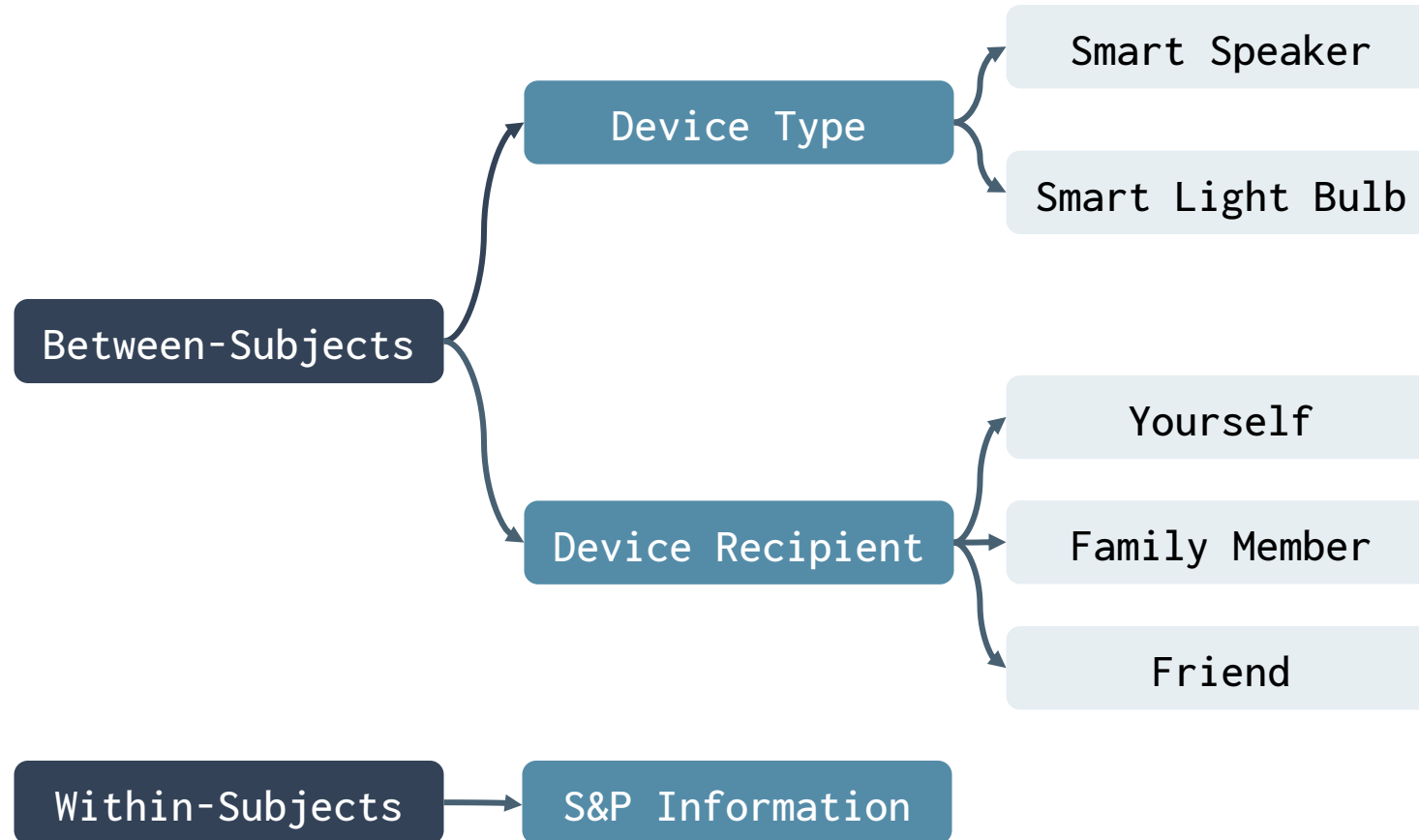


 Security Mechanisms	Security updates	Automatic (available until 1/1/2022)	+
	Access control	Password, Factory default, User-changeable, Multiple user accounts are allowed	+
	Security oversight	Audits performed by internal security auditors	+
	Ports and protocols	www.NS200.example.com/port	
	Hardware safety	www.NS200.example.com/hwsafety	
	Software safety	www.NS200.example.com/swsafety	
	Personal safety	www.NS200.example.com/usersafety	
	Vulnerability disclosure and management	www.NS200.example.com/vulreport	
	Software and hardware composition list	www.NS200.example.com/BOM	
	Encryption and key management	www.NS200.example.com/key	

