

VIAM

# Are we really making the most of our smart home technology?



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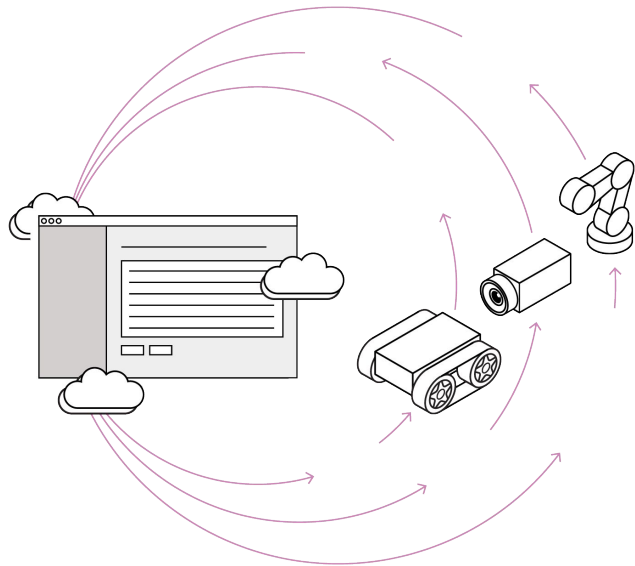
SoCal Linux Expo 2025

## Joyce Lin

Head of Developer Relations, Viam

 joycejetsen | viamrobotics





## Are we really making the most of our smart home technology?

- ✓ **History** of smart homes
- ✓ Choosing the right **sensors**
- ✓ Choosing the right **actuators**
- ✓ Choosing the right **software and AI**
- ✓ Making **smarter** automations

Win a Viam rover!



*Sign up for the  
Viam newsletter*



What is a  
smart home?



What is a  
smart home  
device?



## 1990

- Sunbeam Deluxe Automatic Radiant Control Toaster
- Connected to the internet
- On and Off





1997

- Wi-fi
- 2 Mbps
- Routers, adapters



Never mind



Access Denied



The Free Internet



Be safe while using my WiFi



Network Not Found



No Internet Access



I'm your dad



Every Day I'm Buffering



Pay and use



No Wi-Fi For You

[Love-Quotes-Images.com](http://Love-Quotes-Images.com)

VIAM

1999



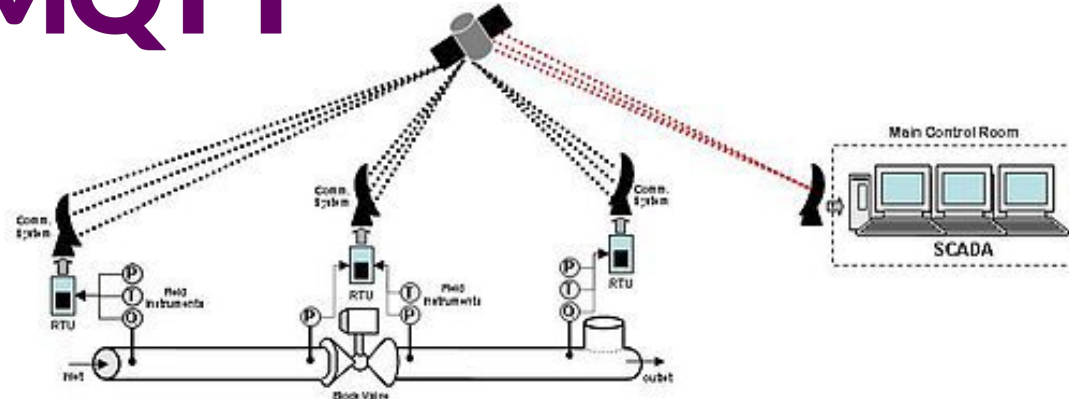
- Z-wave
  - Low-power, wireless
  - Reliable, long-range
  - Proprietary until 2016

# VIAM

1999



- Z-wave
  - Low-power, wireless
  - Reliable, long-range
  - Proprietary until 2016
- MQTT
  - Low-power, low-bandwidth
  - Broker for pub/sub



