



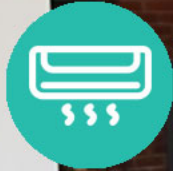
Illustration: Matt Stevens

Rethinking Access Control and Authentication for the Home Internet of Things (IoT)

Weijia He, Maximilian Golla, Roshni Padhi, Jordan Ofek,
Markus Dürmuth, Earlence Fernandes, Blase Ur







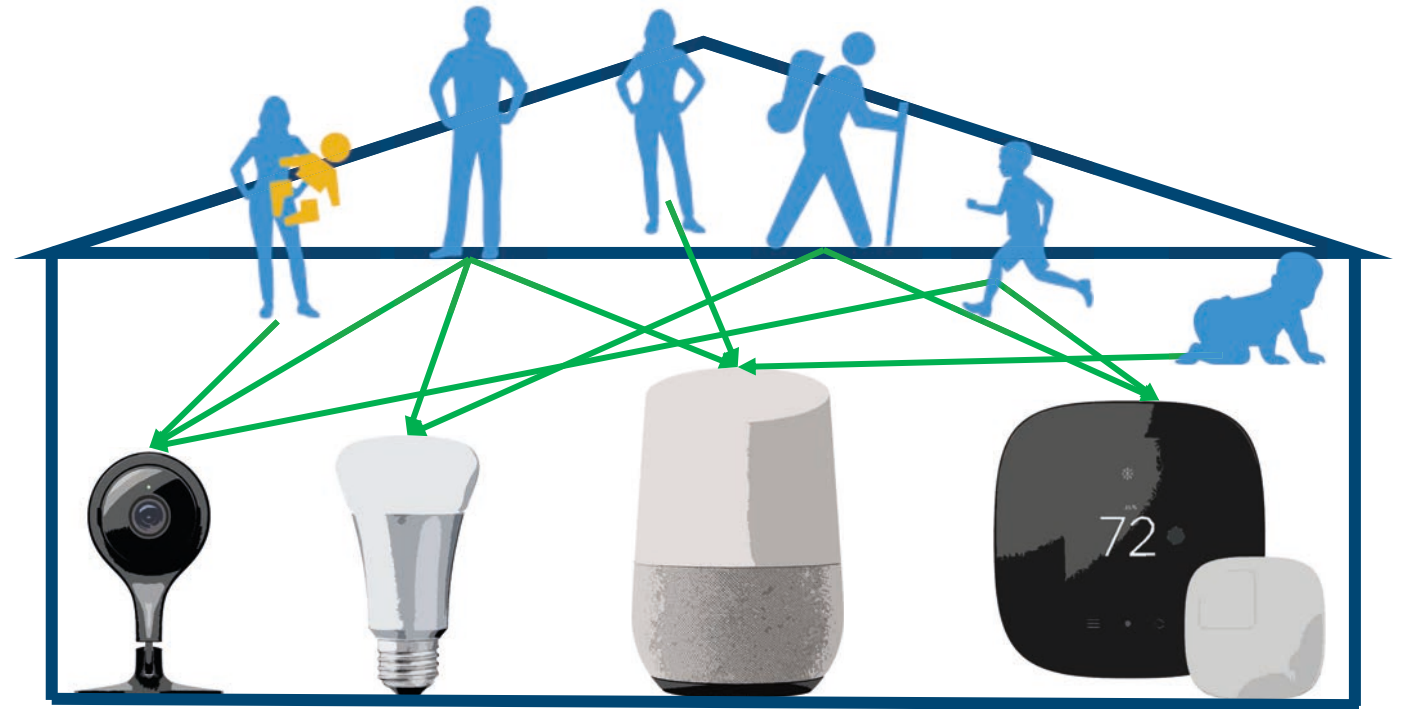
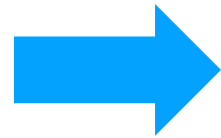
c|net

CNET Smart Apartment - cnet.com

From Single User to Multi User



Single User



Multi User

Vendors Still Treat It The Old Way!



Please Enter Your Password:



Nest Learning Thermostat
nest.com
South Park Logo
deviantart.com



Home IoT Devices



“Play music!”

“Order me a puppy!”



Research Goals



We conducted a user study to...

- Map desired access-control policies for home IoT devices
 - How policies vary by relationships and capabilities
 - Identify potential default policies

Method

User Study

Imagine you are the owner of a **<smart device>**.

Using this device, some users can access the following feature:

<capability>.

6x When should **<relationship>** be able to use this feature?

- Always
- Sometimes
- Never

User Study

Imagine you are the owner of a **Smart Voice Assistant**.

Using this device, some users can access the following feature:

Make online purchases (e. g., on Amazon) on a shared household account.

When should **your spouse** be able to use this feature?

- Always
- Sometimes
- Never

Are Relationships and Capabilities Enough?



5 pm – 6 pm



12 am – 1 am



Research Goals



We conducted a user study to...

- Map desired access-control policies for Home IoT Devices
 - How policies vary by relationships and capabilities
 - Identify potential default policies
- What contextual factors affect the user's decision?

6 Relationships



24 Relationships



6 Relationships

- Your Spouse
- Your Teenage Child
- Your Child in Elementary School
- A Visiting Family Member
- The Babysitter
- Your Neighbor

22 Capabilities

1)



tom's guide PRODUCT REVIEWS DEALS HOW TO FORUM IPHONE 8 AND IPHONE X

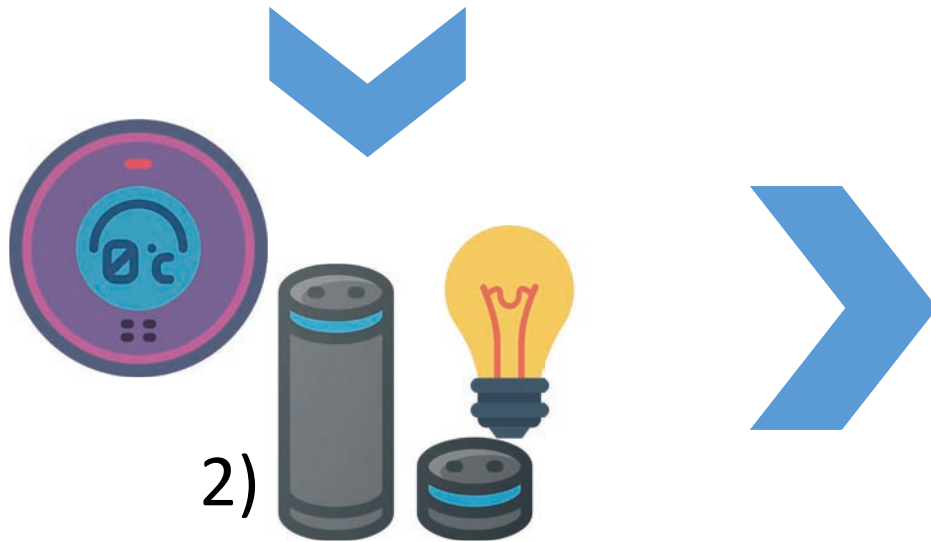
SMART HOME > BEST PICKS

Best Smart Home Gadgets of 2017

by MIKE PROSPERO Aug 3, 2017, 12:21 PM

f t p d i n s

Best Smart Speaker AMAZON ECHO	Best Security Camera NETGEAR ARLO Q	Best Light Bulb PHILIPS HUE WHITE A19 STARTER KIT
8/10 REVIEW > \$179.99 > Amazon	9/10 REVIEW > \$145 > Amazon	8/10 REVIEW > \$69 > Amazon