The Survey Tested 16 Privacy and Security Attributes

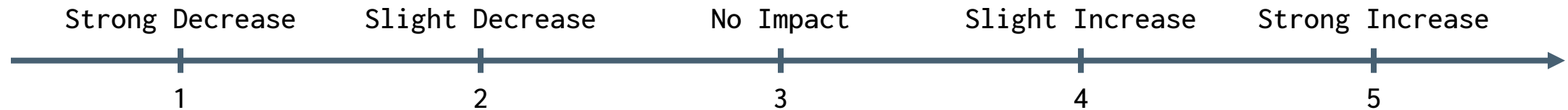
Attribute	Most protective value	Least protective value
	Decrease risk and Increase willingness to purchase	Increase risk and Decrease willingness to purchase
Security update	Automatic	None
Access control	Multi-factor authentication	None
→ Purpose	Device function	Monetization
Device/cloud storage	None	Identified
Shared with/sold to	None	Third parties
Device/cloud retention	None	Indefinite
Collection/sharing frequency	On user demand	Continuous

We Conducted a 1,371-Participant **Mixed-Design** Survey

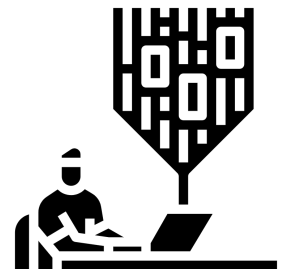


Our Models Included Ordinal DVs and Categorical IVs

- Two models to describe risk perception/willingness to purchase
- In each model, the dependent variable (DV) took 5 ordinal levels

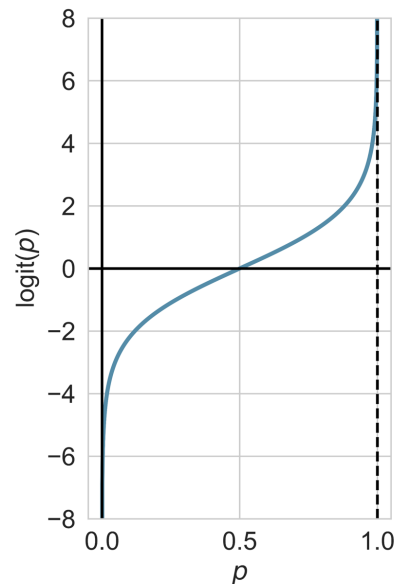


- Five categorical independent variables (IVs) per model
 - S&P Information: 33 levels
 - Device Type: 2 levels
 - Device Recipient: 3 levels
 - Prior Scenarios: 3 levels
 - Device Exposure: 3 levels
- One-hot encoding to convert each IV to multiple binary variables



We Built Cumulative Linear Mixed Models (CLMMs)

The probability that the i^{th} observation belongs to level $j \in \{1, 2, 3, 4\}$ or below is modeled as



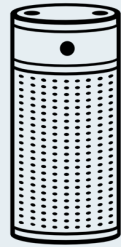
Threshold Parameter

$$\text{logit}(\Pr(Y_i \leq j)) = \alpha_{j|j+1} - u_{\text{participant}_i} \text{ Random Per-Participant Effect } \overset{\text{i.i.d.}}{\sim} \mathcal{N}(0, \sigma_u^2)$$

- $\beta_{\text{sp_attribute_value}_i}$
- $\beta_{\text{prior_scenarios}_i} - \beta_{\text{device_exposure}_i}$
- $\beta_{\text{device_type}_i} - \beta_{\text{device_recipient}_i}$