# VIAM

2003

- Zigbee
- Low-power
- Mesh networking

 **zigbee**



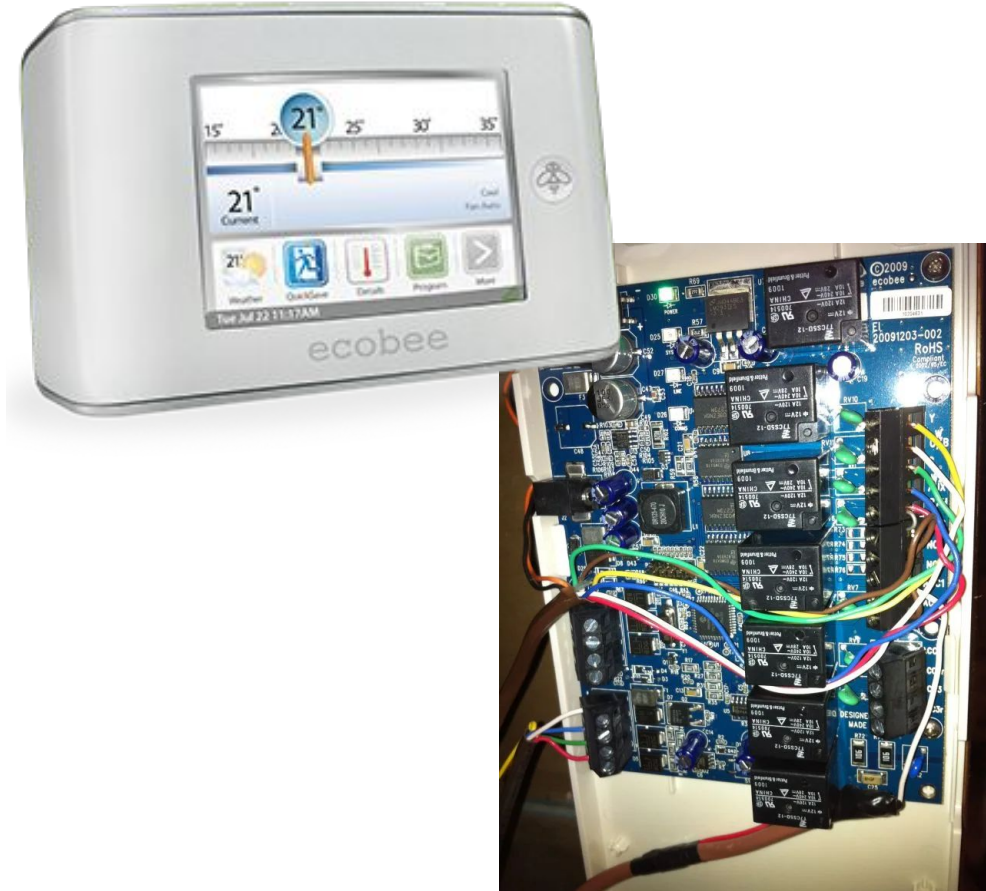
## 2007

- iPhone
- Smart phone with internet capabilities
- Mobile apps for mobile control



## 2008

- Ecobee smart thermostat
- Wi-fi-enabled
- Web interface for remote control
- Monitoring and adjusting





## 2010

- OpenHAB
- Open-source platform
- Multi-protocol (Zigbee, Z-Wave, MQTT)
- Local control, privacy

The screenshot shows a web browser interface for OpenHAB. The address bar displays the URL `127.0.0.1:8080/openhab.app?sitemap=dolphin#`. The page title is "Main Menu". Under the "MQTT" section, there are four items:

- MQTT Switch 1**: A lightbulb icon and a toggle switch in the "off" position.
- MQTT Switch 2**: A lightbulb icon and a toggle switch in the "off" position.
- Office Lamp**: A lightbulb icon, a label "Main Menu" in a black box, and a toggle switch in the "on" position.
- Temperature**: A thermometer icon and a numerical value of `32.2 °C`.

Below the MQTT controls is a "Temperature Graph" showing a line chart of temperature over time. The y-axis ranges from 24 to 32, and the x-axis shows times from 17:10 to 18:00. The graph shows a sharp drop in temperature at approximately 17:45, followed by a recovery.

Time	Temperature (°C)
17:35	31.5
17:40	31.0
17:45	24.0
17:50	31.5
17:55	31.8
18:00	32.2

©2010-2014 openHAB.org

## 2010

- Nest learning thermostat
- Self-learning to reduce manual control
- Energy efficiency





## 2011

- Siri released to the public
- Voice assistant
- Natural language control
- Hands-free automation



iOS 5 (2011)



iOS 7 (2013)



iOS 9 (2015)



iOS 9.X (2016)



iOS 11 (2017)



