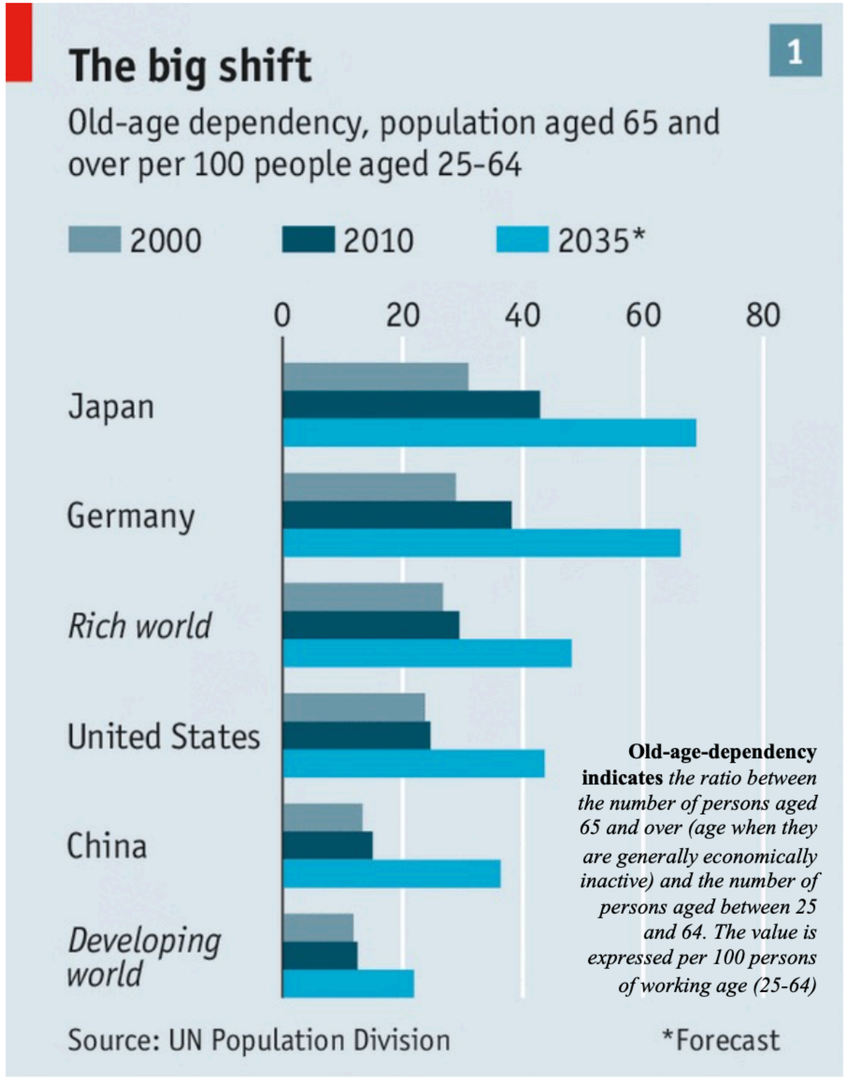
Health Monitor System

Hannah Jiang 12011742
Tutor Dr. Wan Fang

DS323 AI in Design

Thu Nov 2 2022

Problem Identified



Humans spend a considerable portion of time at home. Around the world, the population is aging. This would increase the importance of independent living, chronic disease management, physical rehabilitation and mental health of older individuals in daily living spaces.

