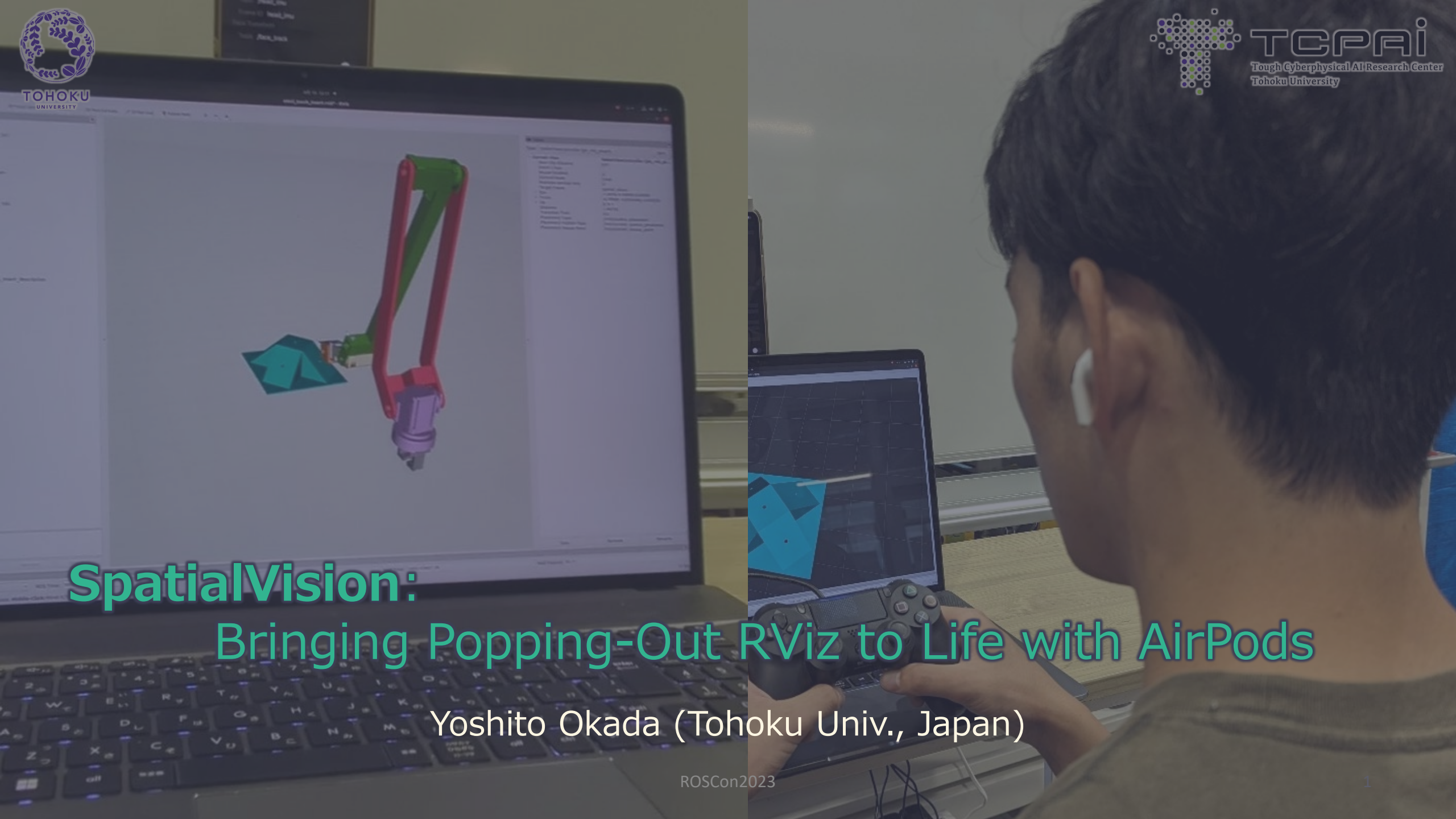


SpatialVision:
Bringing Popping-Out RViz to Life with AirPods

Yoshito Okada (Tohoku Univ., Japan)