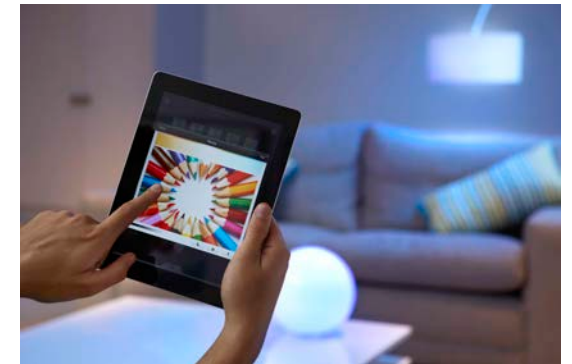
Order Online



Mower Rule



Live Video



Lights Rule



Answer Door

3)

Results

425 Participants



54% Male



46% Female

Age
25-34 47%

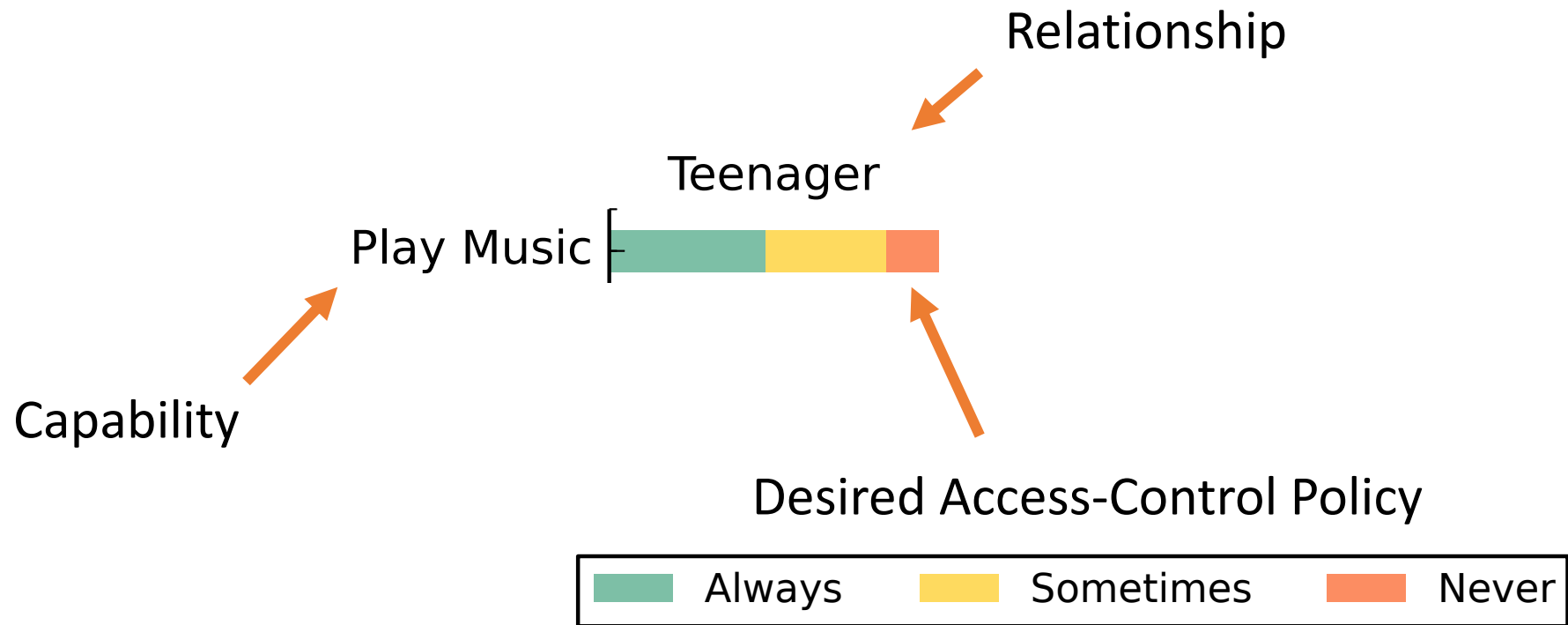
CS 19%

Home IoT Device 44%

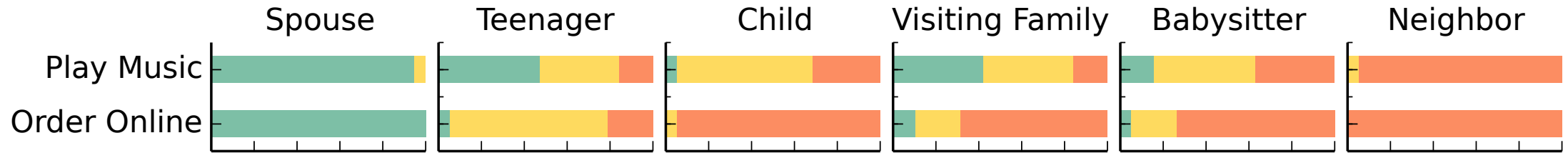


Results

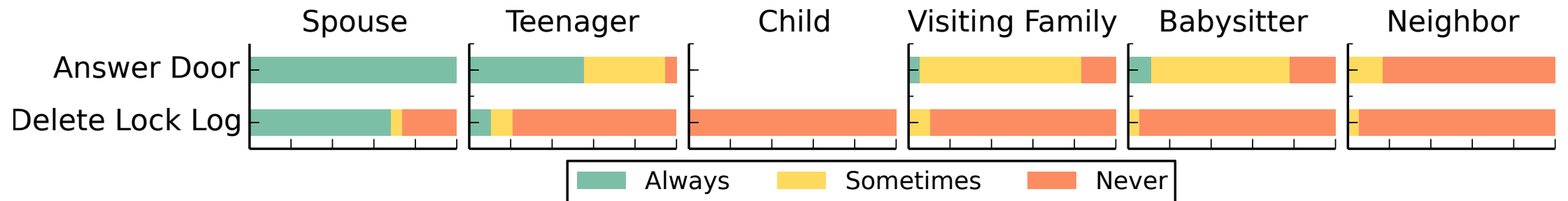
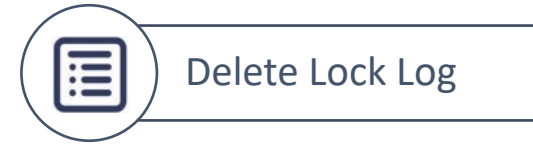
Given **one particular capability**, what **access-control policy** should be set up for **whom**?