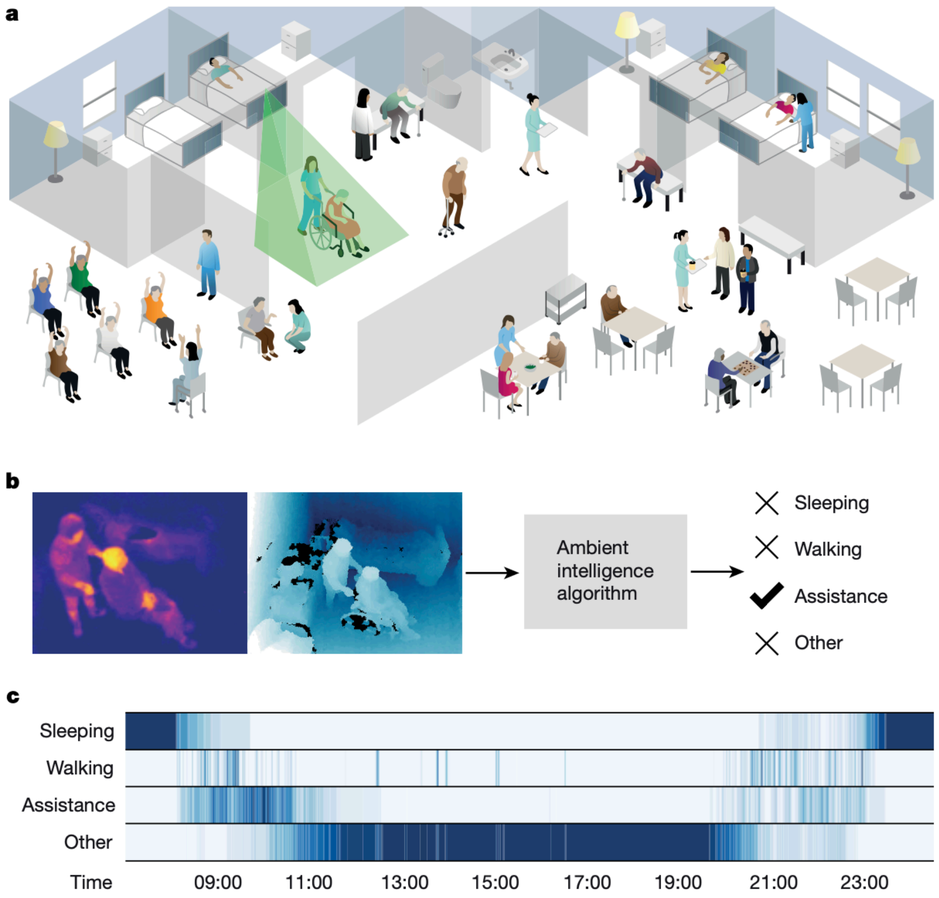
1/5 falls causes a serious injury

- **a broken bone or head injury Fear of falling**
- **seriously affect an aging adult's quality of life**
- **keep a person from being active and thriving**

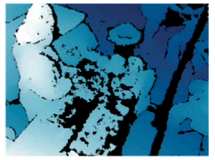
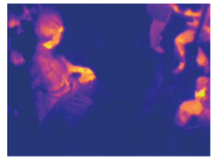
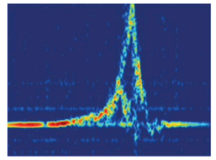
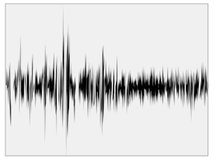
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5179143/

Lecture research

Illuminating the dark spaces of healthcare with ambient intelligence



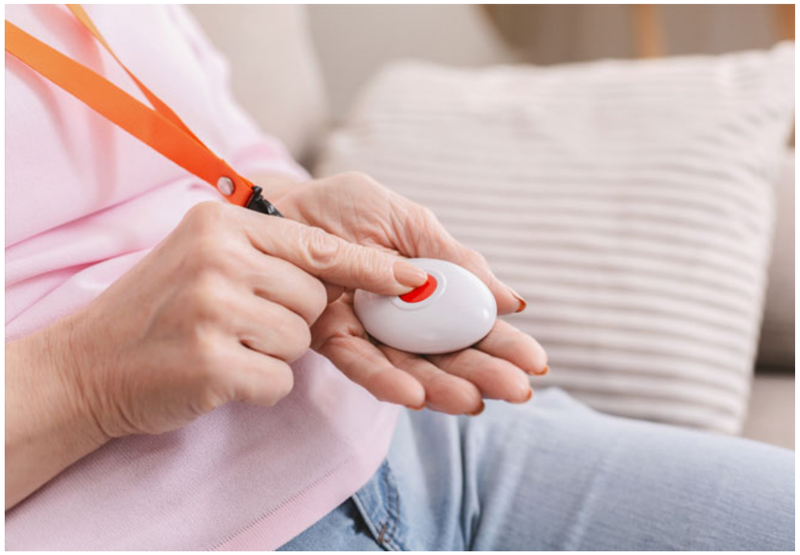
Review

	Camera	Depth sensor	Thermal sensor	Radio sensor	Acoustic sensor
Sensory information	RGB, colour, video	Lidar	Infrared	Radar, Wi-Fi	Microphone
Function	Measures colour (visible light)	Measures distance to objects	Measures surface temperature	Estimates distance and velocity	Measures air pressure waves (sound)
Sampling rate	30 Hz (1,920 × 1,080)	30 Hz (1,280 × 720)	10 Hz (640 × 480)	800 Hz	44.1 kHz
Bit depth	24 bits	16 bits	16 bits	32 bits	16 bits
Uses	Object recognition, person detection	3D object detection, robotic navigation	Night vision, equipment safety	Motion detection, object detection	Speech recognition, event detection
Data visualization					