About Me: Yoshito OKADA

- Project Associate Professor, Tohoku University, Japan
- yoshito-okada

Search and Rescue robots
[Okada+, IROS2010]

Bridge inspection drones
[Mizutani+, IROS2013]

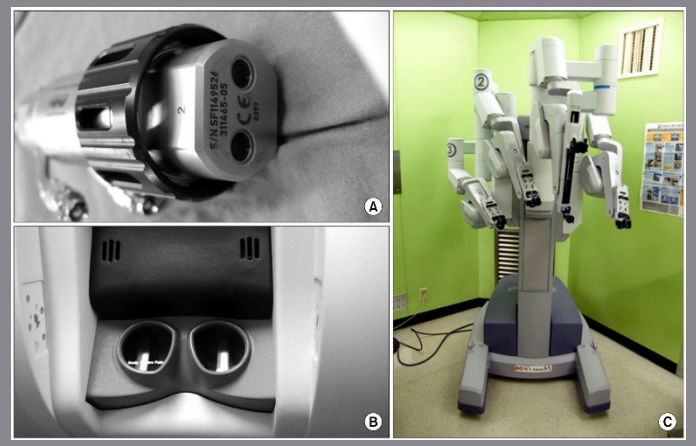
Tracked vehicle simulation
[Okada+, ICRA2020]

Overlaid fiducial markers
[Okada+, ICRA2021]

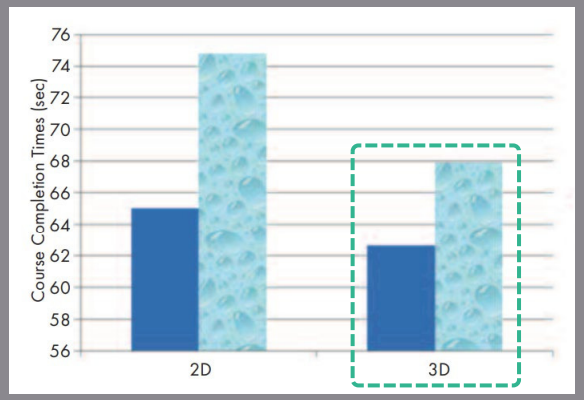
Today's topic:
Stereoscopic system **SpatialVision**

* Standard display

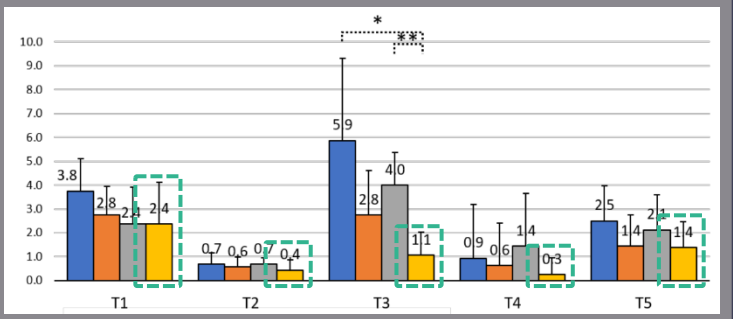
Stereoscopic System (SS) is useful



Surgical robots often employ SS
[Nam+, 2012]



SS **expedited UGV's movement** through tight spaces
[Chen+, 2010]

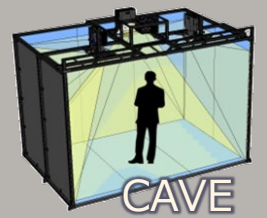


SS **reduced collision** with surroundings
[Luo+, 2021]