} Model Coefficients

Smart Speaker **Increased Risk** Perception



Smart Speaker



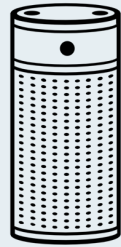
$$\beta = 0.44$$



Smart Light Bulb



Smart Speaker **Decreased** Willingness to **Purchase**



Smart Speaker



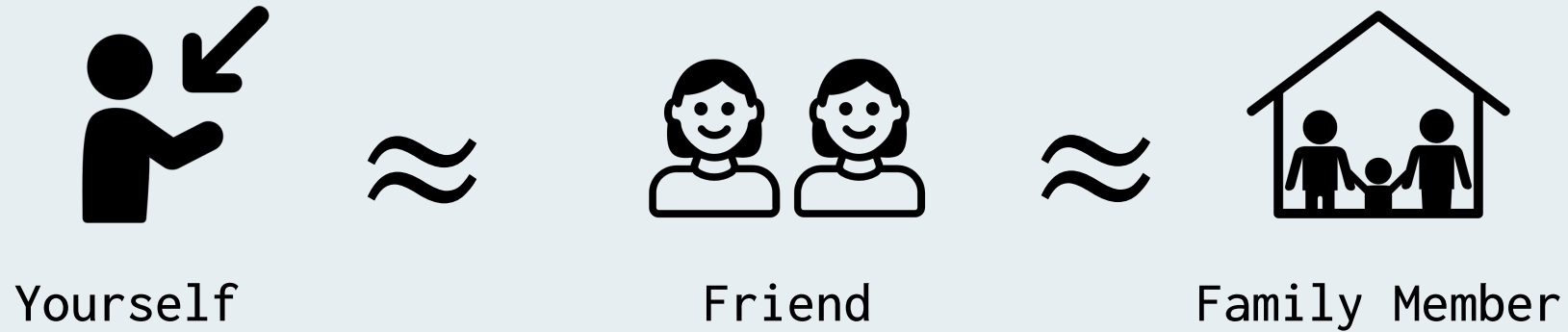
$$\beta = -0.42$$



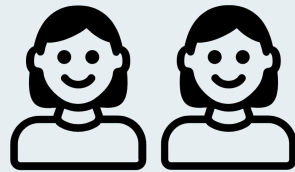
Smart Light Bulb



Device Recipient Did Not Impact Risk Perception



Participants Were Less **Willing** to Purchase for **Friends**



Friend



$$\beta = -0.13$$



Yourself



Label Content Influenced as We Hypothesized



Most protective value of a privacy/security attribute

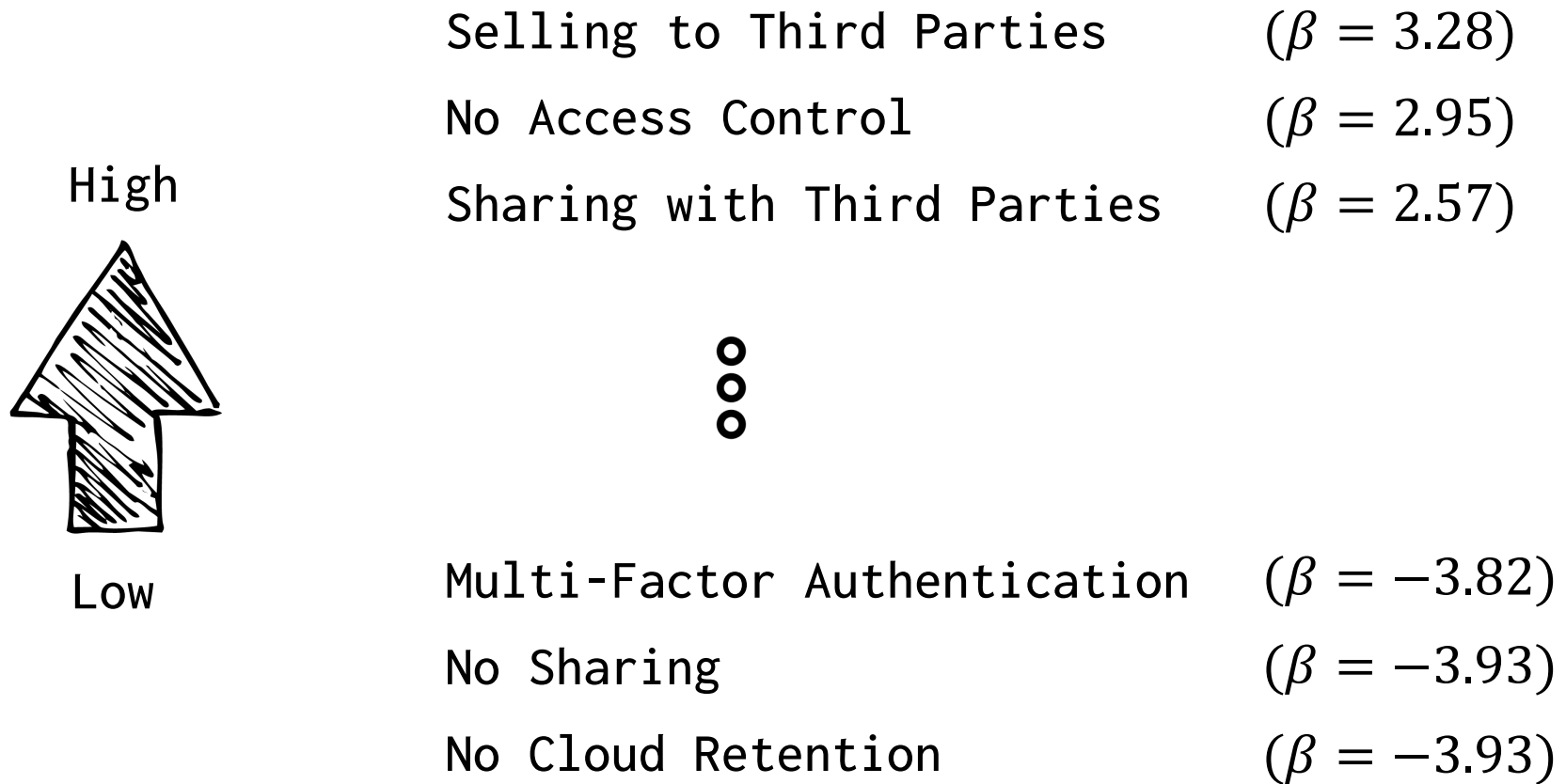
- Significantly **decreased** the risk perception
- Significantly **increased** the willingness to purchase