The fear of falling can be reduced due to the perceived safety benefit of fall-detection systems.
Wearable devices-96%
Ambient sensor-97%
Bluetooth-98%
Depth & radar-98%

file:///Users/jianghanxi/Library/Containers/com.tencent.xinWeChat/Data/Library/Application%20Support/com.tencent.xinWeChat/2.0b4.0.9/ade8bb29e97454d8f0b6c3e1f16fb0aa/Message/MessageTemp/14e9dc93bf5337907220c3d20ccb807f/File/Illuminating%20the%20dark%20spaces%20with%20ambient%20intelligence.pdf

Market

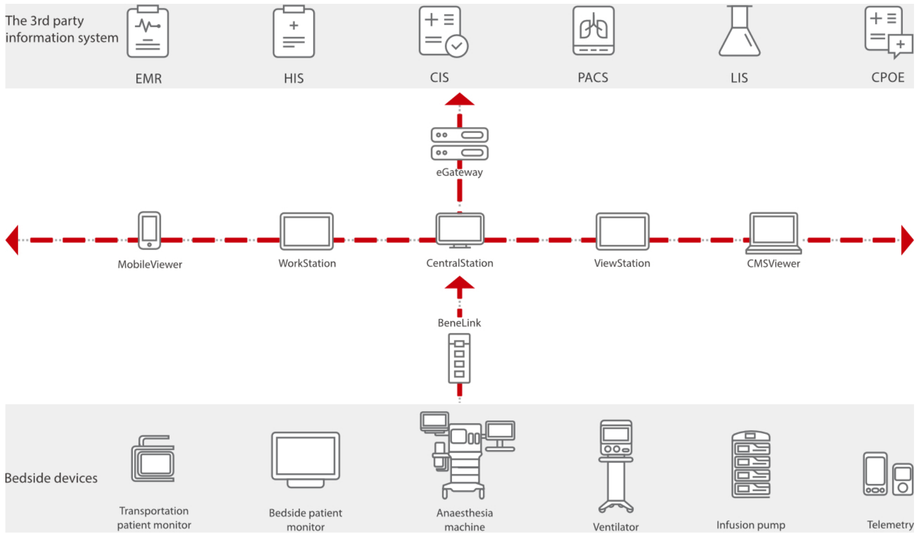


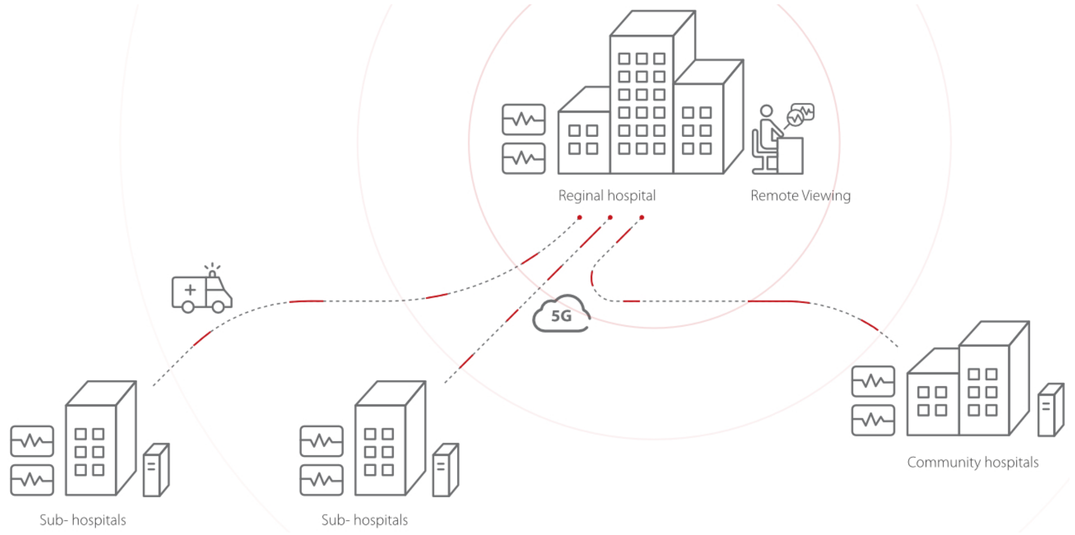
Panic button & Monitoring watch:
Wearable device
Cannot detect the falling by themselves

https://www.connectsecurity.com/home-security/panic-button
https://www.unaliwear.com/unaliwear-home-clp3/?