Would also be useful in design

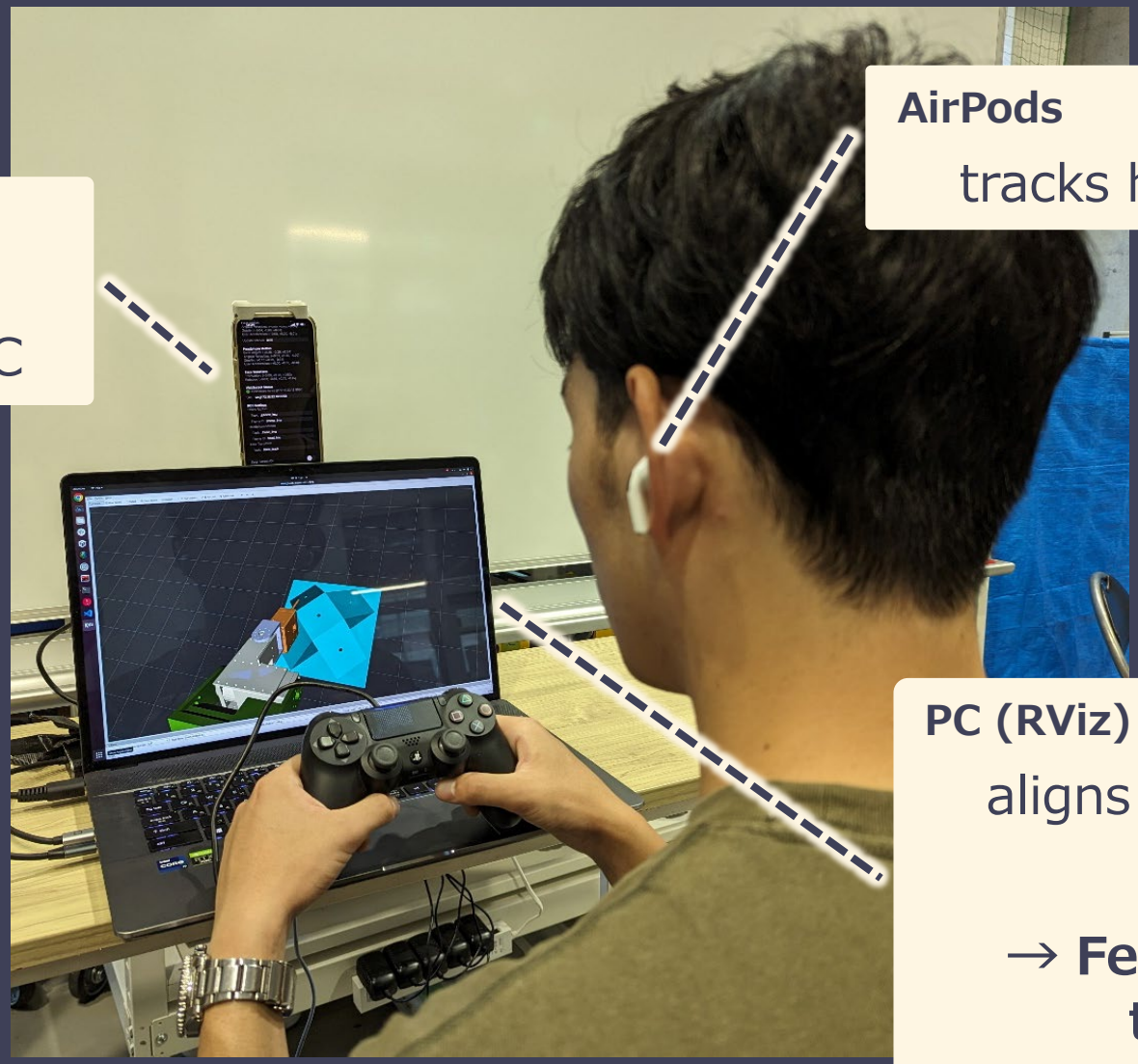
But SS can be bulky & costly

Display

Head tracking	Projectors	LC shutter gl. + disp.	Polarized gl. + disp.	Lenticular display	HMD	Standard display
MoCap	 CAVE	$$$	$$$	$$$	Oculus, HTC	$$
VSLAM					Meta, Apple	
Face track camera				Sony, ASUS		
IMU		$$	$$	$$	$$	$
None						