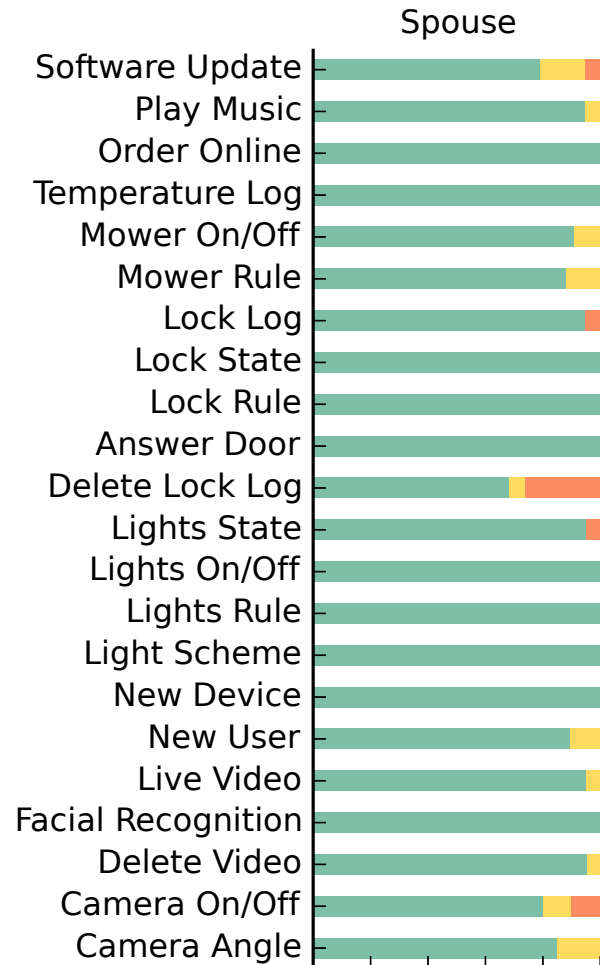
Comparison Between Capabilities



Capabilities Within One Device



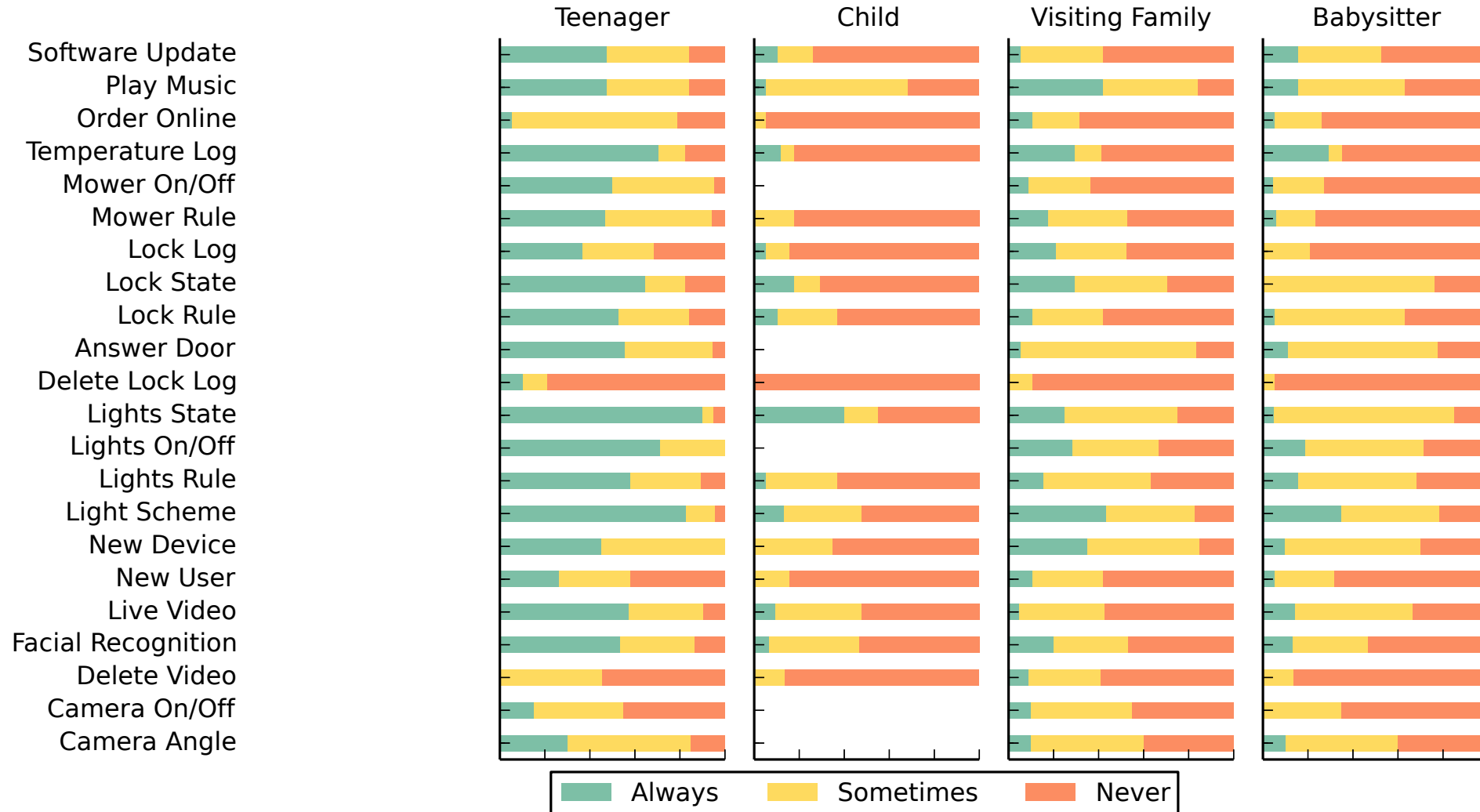
Spouse Can Do Almost Everything



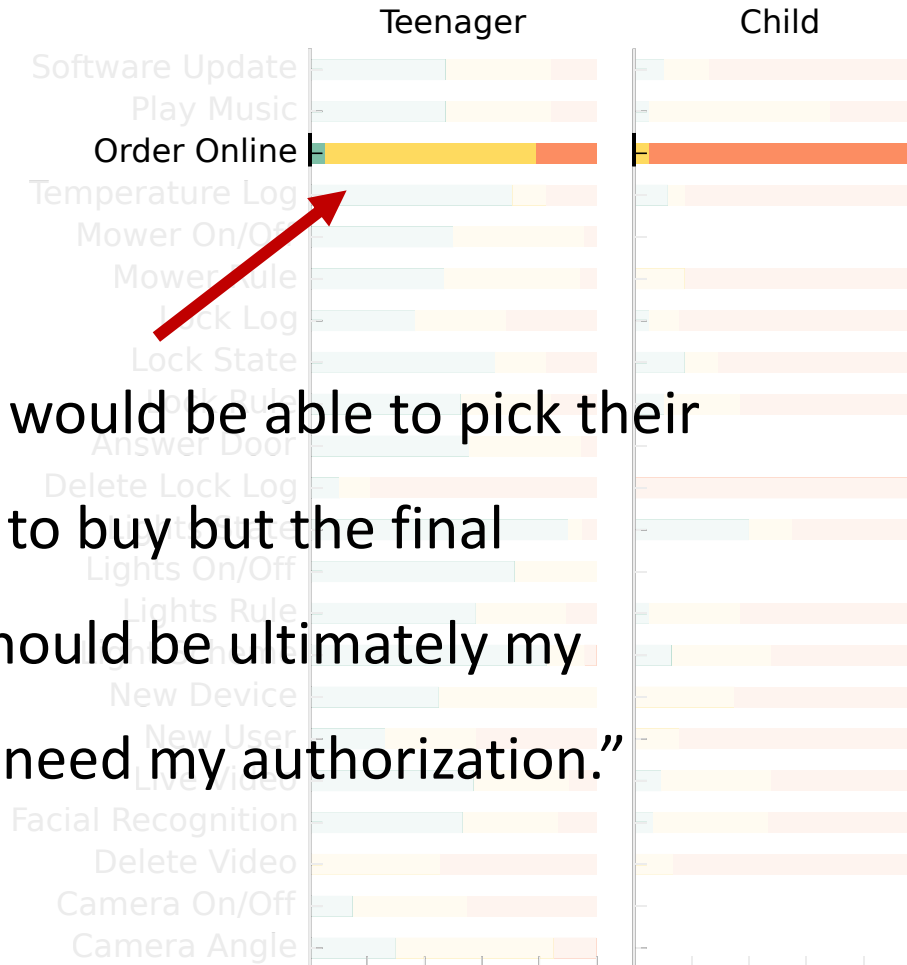
Neighbor Can Do Nothing



Other Relationships Are More Complex

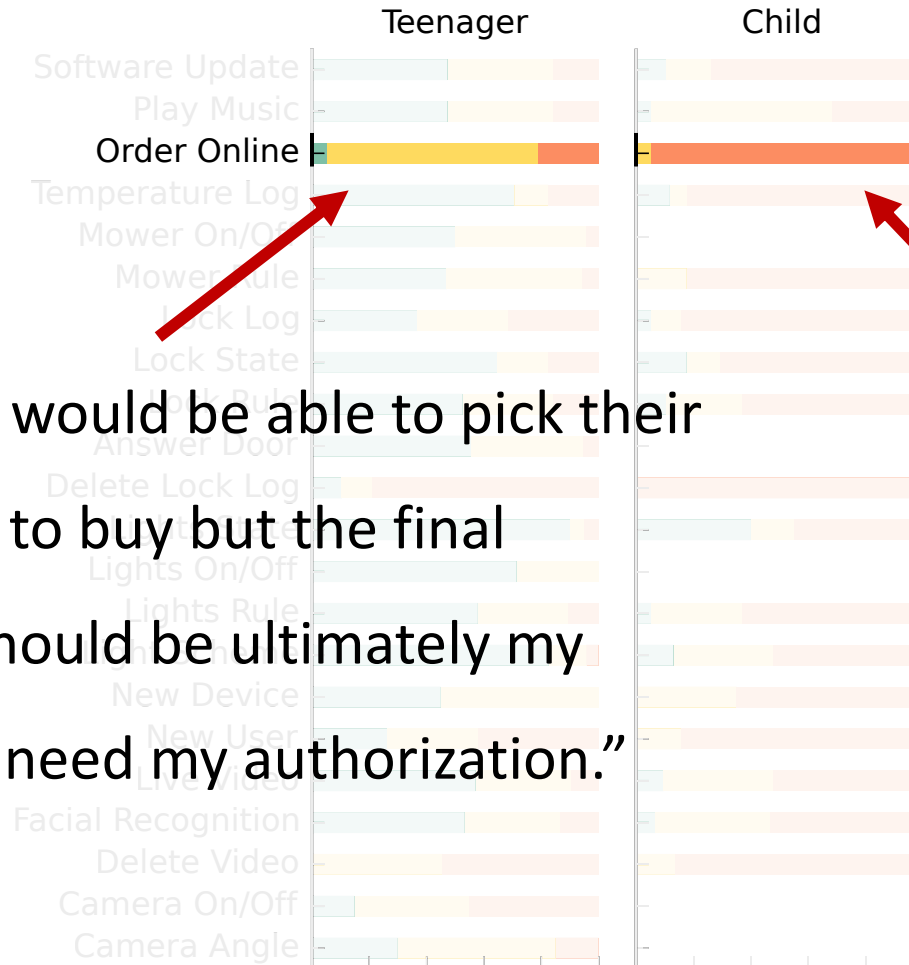


Teenager vs. Child



“At 16 they would be able to pick their own things to buy but the final purchase should be ultimately my choice and need my authorization.”

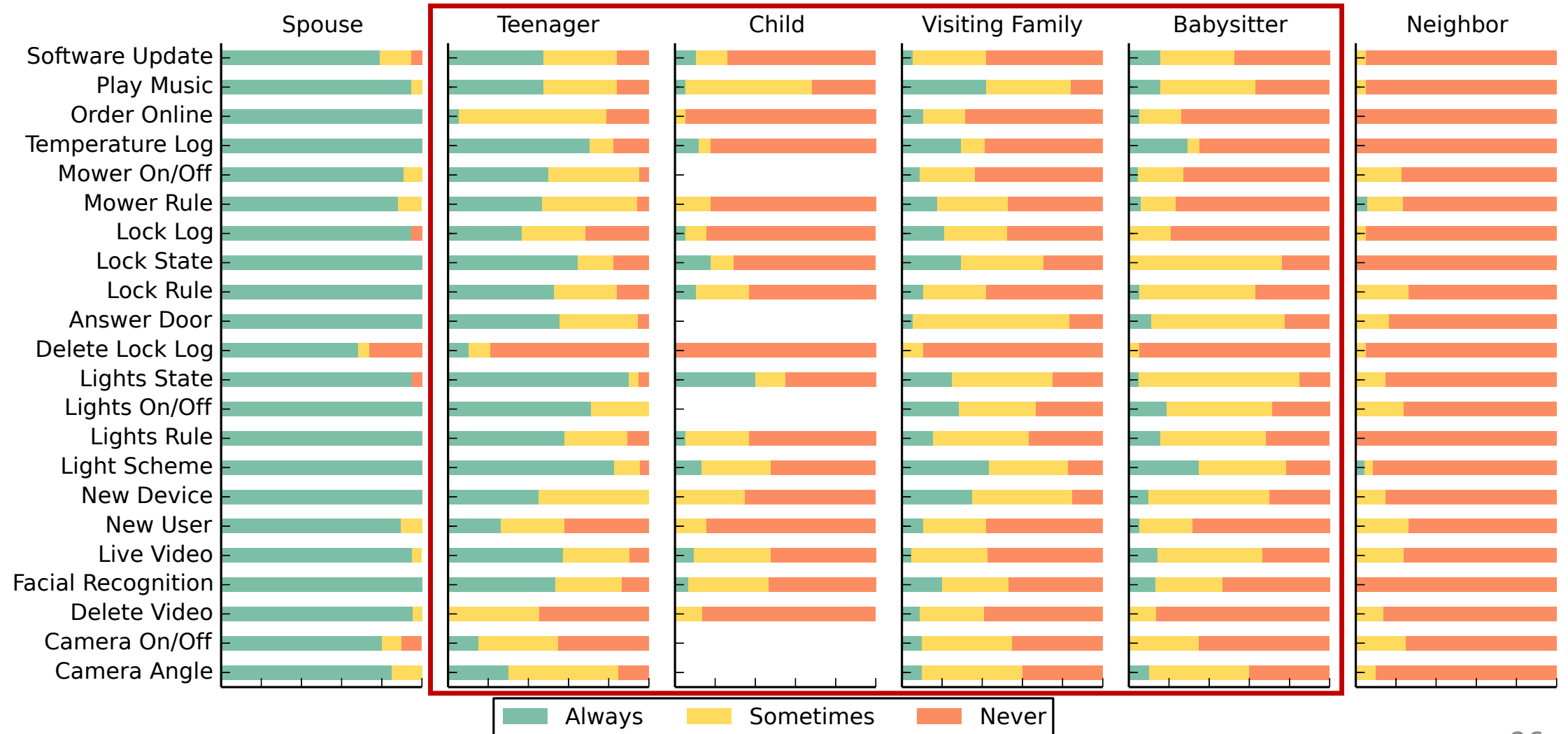