Market

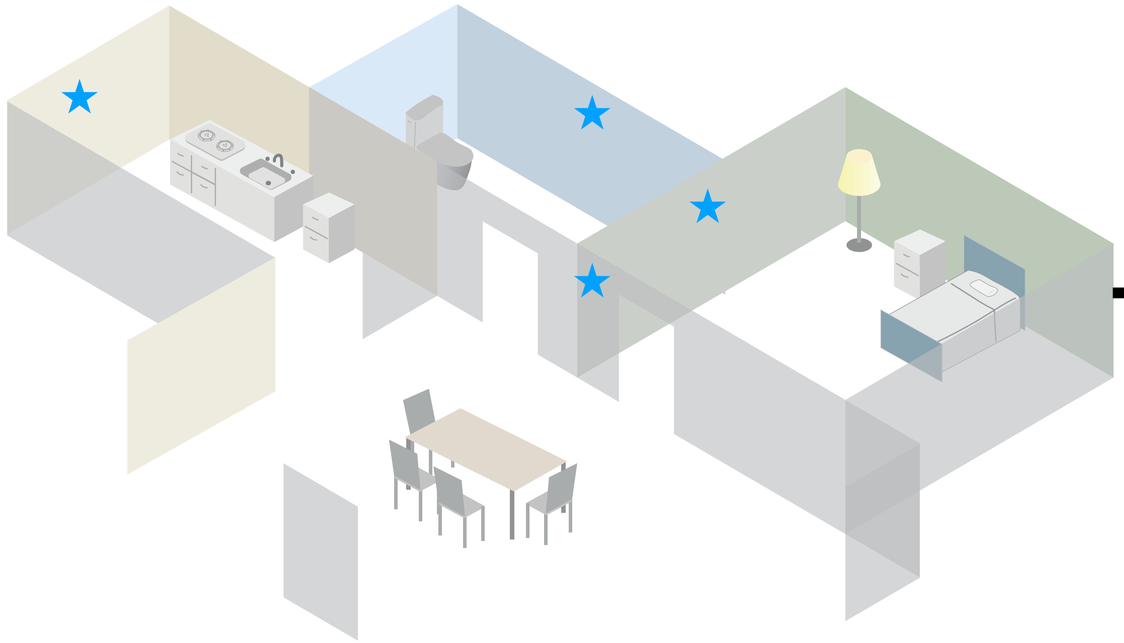
mindray™

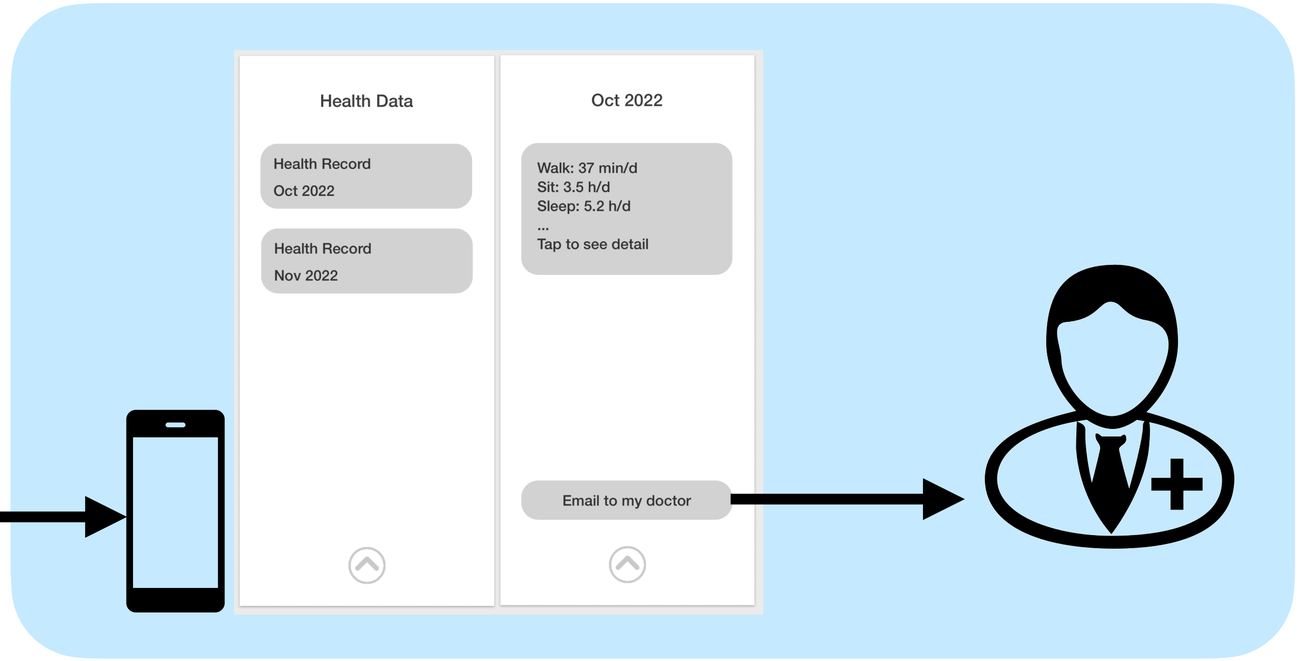


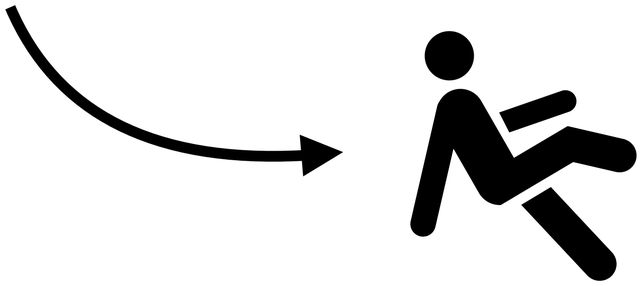