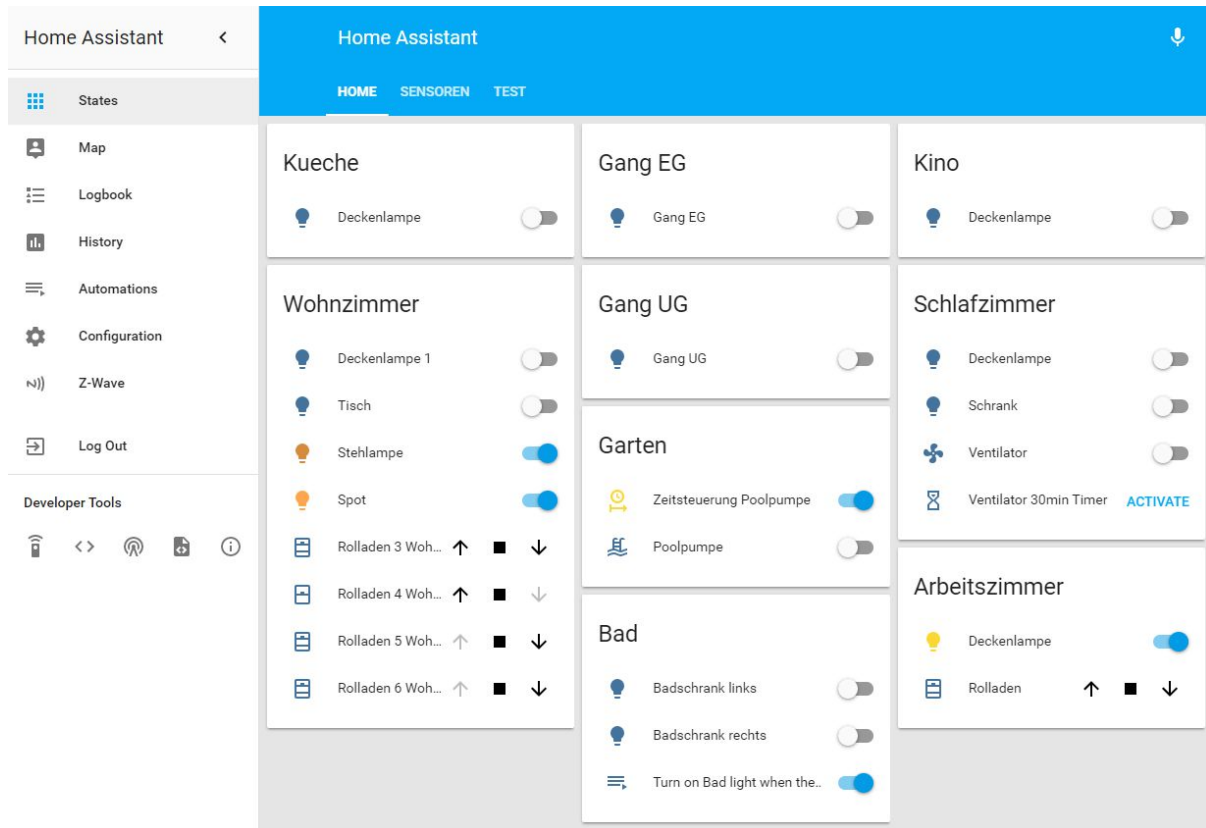
iOS 15 (2021)



iOS 18 (2024)  
Apple Intelligence

## 2013

- Home Assistant
- Open-source platform
- Local control, privacy-first
- Extensible with community support



2014

- Amazon Echo and Alexa
- Voice-controlled
- Control other devices

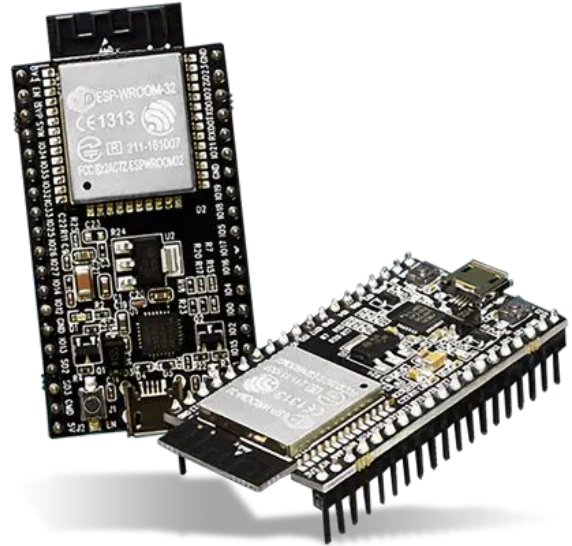


2016

- ESP32
- Wi-fi and BT enabled
- Cheap



# ESPRESSIF



# VIAM

## 2022

- Matter
- Universal smart home standard
- Wi-Fi, Thread, Ethernet



What is a  
smart home?





1990s

The internet-connected dumb device

- Smart toaster



2010s

The smart ecosystem

- Amazon Alexa, Google Assistant, Apple Home Kit
- Home Assistant, OpenHAB
- Zigbee, Z-wave



Future

?



2000s

The remote control

- Thermostat, security cameras, smart plugs
- Siri, Google Now



2020s

AI & Context-aware

- ML to predict behavior
- Energy and sustainability
- Local automation over cloud services
- Matter

## What is a smart home?



An adaptive living space where connected devices work together to enhance **convenience, security, and efficiency** to learn from user behavior to anticipate needs rather than just respond to commands.



