Tracking

Tue, July 21 (Week 5)

Head Tracking

Head tracking is a computational problem of converting

Signals from sensors:

accelerometer, gyroscope, magnetometer, and color/depth cameras

To *position and rotation* of the headset in the *real world.*

Position vs. Velocity (Angle vs. Angular Velocity)

There are sensors good at accurately knowing the current position (or angle)

: magnetometer, color/depth cameras (outside of AR, ruler)

And that are good at quickly catching the velocity (or angular velocity)

: accelerometer, gyroscope (outside of AR, speed camera)

Sensor Fusion

Gyroscope: quality data source for angular velocity

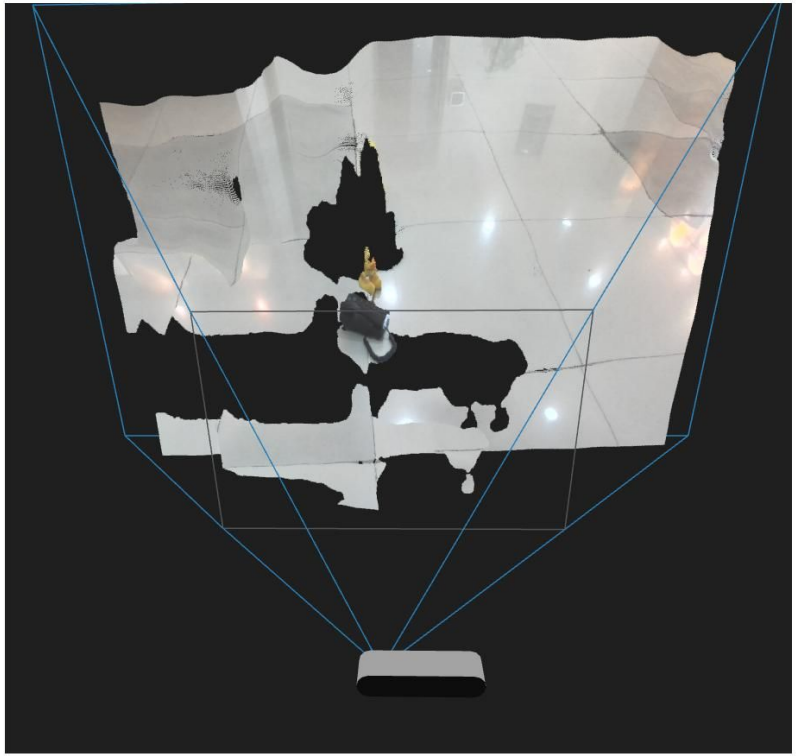
Magnetometer: quality data source for the absolute angle

Gyroscope + Magnetometer: rotation value quickly responding to quick motions that is also correct