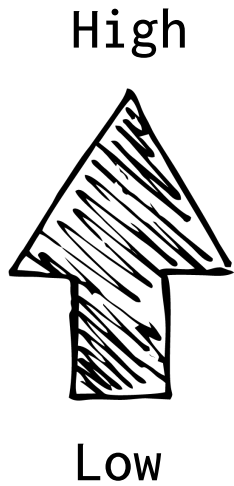
Least protective value of a privacy/security attribute

- Significantly **increased** the risk perception
- Significantly **decreased** the willingness to purchase

Higher Data Exposure Increased Risk Perception



Lower Data Exposure Increased Willingness to Purchase

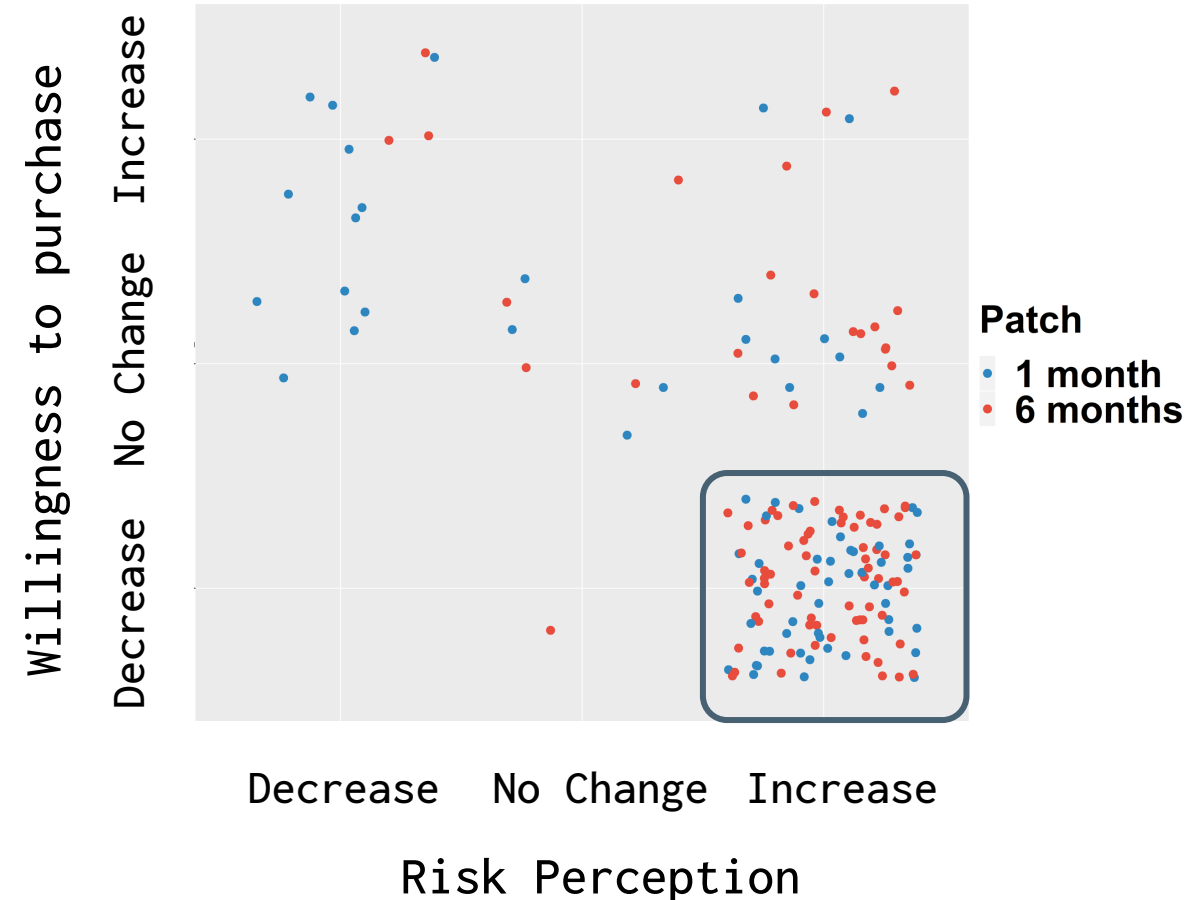
	No Sharing	$(\beta = 2.92)$
	No Cloud Retention	$(\beta = 2.62)$
	No Device Retention	$(\beta = 2.58)$
	⋮	
	Sharing with Third Parties	$(\beta = -0.13)$
	No Access Control	$(\beta = -2.79)$
	Selling to Third Parties	$(\beta = -2.38)$



Manufacturers Should **Justify** Their **S&P Practices**

Underwriters Lab (UL) guideline:

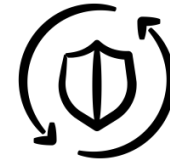
- Most severe: within 1 month
- Less severe: within 3 months
- Least severe: could be left unpatched



Misconception: “No Security Update” Is Secure

“

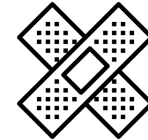
If there are no updates, then the system must be providing maximum security already.