SpatialVision aims **low complexity & cost**

Hardware: AirPods + iPhone + PC



iPhone

forwards head pose to PC

AirPods

tracks head with built-in IMU

PC (RViz)

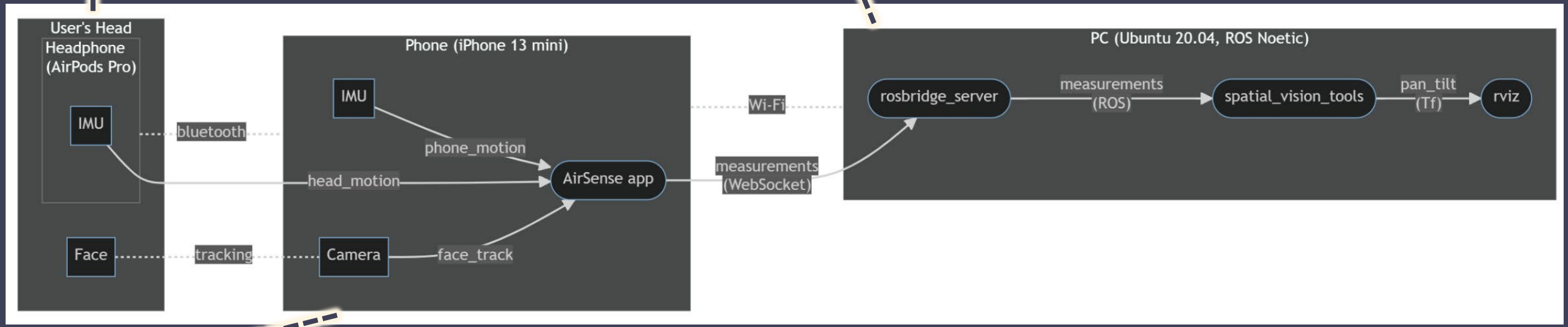
aligns Rviz's camera angle with head pose

→ **Feels 3D due to the motion parallax**

Software: iOS app + ROS 1/2

- Built-in IMU
  (AirPods Pro Gen 2, etc.
  originally for spatial audio)

- Camera pose
  binding to a Tf frame
  (FrameAligned mode)