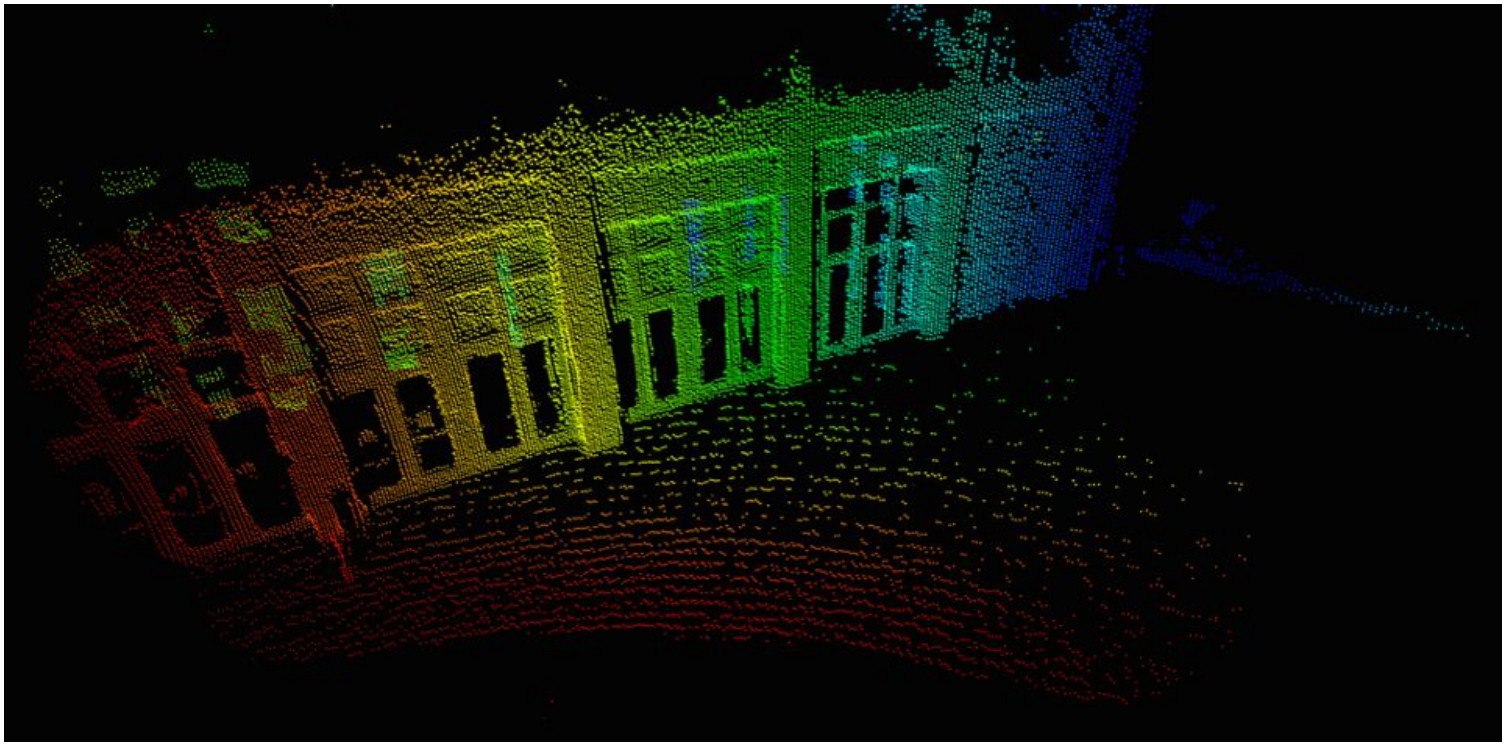
Point Cloud

View Left Data Depth

Depth FPS: 16Hz



Point Cloud



Iterative Closest Point (ICP; Besl & McKay, 1992)

Algorithm matching two point clouds to each other with the combination of Translation, Rotation, and Scaling (the TRS of computer graphics).

Kinect Fusion (Newcombe et al., 2011)