**VIAM**

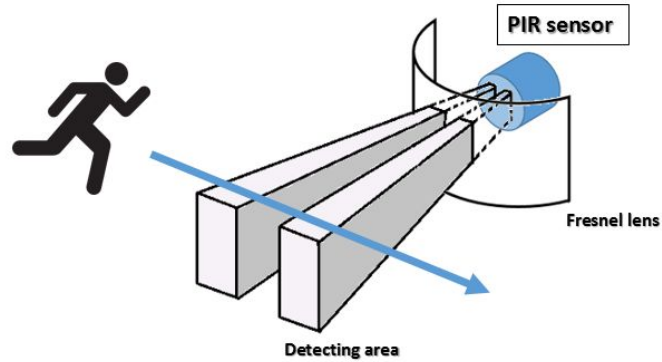
SENSORS

# Seeing the Invisible



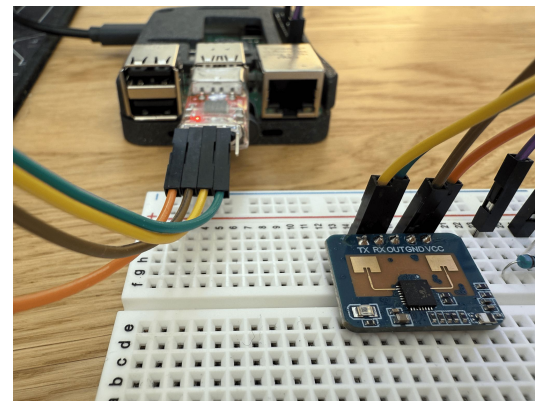
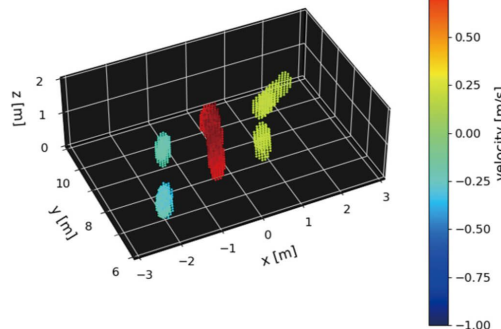
# Seeing the Invisible

- PIR-passive infrared



# Seeing the Invisible

- PIR - passive infrared
- Mmwave - millimeter wave



LOGS
CONNECT

Frame

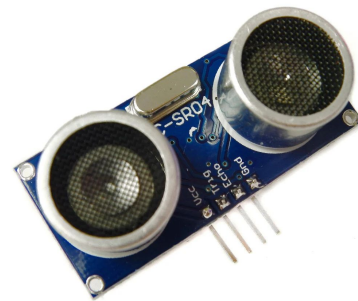
...	+		<b>GetReadings</b>	
...		<code>detection_status</code>		"No Target"
...		<code>moving_distance_cm</code>		147
...		<code>moving_energy</code>		0
...		<code>overall_distance_cm</code>		127
...		<code>static_distance_cm</code>		147
...		<code>static_energy</code>		7

▼ ◇ **kasa-switch**
generic
joyce:kasa:switch



# Seeing the Invisible

- PIR -passive infrared
- Mmwave -millimeter wave
- Ultrasonic
- Cameras
- And more!



people-detector rdk service vision

TEST

camera-1 Refresh every second

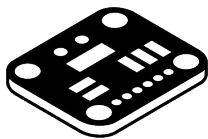
Labels	
> Person (61%)	1
> Dog	1
> Tv	1

DO COMMAND

OPERATIONS AND SESSIONS RTT 10 ms



## Choosing the right sensors



### For your consideration

- Connectivity options

Protocol	Pros	Cons	Best For
Zigbee	Low power, mesh support	Needs a hub, limited range	Smart lights, sensors
WiFi	High bandwidth, no hub	High power, congested frequencies	Cameras, high-data devices
MQTT	Lightweight, reliable messaging	Needs a broker, not for video streams	IoT messaging, sensor networks

- Prioritize Compatibility
- Balance cost vs. accuracy

### Advanced mode

- Leverage sensor networks

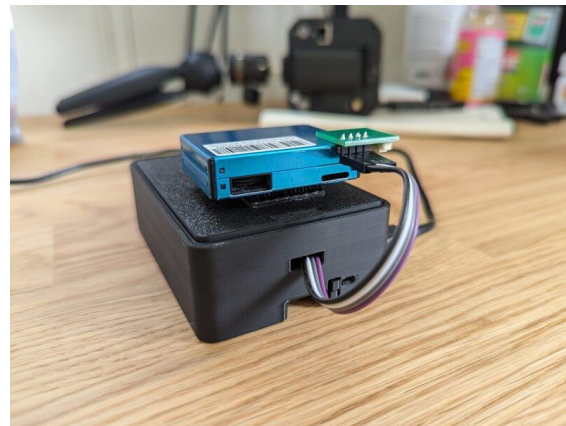
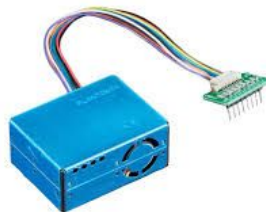
**VIAM**

ACTUATORS

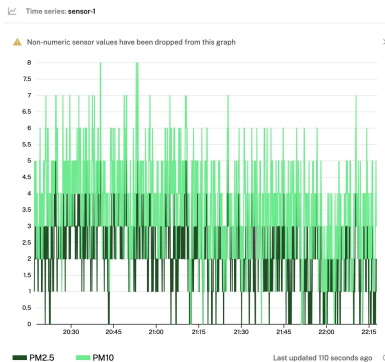
When your home learns to breathe



# When your home learns to breathe



- CO2-carbon dioxide
- PM2.5-particulate matter
- VOCs-volatile organic compounds



◇ **sensor-1** rdk component sensor

✕ TEST

Manual refresh

**GetReadings**

particles_03um	201
particles_05um	180
particles_100um	0
particles_10um	0
particles_1um_05	0





ACTUATORS

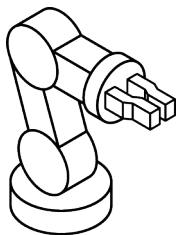
# When your home learns to breathe

- Send an alert
- Activate an air purifier
- Turn on an exhaust fan or HVAC intake
- Open a smart window or ventilation system
- **Baby steps:** smart plug with a box fan