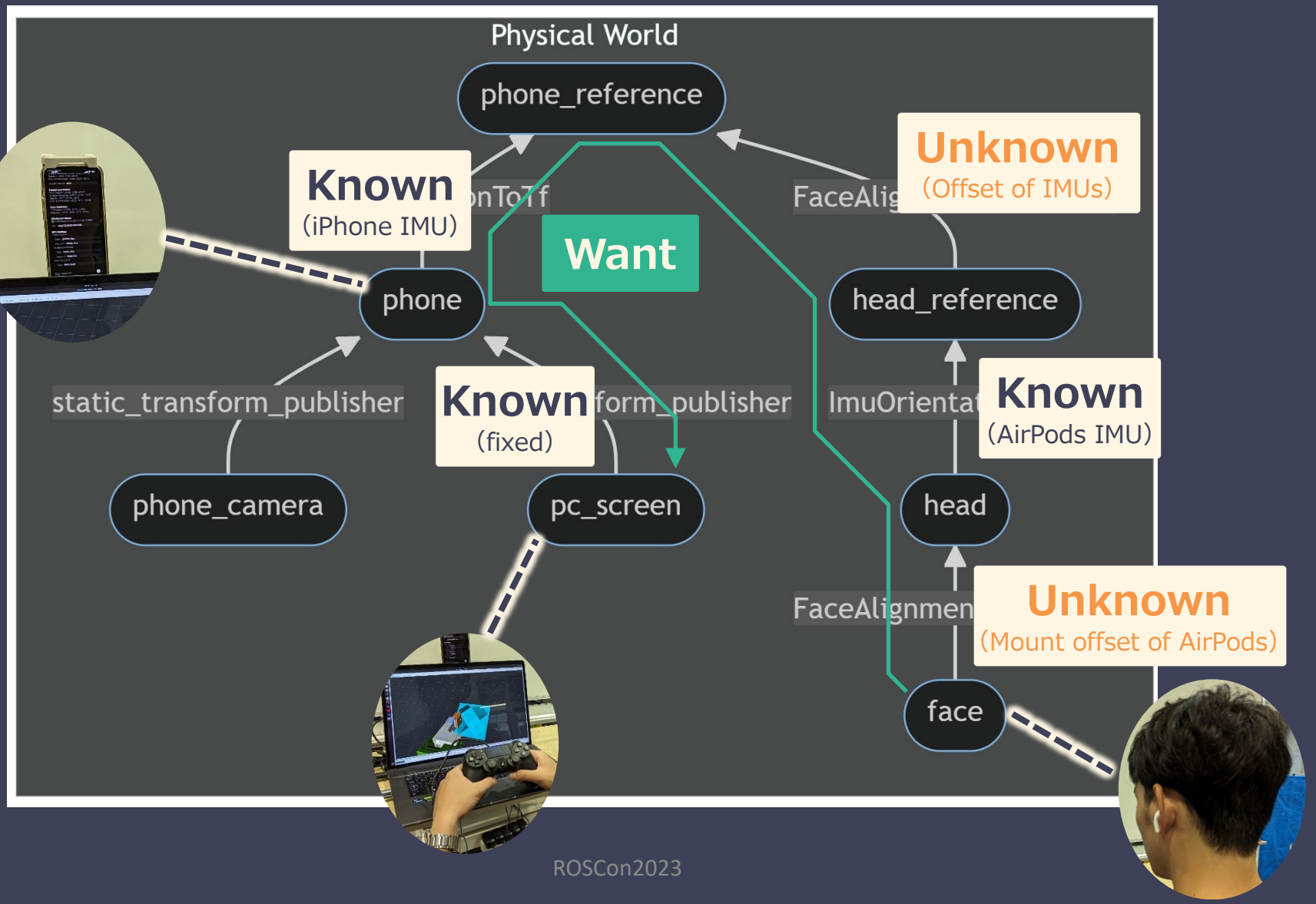
- Access to AirPods IMU
  via API (Core Motion. iOS14 or later)

What if **iOS app** that streams AirPods IMU to **Tf** ?

AirSense:
App streaming iPhone & AirPods sensors to ROS

- iOS15 or later
- ROS1/2
  (requires rosbridge)
- AirPods IMU
- iPhone IMU
- Face track
  by front cam
- Useful as
  a standalone app
  (MagSafe attachable IMU
  that can stream
  via WiFi or mobile)