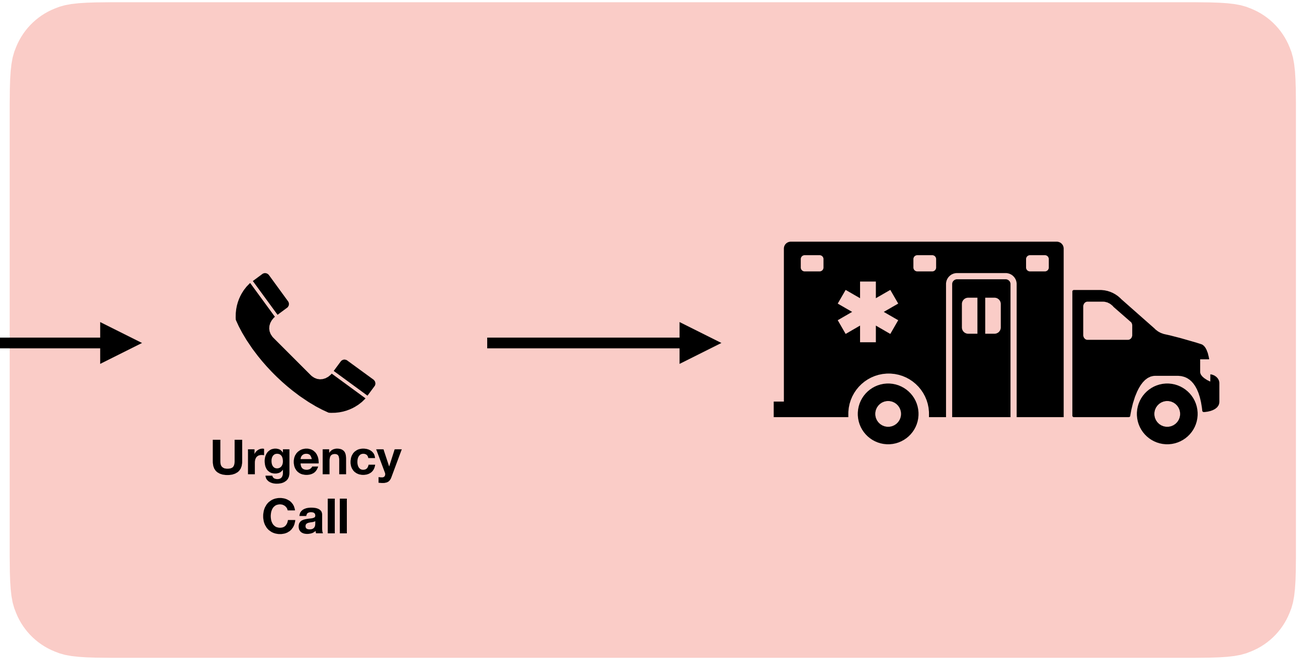
Patient centric data collection
Overall regional care
⬇️
Patient to Doctor