Teenager vs. Child



“At 16 they would be able to pick their own things to buy but the final purchase should be ultimately my choice and need my authorization.”

“They are in no way responsible enough at this age.”

Relationships Matter...But Are Not Enough

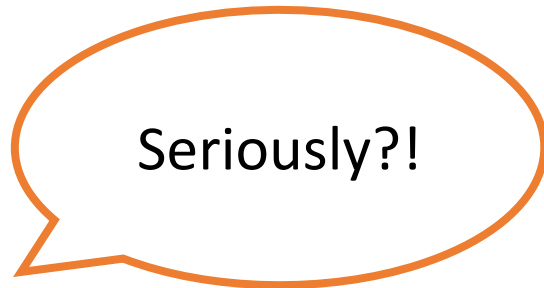


Relationships Matter...But Are Not Enough



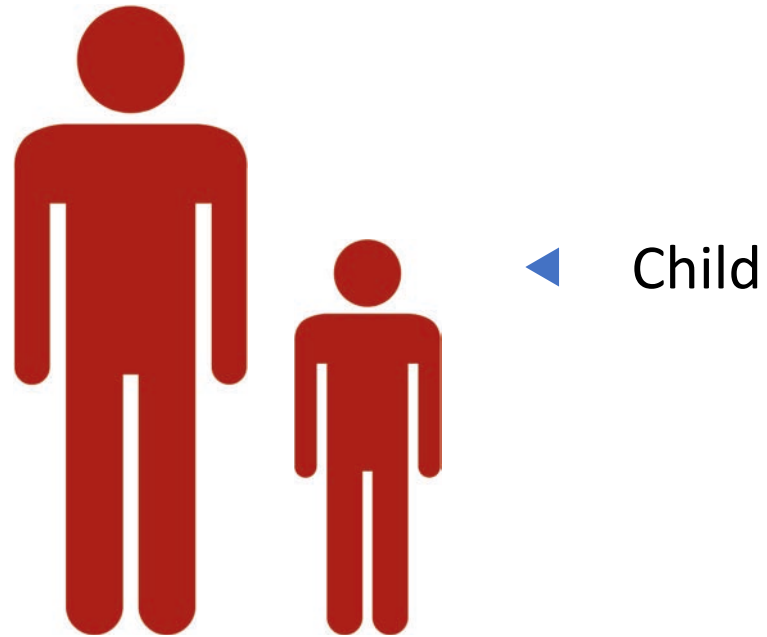
Contextual Factors

Factor: Time of Day



“I would not want anyone trying to use the mower at night. The neighbors would most likely get mad.”