Misconception: “Patch” Indicates Less Security

“

On the label it advertises that patches are even needed. That is why there is a perception of decreased privacy.



We Further Improved the Label

Primary Layer (September '21)

Security & Privacy Overview

Smart Device Co.

Smart Video Doorbell NS200
Firmware version: 2.5.1 - updated on: 11/12/2020
The device was manufactured in: China

	Security Mechanisms	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Security updates</td> <td>Automatic - Available until at least 1/1/2022</td> </tr> <tr> <td>Access control</td> <td>Password - Factory default - User changeable, Multi-factor authentication, Multiple user accounts are allowed</td> </tr> </table>	Security updates	Automatic - Available until at least 1/1/2022	Access control	Password - Factory default - User changeable, Multi-factor authentication, Multiple user accounts are allowed																																									
Security updates	Automatic - Available until at least 1/1/2022																																														
Access control	Password - Factory default - User changeable, Multi-factor authentication, Multiple user accounts are allowed																																														
	Data Practices	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">Sensor data collection</td> <td style="width: 25%; text-align: center;"></td> <td style="width: 25%; text-align: center;"></td> <td style="width: 25%; text-align: center;"></td> <td style="width: 25%; text-align: center;"></td> </tr> <tr> <td>Sensor type</td> <td>Camera</td> <td>Microphone</td> <td></td> <td></td> </tr> <tr> <td>Purpose</td> <td>Providing device functions</td> <td>Providing device functions, Research</td> <td></td> <td></td> </tr> <tr> <td>Data stored on device</td> <td>Identified</td> <td>No device storage</td> <td></td> <td></td> </tr> <tr> <td>Data stored on cloud</td> <td>Identified</td> <td>Identified - Option to delete</td> <td></td> <td></td> </tr> <tr> <td>Shared with</td> <td>Manufacturer, Government</td> <td>Manufacturer</td> <td></td> <td></td> </tr> <tr> <td>Sold to</td> <td>Not disclosed</td> <td>Not sold</td> <td></td> <td></td> </tr> <tr> <td>Other collected data</td> <td colspan="4">Motion, Account info, Payment info, Contact info, Device setup info, Device tech info, Device usage info</td> </tr> <tr> <td>Privacy policy</td> <td colspan="4">www.NS200.smartdeviceco.com/policy</td> </tr> </table>	Sensor data collection					Sensor type	Camera	Microphone			Purpose	Providing device functions	Providing device functions, Research			Data stored on device	Identified	No device storage			Data stored on cloud	Identified	Identified - Option to delete			Shared with	Manufacturer, Government	Manufacturer			Sold to	Not disclosed	Not sold			Other collected data	Motion, Account info, Payment info, Contact info, Device setup info, Device tech info, Device usage info				Privacy policy	www.NS200.smartdeviceco.com/policy			
Sensor data collection																																															
Sensor type	Camera	Microphone																																													
Purpose	Providing device functions	Providing device functions, Research																																													
Data stored on device	Identified	No device storage																																													
Data stored on cloud	Identified	Identified - Option to delete																																													
Shared with	Manufacturer, Government	Manufacturer																																													
Sold to	Not disclosed	Not sold																																													
Other collected data	Motion, Account info, Payment info, Contact info, Device setup info, Device tech info, Device usage info																																														
Privacy policy	www.NS200.smartdeviceco.com/policy																																														
	More Information	<p>Detailed Security & Privacy Label: www.iotsecurityprivacy.org/featured/external/manufacturer/Smart/Video-Doorbell</p>																																													

CMU IoT Security and Privacy Label CISPL 1.0 iotsecurityprivacy.org

Secondary Layer (September '21)