## Choosing the right actuators



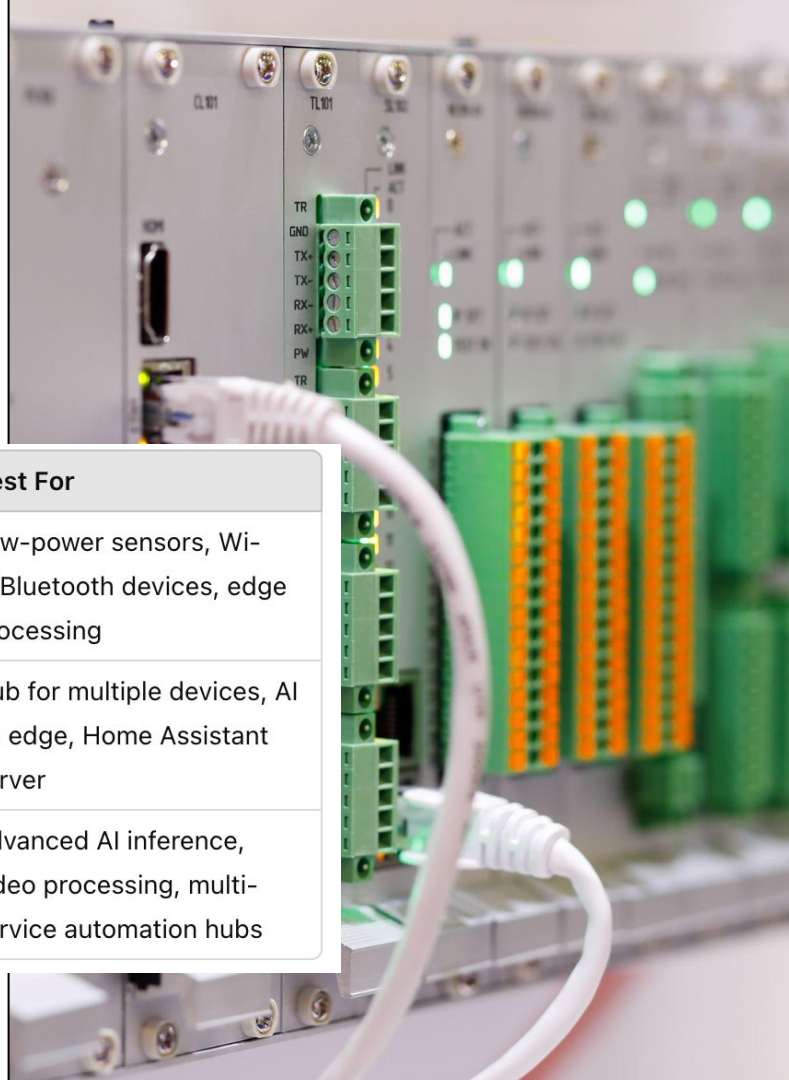
### For your consideration

- Identify the end action
- Consider power requirements
- Balance responsiveness vs reliability
- Prioritize compatibility

### Baby steps

- Begin with a smart plug for basic on/off control of a lamp or appliance

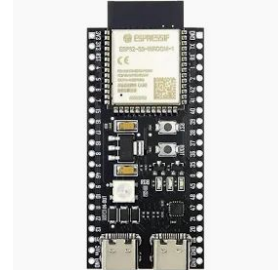
# Choosing the right compute behind the automation



Board	Pros	Cons	Best For
<b>ESP32 (Microcontroller)</b>	Energy-efficient, built-in Wi-Fi/Bluetooth, real-time applications	Limited RAM/storage, requires more programming	Low-power sensors, Wi-Fi/Bluetooth devices, edge processing
<b>Raspberry Pi (SBC)</b>	Versatile, strong community support, broad OS support	Power-hungry, SD card reliability issues	Hub for multiple devices, AI on edge, Home Assistant server
<b>Beelink (Mini PC)</b>	High performance, supports Windows/Linux, multiple OS options	Expensive, higher power consumption	Advanced AI inference, video processing, multi-service automation hubs