Factor: People Around



“They would be allowed to use it whenever I am home with them.”

Factor: Location of User



“Why do you need to use it if you aren’t close?”

Factor: Location of Device



“If it is used in the bedroom then it would matter who has access.”

Factor: Explicit Permission

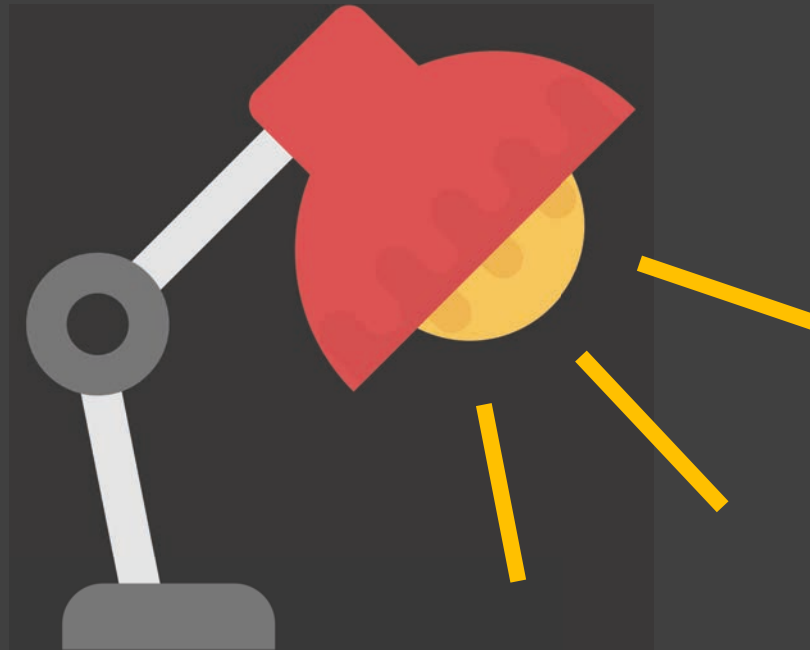


“When they are authorized by the owner.”

Factor: Consequences

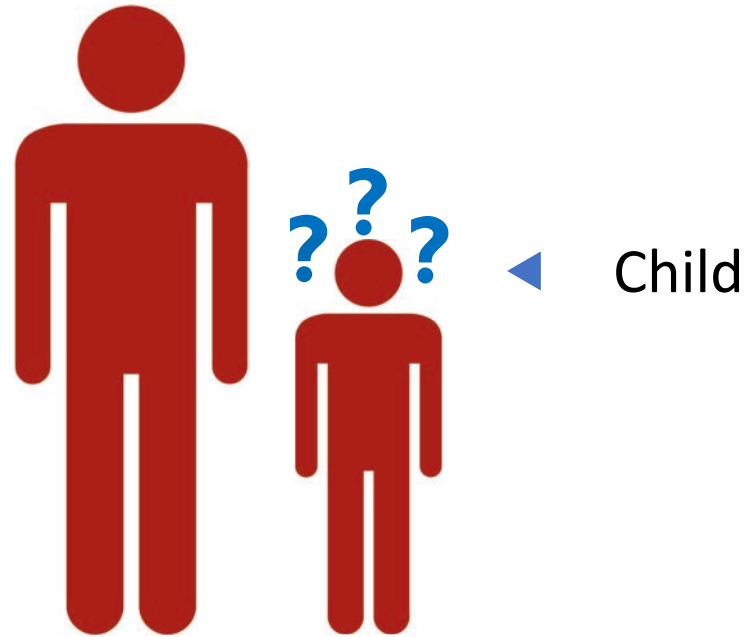


Factor: Responsible Usage



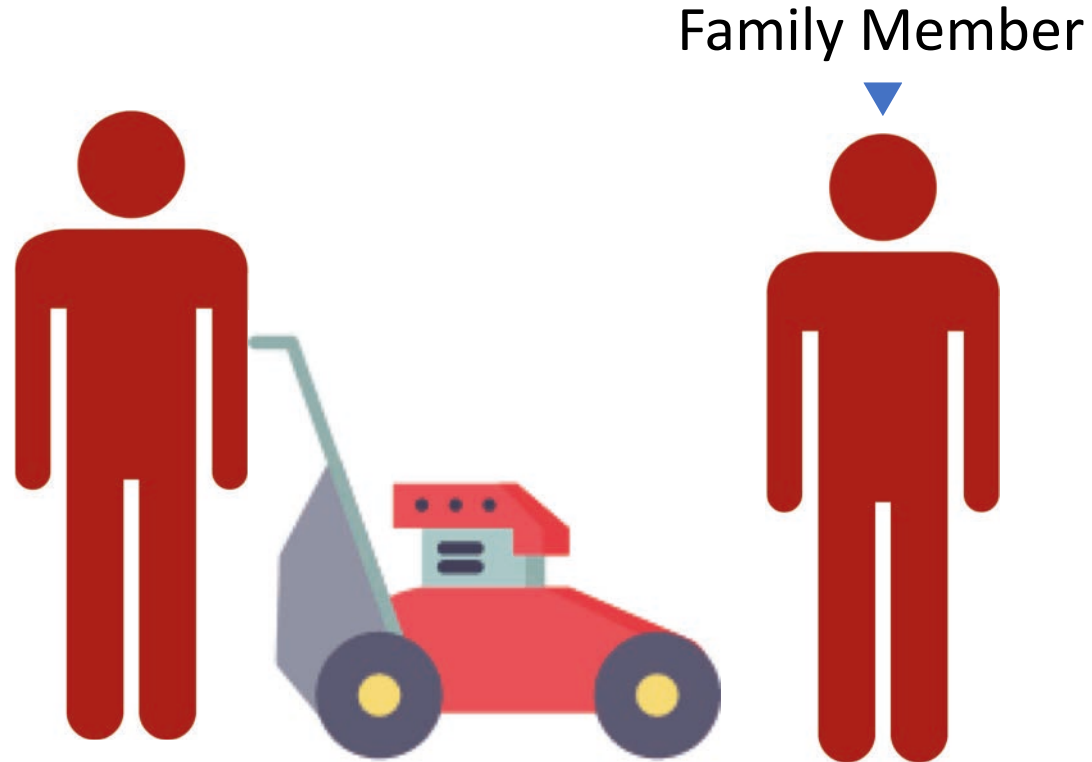
“They shouldn't use the lights if they are using them too frequently.”

Factor: Understanding



“I would need to teach her how to first.”

Factor: Help



“If they want to come over to mow the lawn, then why not?”