Security & Privacy Details

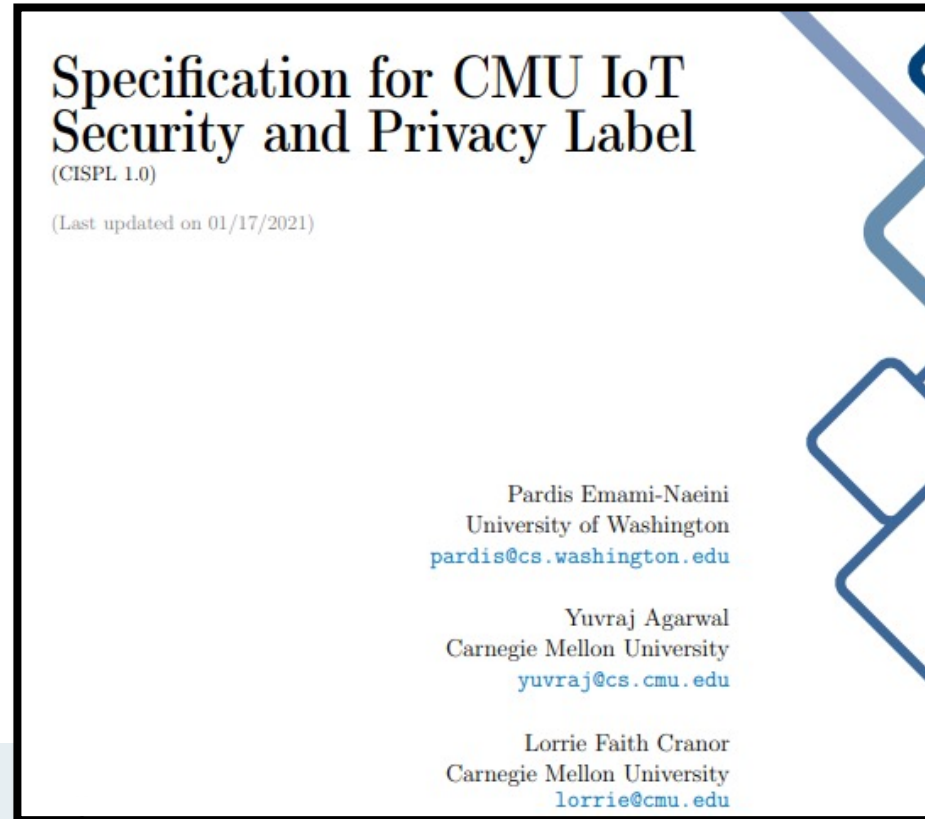
Smart Device Co.

Smart Video Doorbell NS200
Firmware version: 2.5.1 - updated on: 11/12/2020
The device was manufactured in: China