Tf handles pose between PC & user



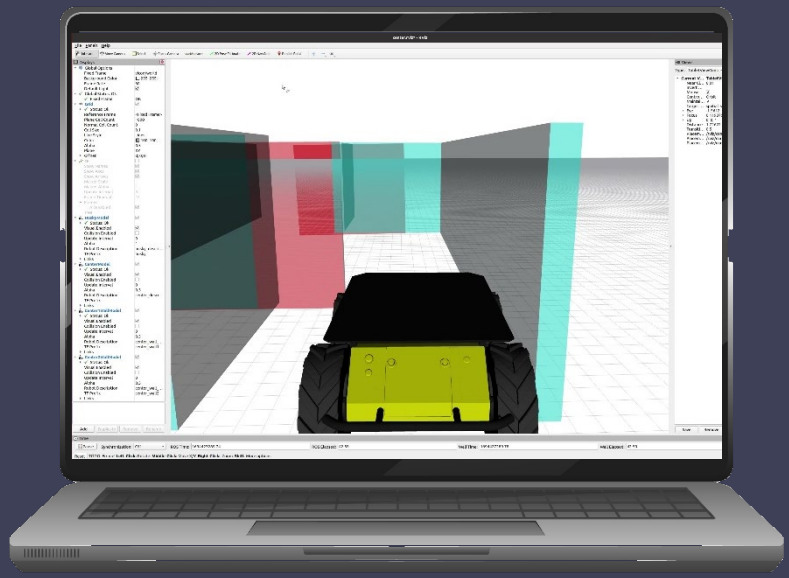
Calibrate “Unknown”s in 10 seconds

- Estimate unknown offsets by matching head track with the iPhone’s front cam
- No camera required once calibrated
  → works out of FOV
  or in a public place
- ROS1 Noetic
  or ROS2 Humble

SpatialVision finally works!

Stars / Issues / PRs are welcome!