User Flow




Health Data
Health Record
Oct 2022
Health Record
Nov 2022
Oct 2022
Walk: 37 min/d
Sit: 3.5 h/d
Sleep: 5.2 h/d
...
Tap to see detail
Email to my doctor




Urgency
Call

CNN

1. Training

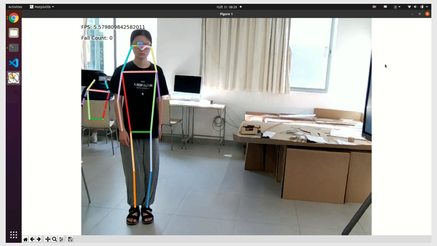
Visualize a few images

Let's visualize a few training images so as to understand the data augmentations.

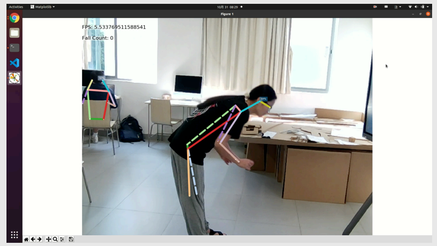
[4]:
```
def imshow(inp, title=None):
    """Imshow for Tensor."""
    inp = inp.numpy().transpose((1, 2, 0))
    mean = np.array([0.485, 0.456, 0.406])
    std = np.array([0.229, 0.224, 0.225])
    inp = std * inp + mean
    inp = np.clip(inp, 0, 1)
    plt.imshow(inp)
    if title is not None:
        plt.title(title)
    plt.pause(0.001)  # pause a bit so that plots are updated


# Get a batch of training data
inputs, classes = next(iter(dataloaders['train']))

# Make a grid from batch
out = torchvision.utils.make_grid(inputs)

imshow(out, title=[class_names[x] for x in classes])
```