Recap: Missing From Current Systems

Relationships

Capabilities

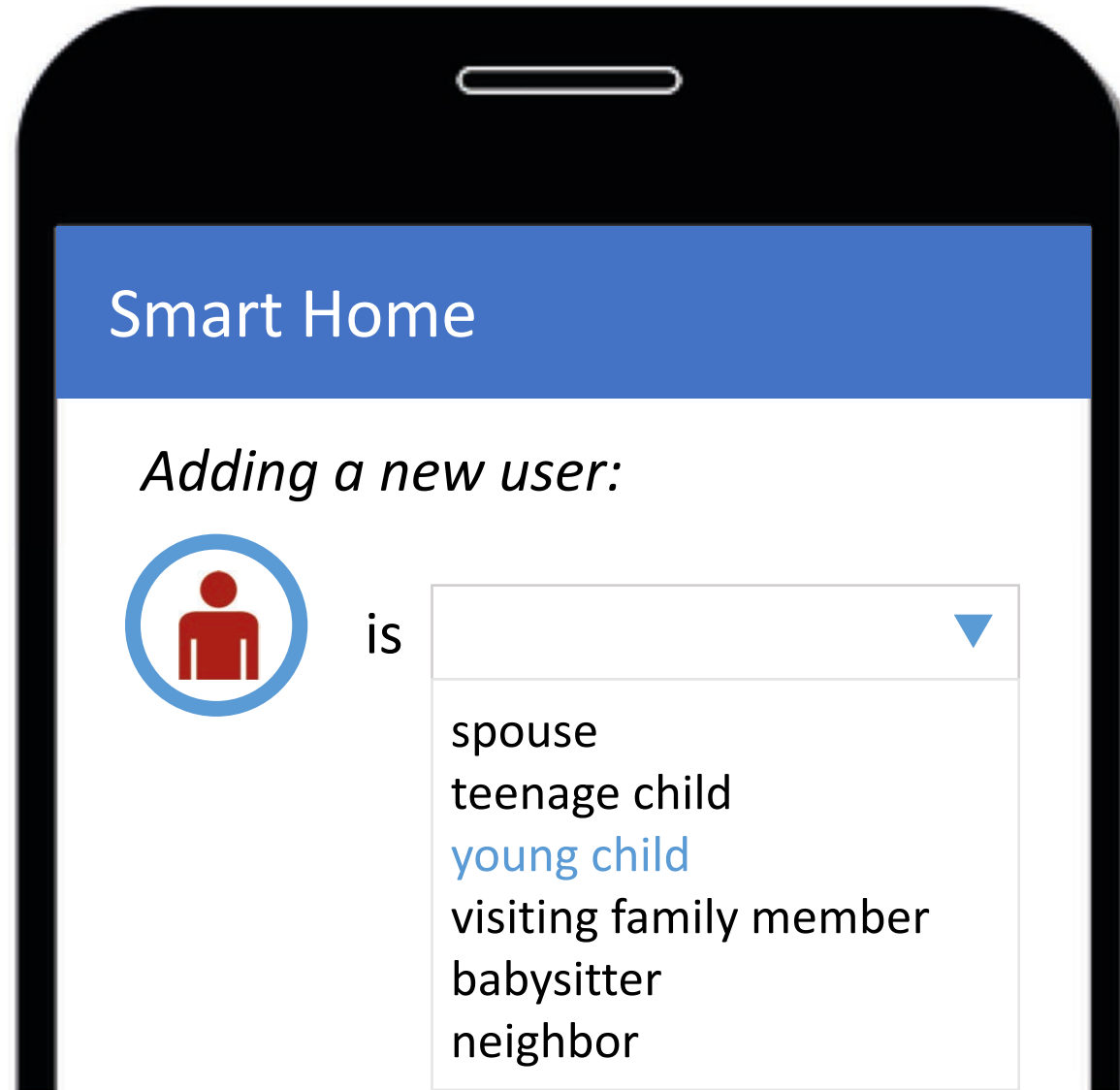
Contextual Factors

Design Implications

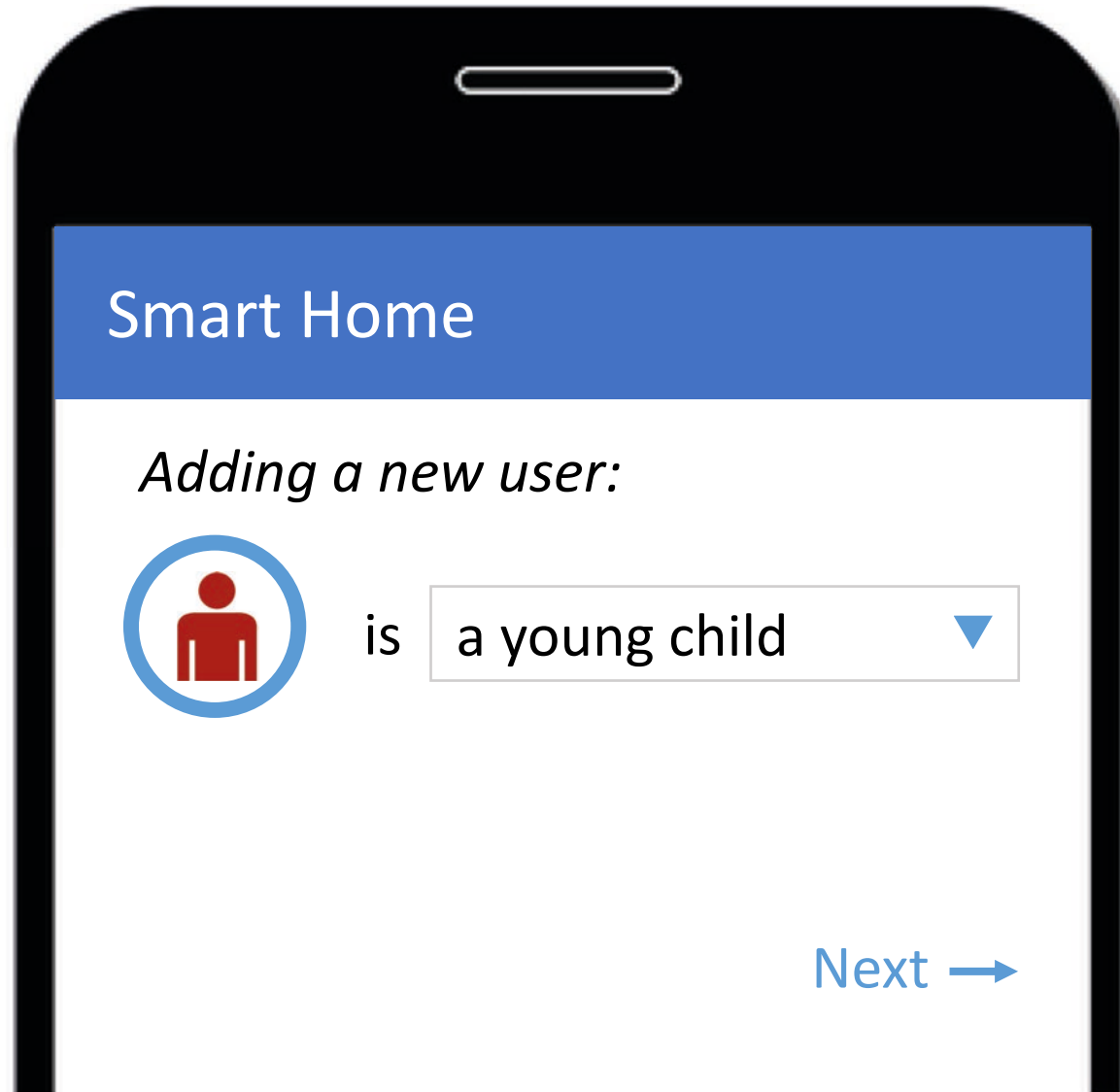
Current: Guest vs. Owner



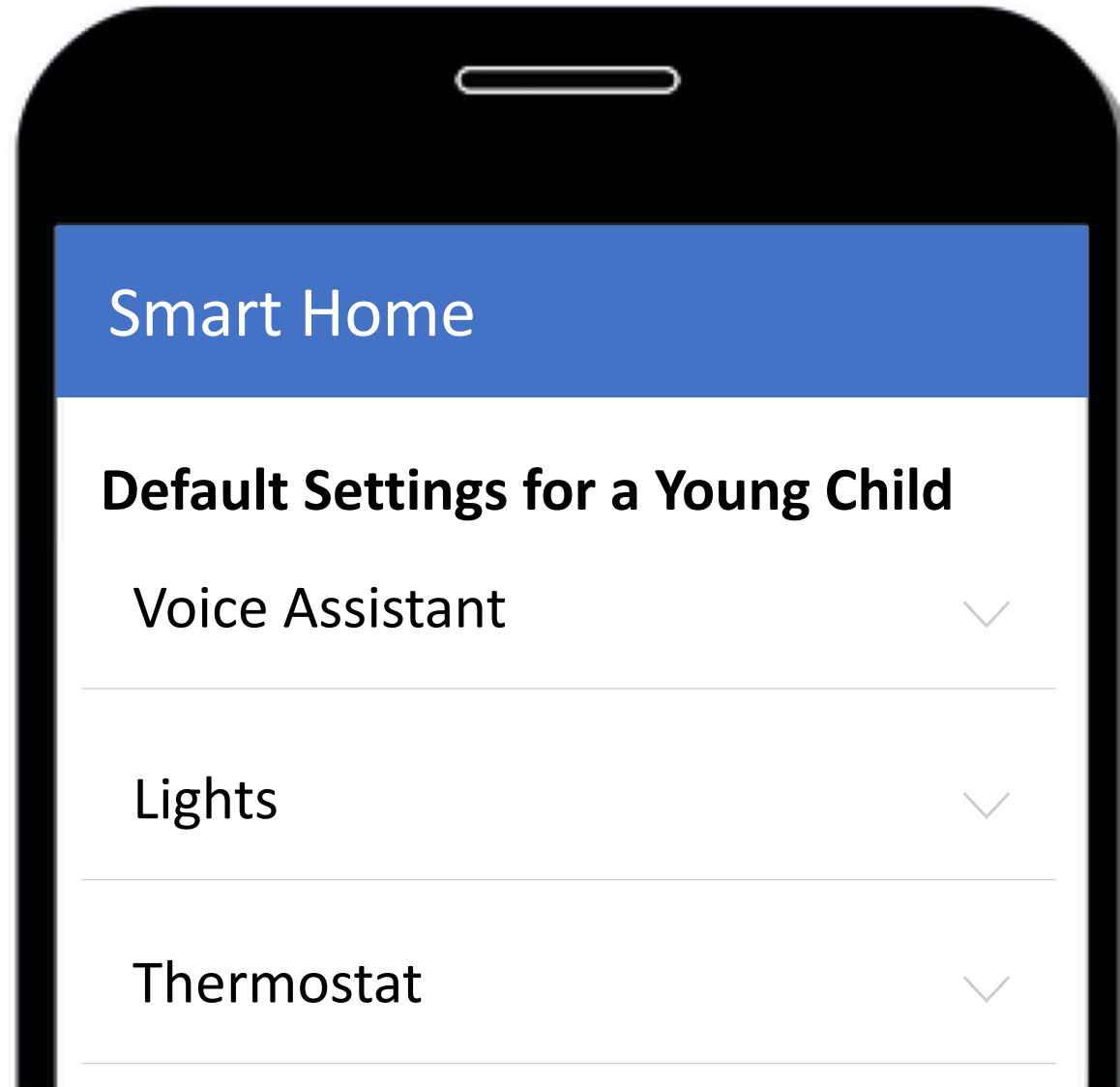
Future: Designing for Relationships



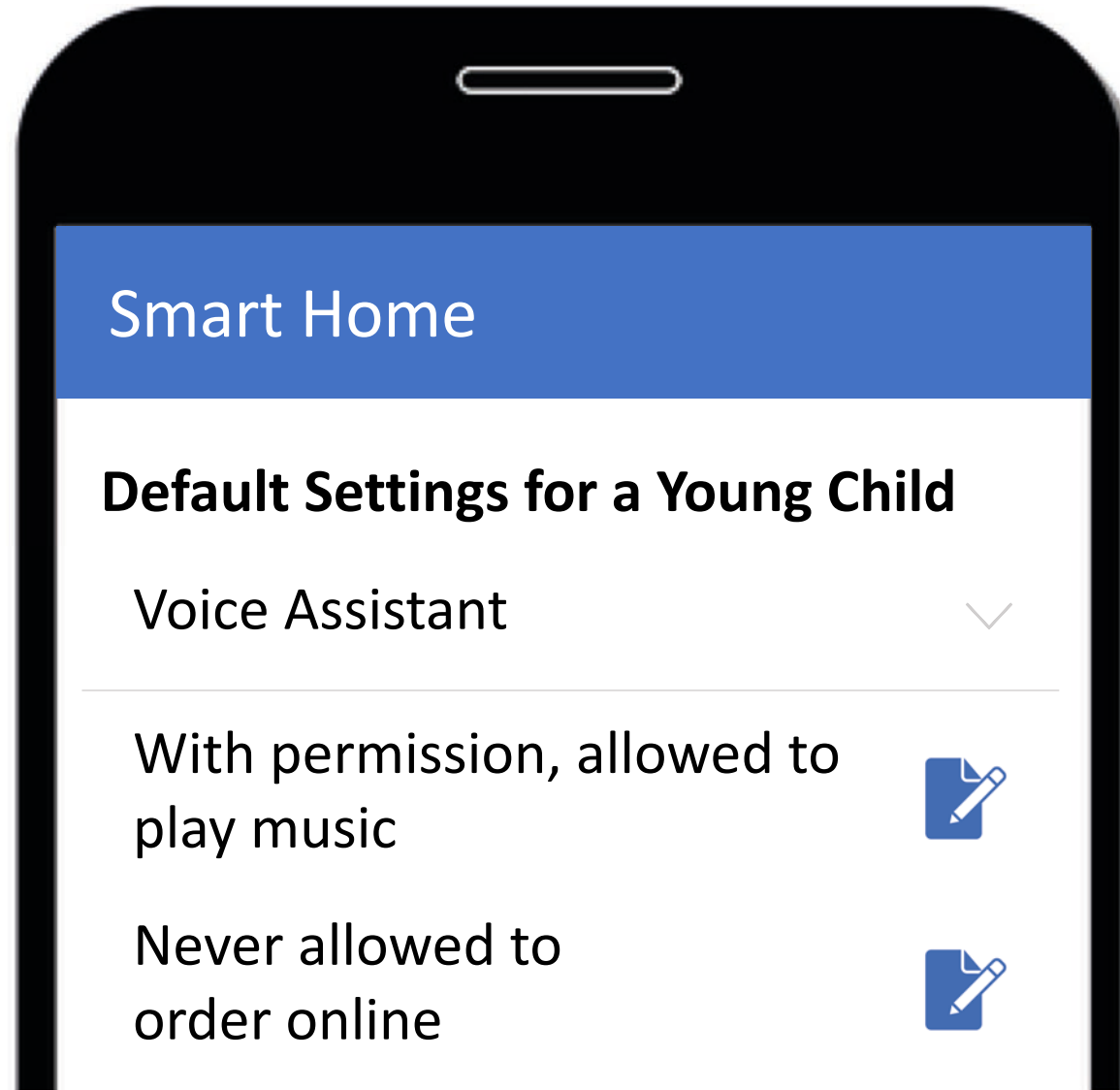
Future: Designing for Relationships



Future: Relationships and Capabilities



Future: Relationships and Capabilities