	Security Mechanisms	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Security updates</td> <td>Automatic - Available until at least 1/1/2022</td> </tr> <tr> <td>Access control</td> <td>Password - Factory default - User changeable, Multi-factor authentication, Multiple user accounts are allowed</td> </tr> <tr> <td>Security oversight</td> <td>No security audits</td> </tr> <tr> <td>Ports and protocols</td> <td>www.NS200.smartdeviceco.com/ports</td> </tr> <tr> <td>Hardware safety</td> <td>Not disclosed</td> </tr> <tr> <td>Software safety</td> <td>www.NS200.smartdeviceco.com/sw_safety</td> </tr> <tr> <td>Personal safety</td> <td>www.NS200.smartdeviceco.com/user_safety</td> </tr> <tr> <td>Vulnerability disclosure and management</td> <td>www.NS200.smartdeviceco.com/vul_report</td> </tr> <tr> <td>Software and hardware composition list</td> <td>www.NS200.smartdeviceco.com/BOM</td> </tr> <tr> <td>Encryption and key management</td> <td>www.NS200.smartdeviceco.com/encryption</td> </tr> </table>	Security updates	Automatic - Available until at least 1/1/2022	Access control	Password - Factory default - User changeable, Multi-factor authentication, Multiple user accounts are allowed	Security oversight	No security audits	Ports and protocols	www.NS200.smartdeviceco.com/ports	Hardware safety	Not disclosed	Software safety	www.NS200.smartdeviceco.com/sw_safety	Personal safety	www.NS200.smartdeviceco.com/user_safety	Vulnerability disclosure and management	www.NS200.smartdeviceco.com/vul_report	Software and hardware composition list	www.NS200.smartdeviceco.com/BOM	Encryption and key management	www.NS200.smartdeviceco.com/encryption																															
Security updates	Automatic - Available until at least 1/1/2022																																																				
Access control	Password - Factory default - User changeable, Multi-factor authentication, Multiple user accounts are allowed																																																				
Security oversight	No security audits																																																				
Ports and protocols	www.NS200.smartdeviceco.com/ports																																																				
Hardware safety	Not disclosed																																																				
Software safety	www.NS200.smartdeviceco.com/sw_safety																																																				
Personal safety	www.NS200.smartdeviceco.com/user_safety																																																				
Vulnerability disclosure and management	www.NS200.smartdeviceco.com/vul_report																																																				
Software and hardware composition list	www.NS200.smartdeviceco.com/BOM																																																				
Encryption and key management	www.NS200.smartdeviceco.com/encryption																																																				
	Data Practices	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Sensor data collection</td> <td style="width: 33%;">Audio</td> <td style="width: 33%;">Motion</td> </tr> <tr> <td>Sensor type</td> <td>Microphone</td> <td>Motion sensor</td> </tr> <tr> <td>Collection frequency</td> <td>Continuous - Option to opt out</td> <td>Continuous - Option to opt out</td> </tr> <tr> <td>Purpose</td> <td>Providing device functions, Research</td> <td>Providing device functions, Research</td> </tr> <tr> <td>Data stored on the device</td> <td>Identified</td> <td>No device storage</td> </tr> <tr> <td>Local data retention time</td> <td>Up to a year</td> <td>No retention</td> </tr> <tr> <td>Data stored in the cloud</td> <td>Identified - Data subject access request</td> <td>Identified - Option to delete</td> </tr> <tr> <td>Cloud data retention time</td> <td>Up to 10 years</td> <td>Up to two months</td> </tr> <tr> <td>Data shared with</td> <td>Manufacturer, Government</td> <td>Manufacturer</td> </tr> <tr> <td>Data sharing frequency</td> <td>Periodic</td> <td>Periodic - Adjustable</td> </tr> <tr> <td>Data sold to</td> <td>Not disclosed</td> <td>Third parties</td> </tr> <tr> <td>Other collected data</td> <td colspan="2">Account info, Payment info, Contact info, Device setup info, Device tech info, Device usage info</td> </tr> <tr> <td>Data linkage</td> <td colspan="2">Data will not be linked with other data sources</td> </tr> <tr> <td>What will be inferred from user's data</td> <td colspan="2">Not disclosed</td> </tr> <tr> <td>Special data handling practices for children</td> <td colspan="2">No</td> </tr> <tr> <td>In compliance with</td> <td colspan="2">GDPR</td> </tr> <tr> <td>Privacy policy</td> <td colspan="2">www.NS200.smartdeviceco.com/policy</td> </tr> </table>	Sensor data collection	Audio	Motion	Sensor type	Microphone	Motion sensor	Collection frequency	Continuous - Option to opt out	Continuous - Option to opt out	Purpose	Providing device functions, Research	Providing device functions, Research	Data stored on the device	Identified	No device storage	Local data retention time	Up to a year	No retention	Data stored in the cloud	Identified - Data subject access request	Identified - Option to delete	Cloud data retention time	Up to 10 years	Up to two months	Data shared with	Manufacturer, Government	Manufacturer	Data sharing frequency	Periodic	Periodic - Adjustable	Data sold to	Not disclosed	Third parties	Other collected data	Account info, Payment info, Contact info, Device setup info, Device tech info, Device usage info		Data linkage	Data will not be linked with other data sources		What will be inferred from user's data	Not disclosed		Special data handling practices for children	No		In compliance with	GDPR		Privacy policy	www.NS200.smartdeviceco.com/policy	
Sensor data collection	Audio	Motion																																																			
Sensor type	Microphone	Motion sensor																																																			
Collection frequency	Continuous - Option to opt out	Continuous - Option to opt out																																																			
Purpose	Providing device functions, Research	Providing device functions, Research																																																			
Data stored on the device	Identified	No device storage																																																			
Local data retention time	Up to a year	No retention																																																			
Data stored in the cloud	Identified - Data subject access request	Identified - Option to delete																																																			
Cloud data retention time	Up to 10 years	Up to two months																																																			
Data shared with	Manufacturer, Government	Manufacturer																																																			
Data sharing frequency	Periodic	Periodic - Adjustable																																																			
Data sold to	Not disclosed	Third parties																																																			
Other collected data	Account info, Payment info, Contact info, Device setup info, Device tech info, Device usage info																																																				
Data linkage	Data will not be linked with other data sources																																																				
What will be inferred from user's data	Not disclosed																																																				
Special data handling practices for children	No																																																				
In compliance with	GDPR																																																				
Privacy policy	www.NS200.smartdeviceco.com/policy																																																				
	More Information	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Call Smart Device Co. with your questions at</td> <td>1 000-000-0000</td> </tr> <tr> <td>Email Smart Device Co. with your questions at</td> <td>info@smartdeviceco.com</td> </tr> <tr> <td>Functionality when offline</td> <td>Limited functionality</td> </tr> <tr> <td>Functionality with no data processing</td> <td>Limited functionality</td> </tr> <tr> <td>Physical actuations and triggers</td> <td>Device blinks when motion is detected</td> </tr> <tr> <td>Compatible platforms</td> <td>Amazon Alexa</td> </tr> </table>	Call Smart Device Co. with your questions at	1 000-000-0000	Email Smart Device Co. with your questions at	info@smartdeviceco.com	Functionality when offline	Limited functionality	Functionality with no data processing	Limited functionality	Physical actuations and triggers	Device blinks when motion is detected	Compatible platforms	Amazon Alexa																																							
Call Smart Device Co. with your questions at	1 000-000-0000																																																				
Email Smart Device Co. with your questions at	info@smartdeviceco.com																																																				
Functionality when offline	Limited functionality																																																				
Functionality with no data processing	Limited functionality																																																				
Physical actuations and triggers	Device blinks when motion is detected																																																				
Compatible platforms	Amazon Alexa																																																				