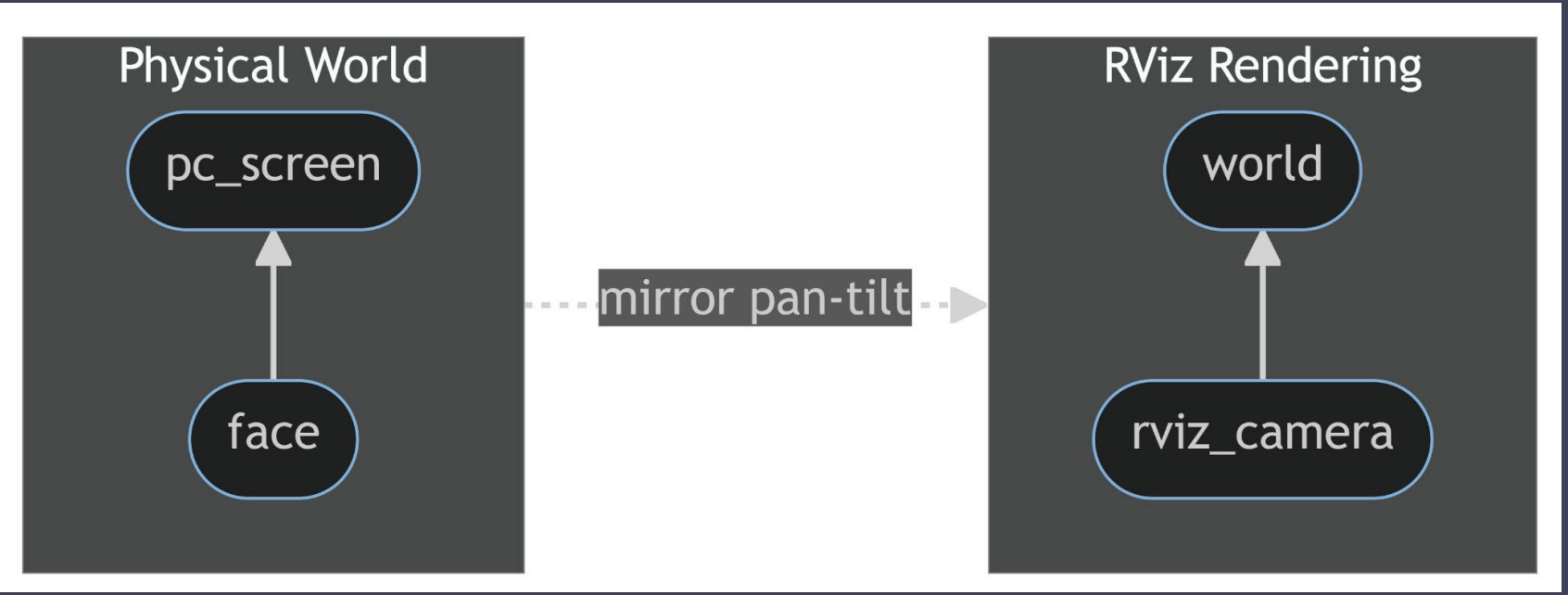
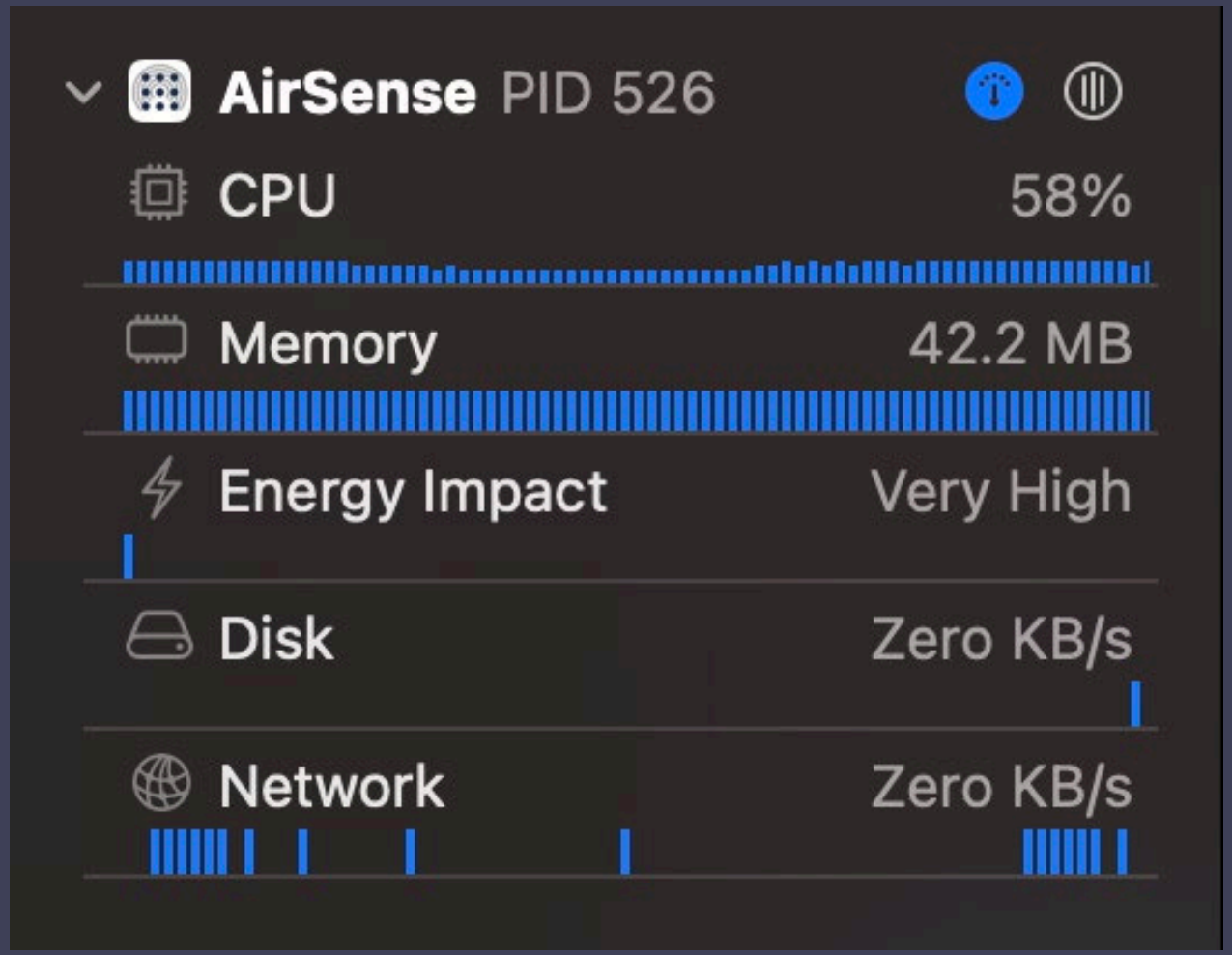
yoshito-okada/AirSense



yoshito-okada/spatial_vision

* Code will be committed
once a paper has been published

ユーザとRVizの視点をTfで同期



ユーザとRVizの視点をTfで同期