2. Validation Prediction

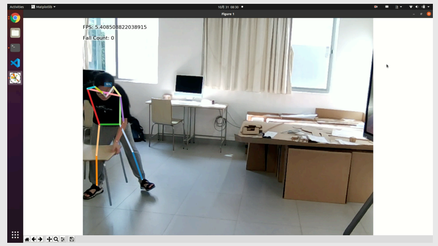
Exoskeleton Training



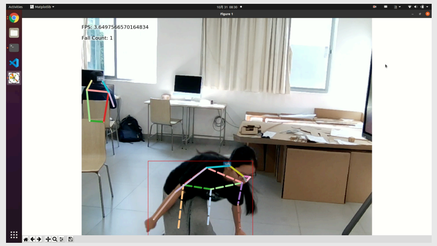
Stand



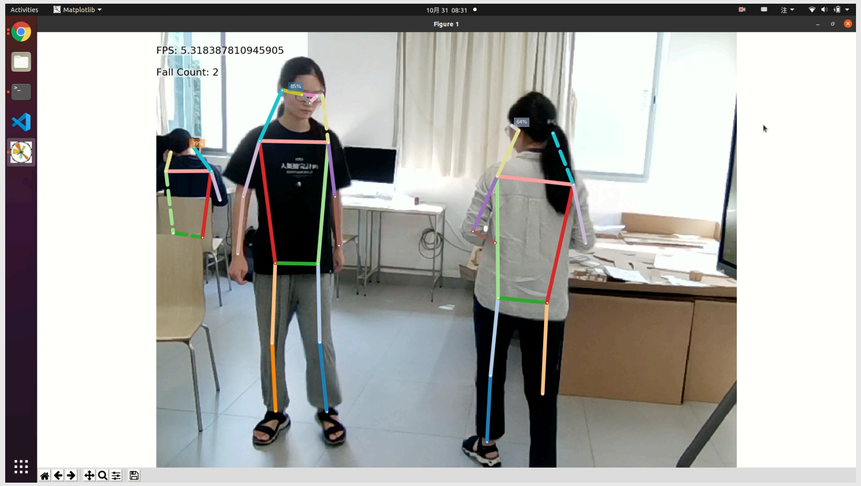
Bend, crouch



Sit



Lie

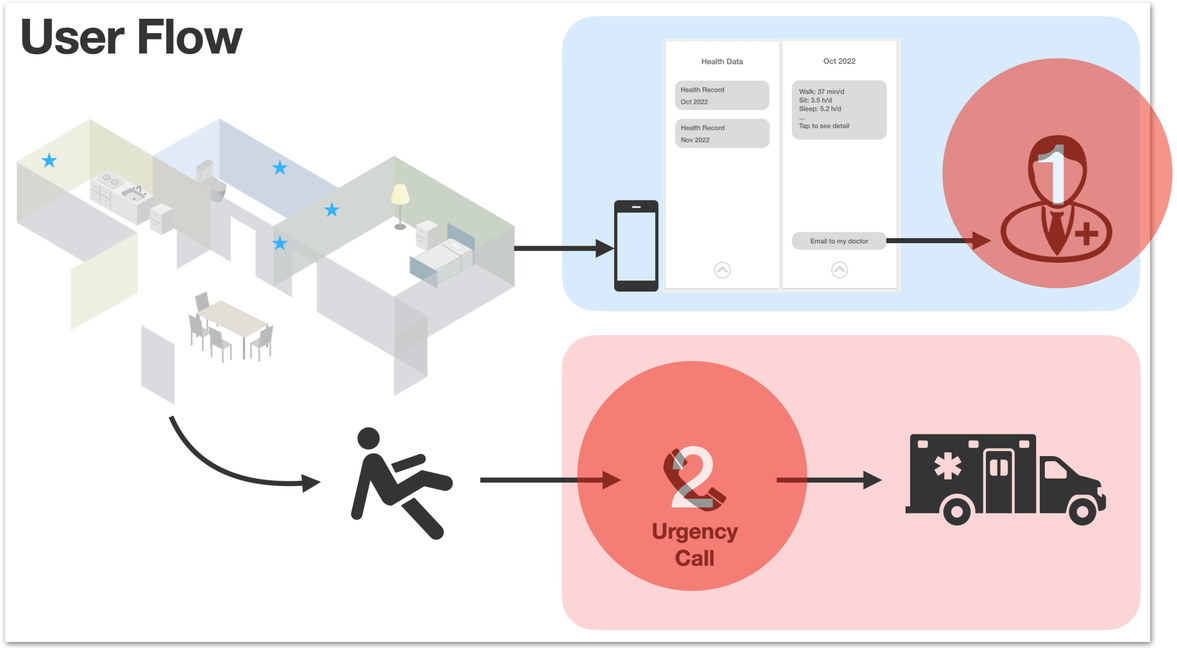


With other participates

False positive:
Subject crouch while test detects a fall

False negative:
Subject lie while test does not detect a fall

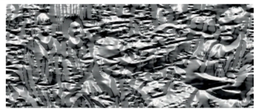
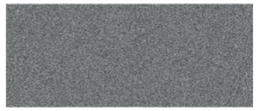
Ethic Issue



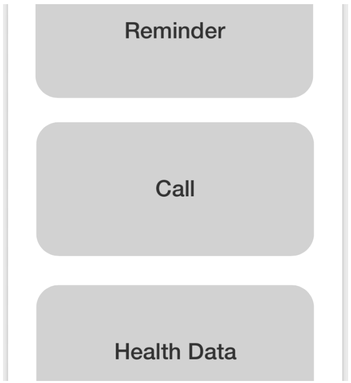
1.1

1.2

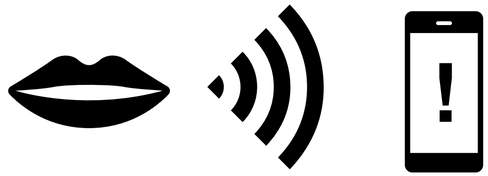
Informed Consent: whether system can deliver the data to the three party without users' concern

Method	Description	Computing hardware	Transformed result
Differential privacy	Adds noise to the data; minimally affects population-level analysis	Edge computer	
Face blurring	Detects and blurs human faces	Sensor, edge computer	
Dimensionality reduction	Reduces the input size by reducing the number of features	Sensor, edge computer	
Body masking	Replaces peoplewith faceless avatars	Edge computer	
Federated learning	Edge devices learn locally, then sends gradient updates to central server	Edge computer, centralized server	
Homomorphic encryption	Enables predictions to be made from encrypted data	Edge computer, centralized server	