CMU IoT Security and Privacy Label CISPL 1.0 iotsecurityprivacy.org

We Prepared a **Label Specification** Document



Check out the specification at:

www.iotsecurityprivacy.org/downloads/Privacy_and_Security_Specifications.pdf

Interactive Label Generator Creates the Label

The screenshot shows the website for the IoT Security & Privacy Label Generator. The page title is "Label Generator". Below the title, there is a paragraph explaining the tool's purpose: "This tool will generate an IoT Security & Privacy Label. Fill out the fields in the four sections below and scroll down to see the primary and secondary layers of your label. For best results, we recommend using Google Chrome or Firefox." Below this paragraph, there are "Additional notes" which include instructions on how to use the tool, such as running it locally, using print buttons, downloading HTML files, saving JSON files, embedding XML files, and downloading ZIP files. A large dashed box contains the instruction: "Drop a JSON file or click here to work on a previously generated IoT label." Below this box, there is a progress indicator with four steps: "Device Information", "Security Mechanisms", "Data Practices", and "More Information". The "Device Information" step is currently active, indicated by a red dot and a bracket pointing to a large empty box below it.

iotsecurityprivacy.org/generate/

IoT Security & Privacy Label

HOME PEOPLE RESEARCH LABELS FEATURED GENERATE SPONSORS NEWS

Label Generator

This tool will generate an IoT Security & Privacy Label. Fill out the fields in the four sections below and scroll down to see the primary and secondary layers of your label. For best results, we recommend using [Google Chrome](#) or [Firefox](#).

Additional notes:

- The label generator runs locally in your web browser and does not send information to our server.
- Use the print buttons to print it out or save the PDF (you may need to enable background graphics and scale down the labels to fit on the page in the print preview).
- Download the HTML to display the label as a stand-alone web page or embed it on your website.
- Save the JSON file so that you can upload it if you want to make any changes to your label.
- Embed the XML file on your website
- The ZIP download contains the HTML files for both layers of the label, the JSON, the XML, and the embed codes for both the layers.

Drop a **JSON** file or click here to work on a previously generated IoT label.

Device Information Security Mechanisms Data Practices More Information

Check out the tool at:
www.iotsecurityprivacy.org/generate

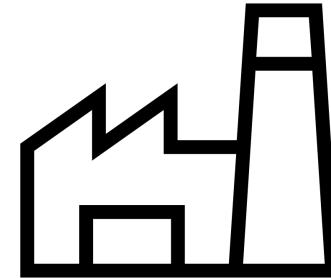
We Have Several Ongoing Label Efforts



Monetary valuation of IoT security and privacy



In conversation with NIST and CR



Piloting the label for real smart devices

IoT Label Effectively Informs Consumers and Experts

- Designed the label with input from experts
- Evaluated the usability of the label
- Prepared a specification document for the label
- Developed a tool to generate the label

Check out the latest updates on this project at:









www.iotsecurityprivacy.org

Pardis Emami-Naeini
pardis@cs.duke.edu

Security & Privacy Overview

Smart Device Co.

Smart Video Doorbell NS200
Firmware version: 2.5.1 - updated on: 11/12/2020
The device was manufactured in: China

 Security Mechanisms	Security updates	Automatic - Available until at least 1/1/2022			
	Access control	Password - Factory default - User changeable, Multi-factor authentication, Multiple user accounts are allowed			
 Data Practices	Sensor data collection	 Visual	 Audio	 Physiological	 Location
	Sensor type	Camera	Microphone		
	Purpose	Providing device functions	Providing device functions, Research		
	Data stored on device	Identified	No device storage		
	Data stored on cloud	Identified	Identified - Option to delete		
	Shared with	Manufacturer, Government	Manufacturer		
	Sold to	Not disclosed	Not sold		
Other collected data	Motion, Account info, Payment info, Contact info, Device setup info, Device tech info, Device usage info				
Privacy policy	www.NS200.smartdeviceco.com/policy				
 More Information	Detailed Security & Privacy Label: www.iotsecurityprivacy.org/featured/external/manufacturer/Smart/Video-Doorbell				

CMU IoT Security and Privacy Label **CISPL 1.0** iotsecurityprivacy.org 