# Choosing the right compute behind the automation

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ESP32-S3



Pi AI HAT+



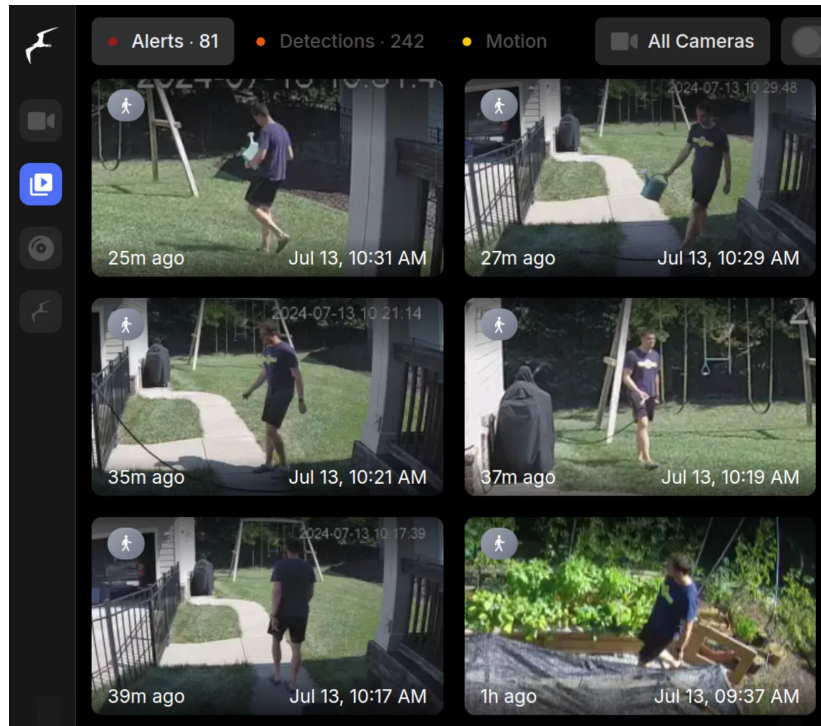
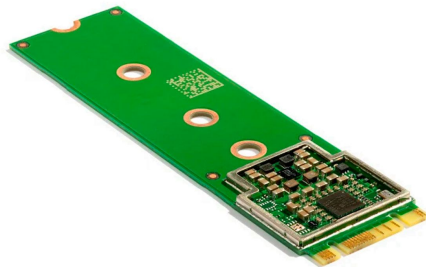
Coral TPU



DECISIONS

# Choosing the right AI

- Frigate - Network video recorder (NVR)



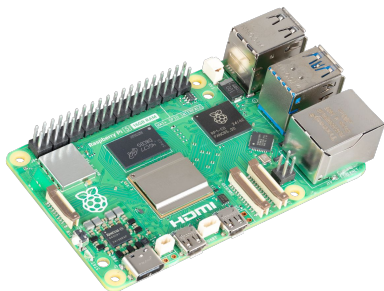


DECISIONS

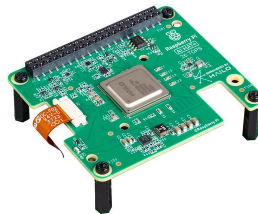
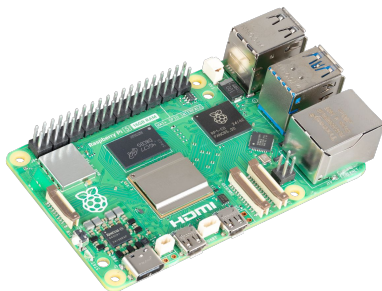
# Choosing the right AI

- Viam integration with Home Assistant

Home Assistant



TFLite, COCO



Viam 'Detect Objects in Images'

Action: Viam: Detect Objects in Images

Get a list of detected objects from an image.

Viam machine: Home - assistant

Detector Name: vision-1

Confidence:  0.6

Filepath:

Camera Entity:  Backyard

**Yard Alert**

Detected Person:

2 minutes ago

DISMISS

DISMISS ALL



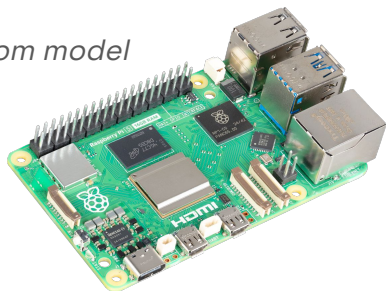


DECISIONS

# Choosing the right AI

- Refill snack dispenser

*custom model*



The screenshot shows the VIAM web interface. At the top, there are navigation tabs: VIAM, FLEET, DATA, REGISTRY, DOCS, TRY VIAM, and DevR. Below this is a sub-navigation bar with ALL DATA, DATASETS, TRAINING, MODELS, and QUERY. The main content area is divided into a left sidebar for filters and a main grid for images.