2.1 **Positive Action**



2.2 **Passive Reaction**



Moreover

- **Think about combine the system with assistive robot**
- **Optimize the ML part for higher accuracy**

Further problem? Whether they want a cam-like sensor in their bathroom

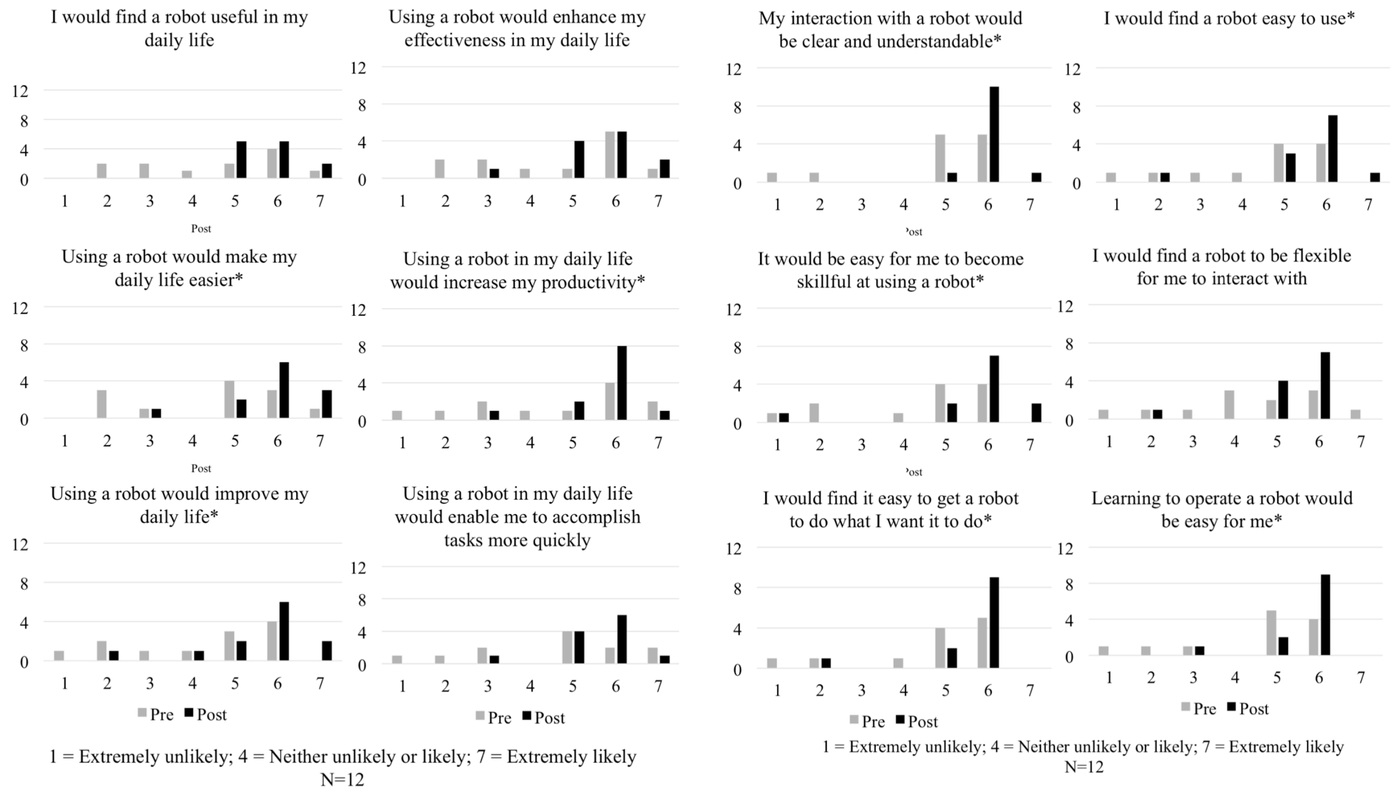
Your job? As manager incontered what problem?

1. Lying on the ground
2. Indirectly contact with urgency office

Human appearance or cute animal?…
Kids interaction with design!

Noise cancellation earphone-vibrate

Sensor: microphone; frequency is different
Lots of belt design-different?
Uncomfortable



Look for different rather than similarity?
Robot cannot goes like human.

https://journal.gerontechnology.org/archives/62befaf7426e4f1ba03b343dd4319cef.pdf