Current: Full Access or Temporary Access

Set Access Time

Start Date Thu, 19 July 2018

Start Time 06:00 PM

>	<	
8	58	
9	59	
10	00	AM
11	01	PM
12	02	
1	03	

End Date Thu, 19 July 2018

End Time 06:00 PM

OK Cancel

10:12 AM 100%

← ADD SCHEDULE ✓

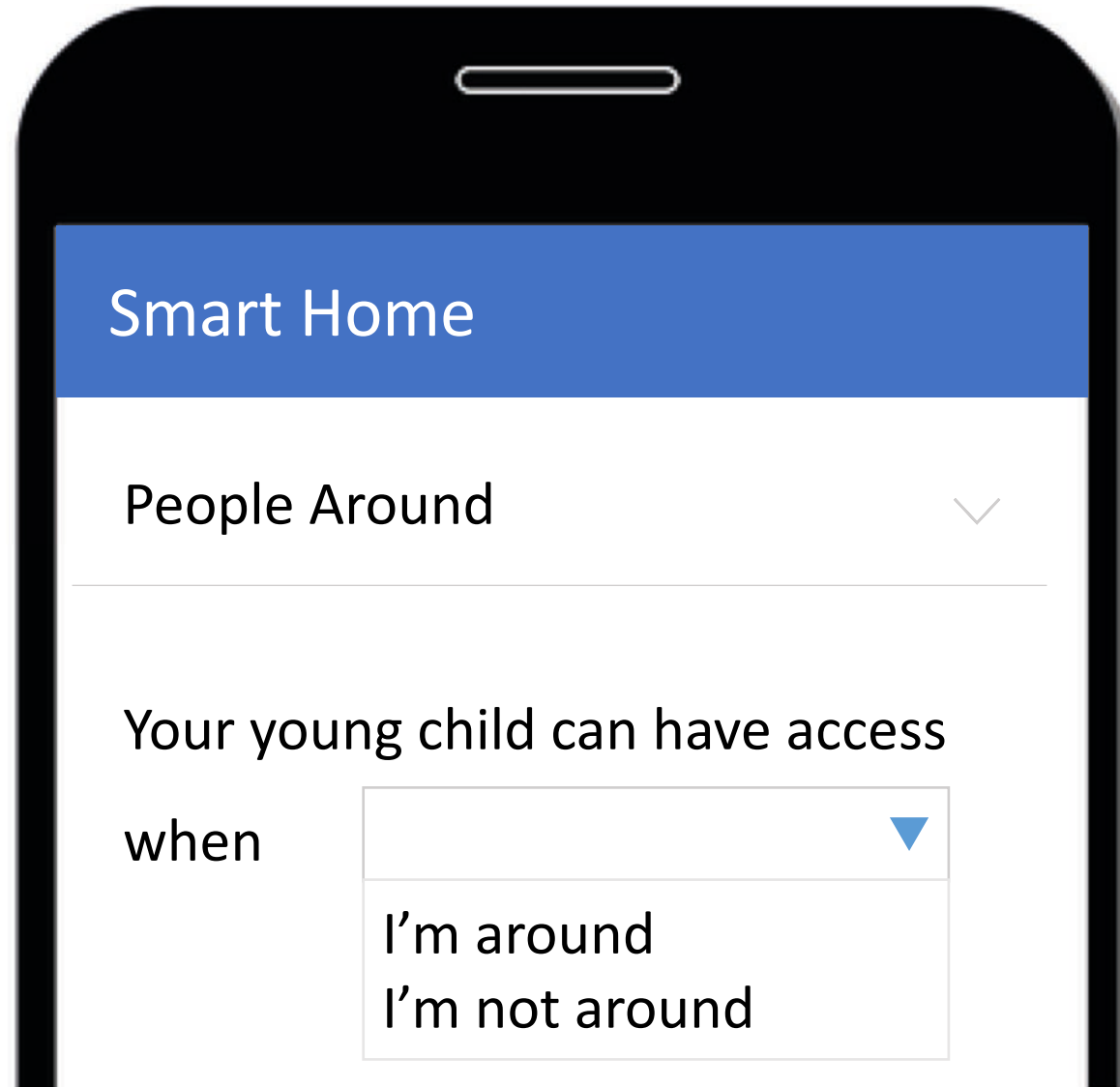
Set individual date and time to allow users to access the door temporarily.

June 19 to 21 July

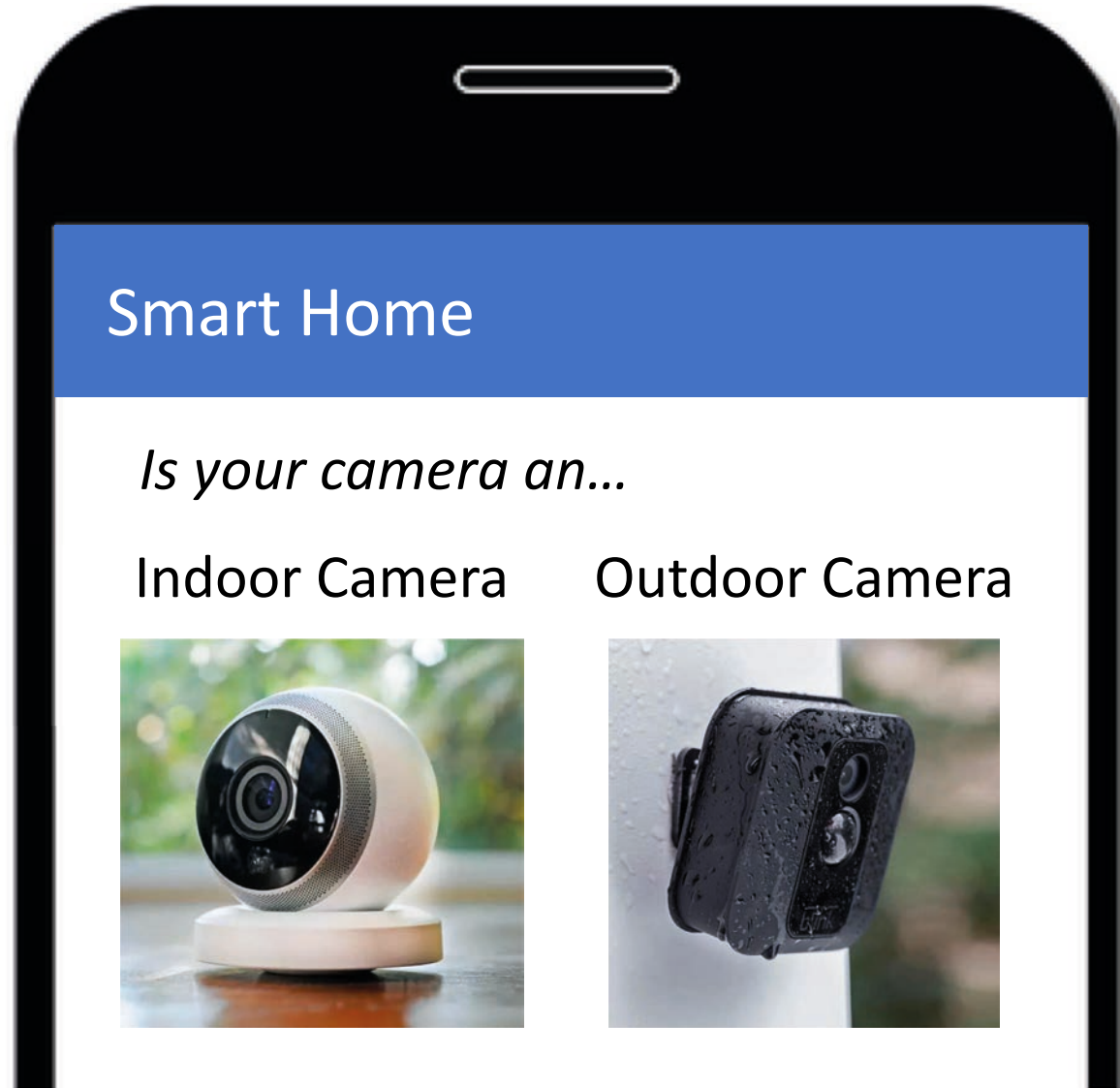
ACCESS TIME USERS

Thu, 19 Jul 2018 02:00 PM to Sat, 21 Jul 2018 12:00 PM

Future: Contextual Factors



Future: Device Context



Smart Home

Is your camera an...

Indoor Camera



Outdoor Camera



Future: Device Location

Smart Home

Is your camera placed in...

Living Room



Bedroom





Capability-Based
Access-Control Policies



Relationships Determine
Default Policies



Support Context-
Dependent Policies

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