**Filters:**

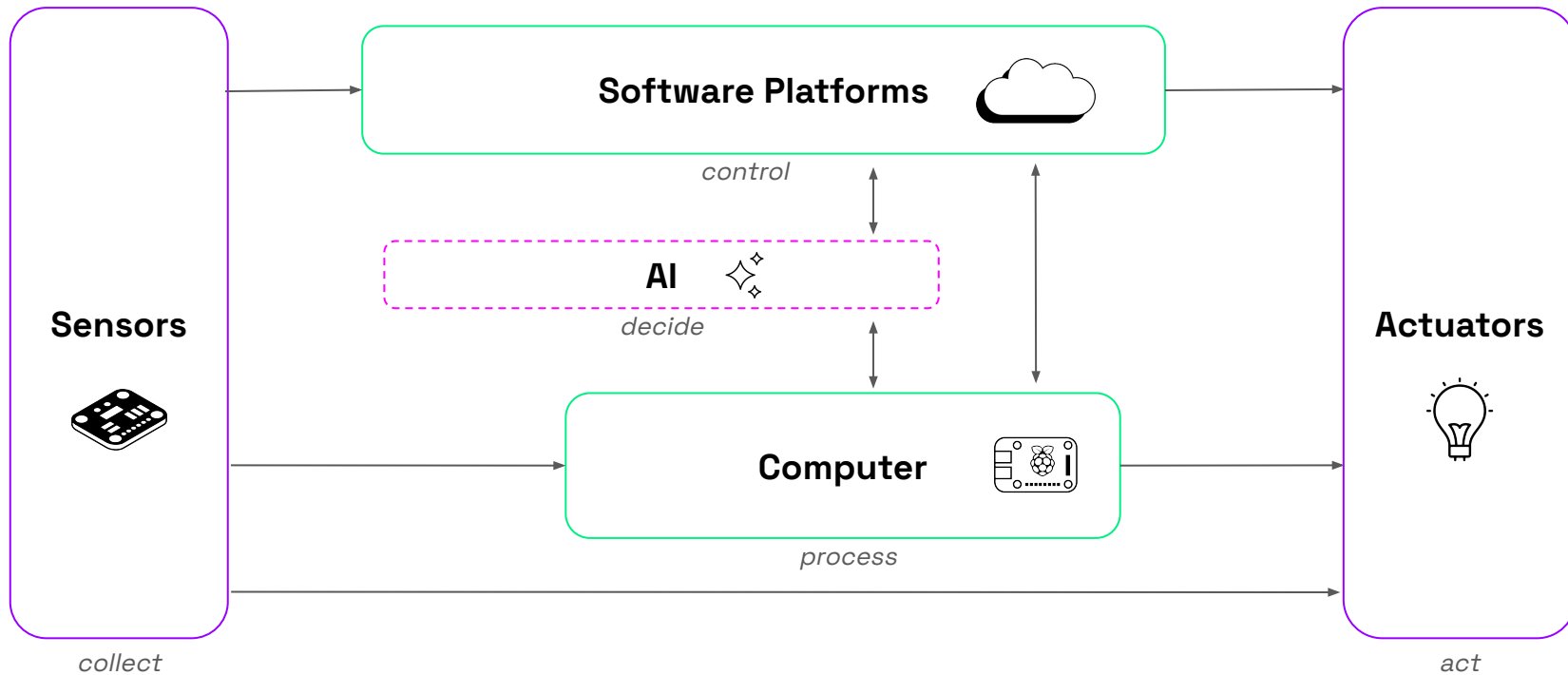
- Location: snacks
- Machine name: All
- Machine ID: 11247728-8a06-44df-980e-cc09e9f
- Machine part name: All
- Machine part ID: b4be134d-a8b5-4d85-aeda-6e0ab3
- Component name: camera-1
- Component type: camera
- Method: All
- Start time (PST): 02/25/2025
- 01:37:46 PM
- End time (PST): mm/dd/yyyy

**Images:**

The main grid displays a series of images showing a snack dispenser's camera view. The images are arranged in a 4x6 grid. The first three columns show the dispenser with a pile of colorful snacks. The fourth column shows the dispenser with a dark, empty tray. The fifth and sixth columns show the dispenser with a pile of snacks, with a hand visible in the first image of the fifth column, suggesting the process of refilling or interacting with the dispenser.

*codelab*








AUTOMATIONS

# Context-aware automations

- Instead of a notification that someone is in your yard, raise a barrier to permit access or sound an alarm to scare them away

### Yard Alert

Detected Person:



2 minutes ago

DISMISS

DISMISS ALL

#### Viam 'Detect Objects in Images'

Action  
Viam: Detect Objects in Images

Get a list of detected objects from an image.

Viam machine: Home - assistant

Detector Name: vision-1

Confidence: 0.6

Filepath:

Camera Entity: Backyard

Response variable: people\_detections







AUTOMATIONS

# Context-aware automations

- Instead of logging spikes in air quality, trigger an air purification system or identify root cause of fluctuations

ALL DATA DATASETS TRAINING MODELS QUERY

Filters Reset

Open as query

Location: Joyce's House

Machine name: All

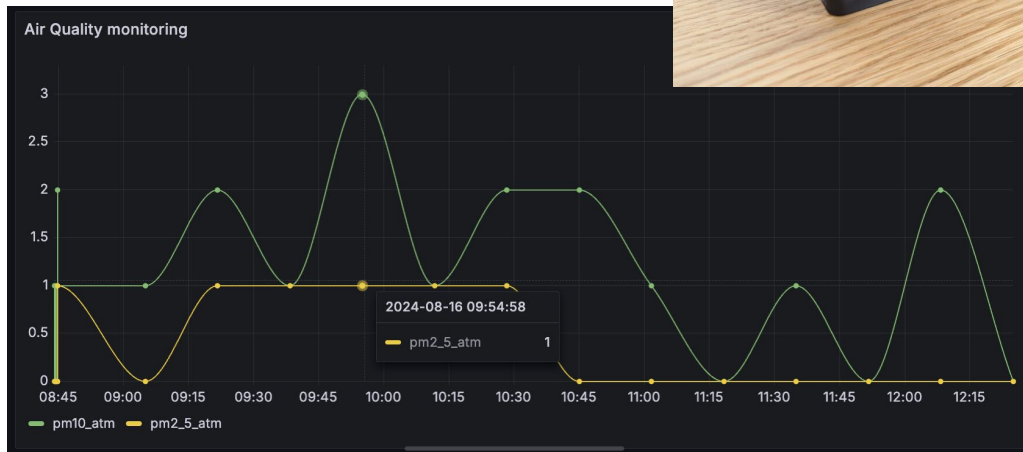
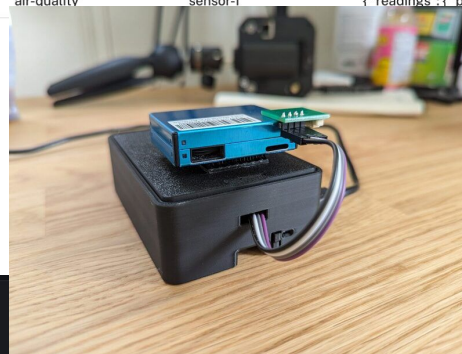
Machine ID: 859682e5-5922-4f3d-b651-ecae4e

Machine part name: All

Machine part ID: 7e8e7e08-a6ea-4104-a114-59ab59f

Images Files Point clouds **Sensors** Export

Time (PDT)	Location	Machine Name	Component name	Reading
10/07/24, 1:32:34.525 PM	Joyce's House	air-quality	sensor-1	{"readings":{"particles_05um":170,"pm1_0_atm":1}}
10/07/24, 1:32:32.428 PM	Joyce's House	air-quality	sensor-1	{"readings":{"pm2_5_CF1":2,"pm10_CF1":1}}
10/07/24, 1:32:29.284 PM	Joyce's House	air-quality	sensor-1	{"readings":{"pm2_5_CF1":2,"particles_05um":170,"pm10_CF1":1}}
10/07/24, 1:32:26.140 PM	Joyce's House	air-quality	sensor-1	{"readings":{"pm2_5_CF1":2,"pm10_CF1":1}}
10/07/24, 1:32:22.986 PM	Joyce's House	air-quality	sensor-1	{"readings":{"pm2_5_atm":1,"particles_05um":170,"pm10_atm":1}}
10/07/24, 1:32:19.844 PM	Joyce's House	air-quality	sensor-1	{"readings":{"pm10_CF1":1,"pm1_0_atm":1}}
10/07/24, 1:32:16.698 PM	Joyce's House	air-quality	sensor-1	{"readings":{"particles_25um":0,"partic...
10/07/24, 1:32:13.554 PM	Joyce's House	air-quality	sensor-1	{"readings":{"particles_25um":0,"pm1_0...





AUTOMATIONS

# Context-aware automations

- Instead of an alert when a leak is detected, a smart home shuts off the water valve automatically.



# Thinking beyond just “on” and “off”

- Leverage sensor networks
- Someone in the room?
  - Presence
  - Person vs cat
  - Time of day
  - Low light
  - Temperature





## CONTEXT-AWARE AUTOMATIONS

# Thinking beyond just “on” and “off”

- Choosing actuators that adapt (respond proportionally)
- Someone is in the room
  - Turn on the light based on ambient light
  - Update the thermostat according to personal preferences
  - Trigger air filtration based on occupancy





1990s

The internet-connected dumb device

- Smart toaster



2010s

The smart ecosystem

- Amazon Alexa, Google Assistant, Apple Home Kit
- Home Assistant, OpenHAB
- Zigbee, Z-wave



Future

Adaptive & Intent-based

- AI models to anticipate needs
- Edge computing
- Ecosystem compatibility



2000s

The remote control

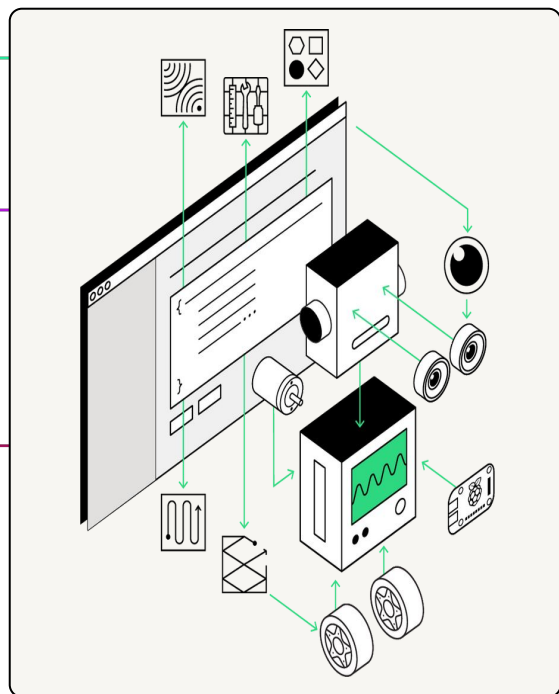
- Thermostat, security cameras, smart plugs
- Siri, Google Now



2020s

AI & Context-aware

- ML to predict behavior
- Energy and sustainability
- Local automation over cloud services
- Matter



## How to not rely on cloud services

Privacy, speed, reliability

- Use open-source software and models
- Train in the cloud, deploy locally
- Adopt local protocols


## The smartest home is one that you control

Cost, control, privacy, resilience

- Leverage sensor networks
- Choose interoperability
- Know when to self-host
- Know how to prompt AI



# Thank You!

 joycejetsen | viamrobotics

Win a Viam rover!



Presence detector



Air quality monitor



People detection in Home Assistant



Snack dispenser