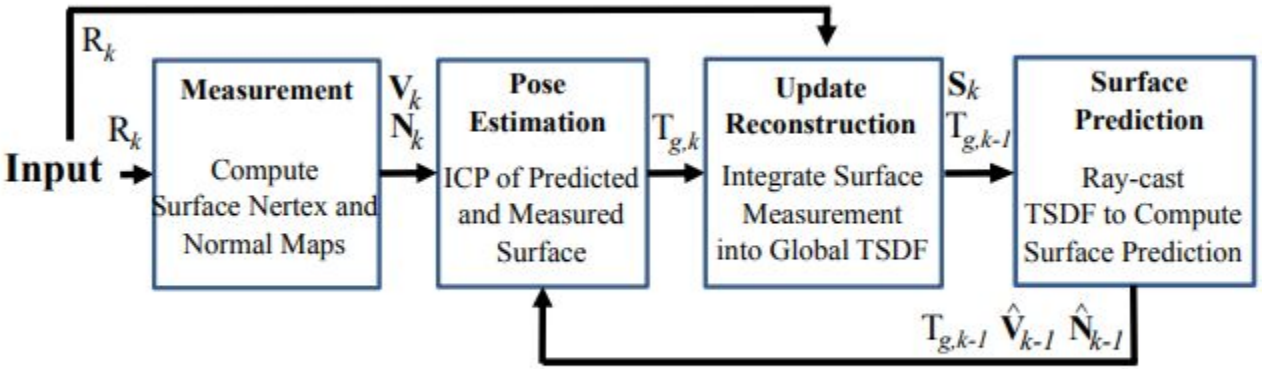
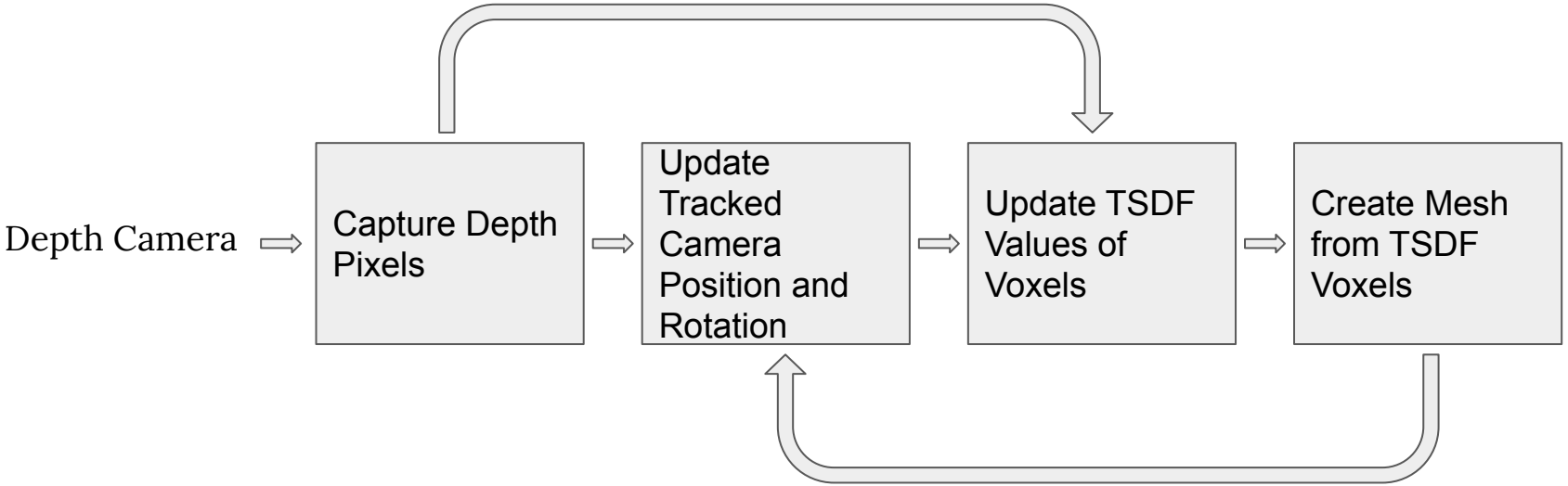
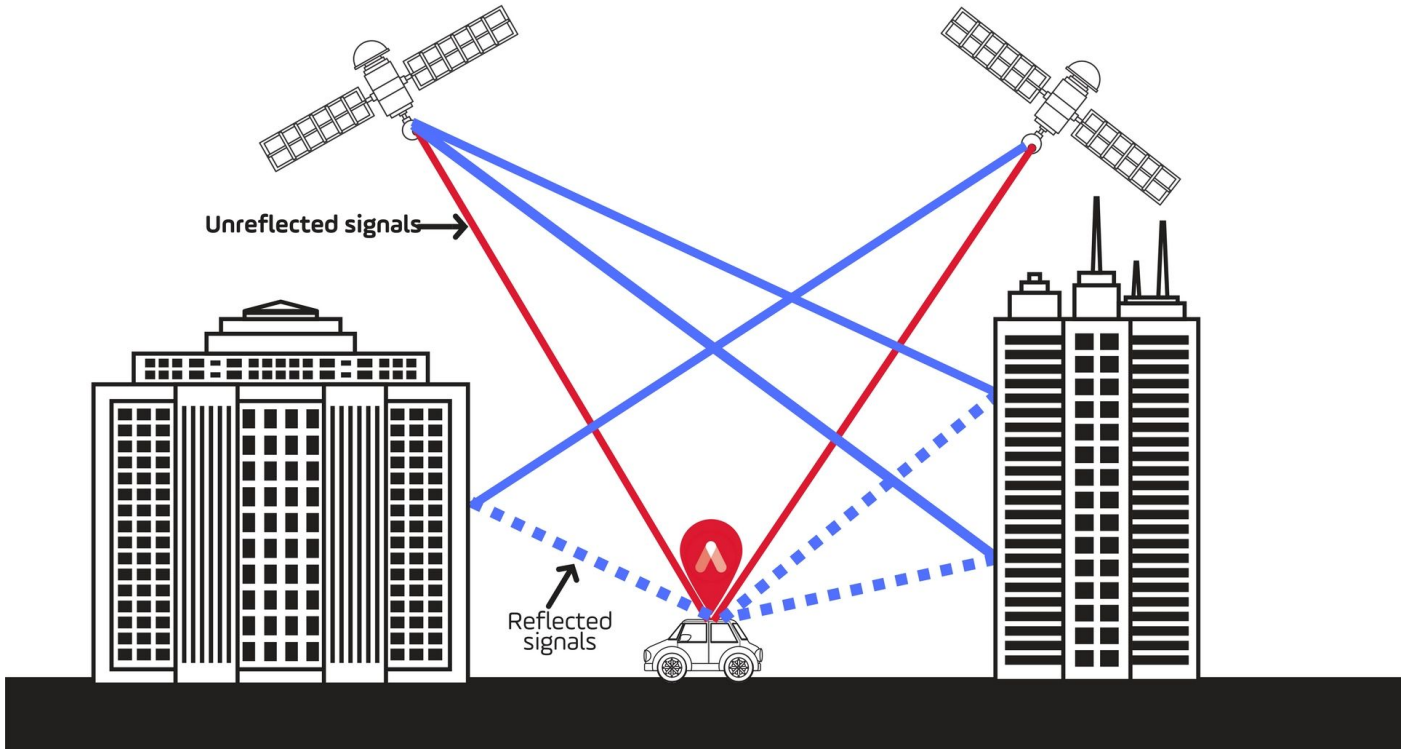


Figure 3: Overall system workflow.

Kinect Fusion (Newcombe et al., 2011)



GPS (Global Positioning System)



Wifi Tracking

Similar to GPS, but for indoors.

Earth : Satellites = Building : Wifi Routers

VR today

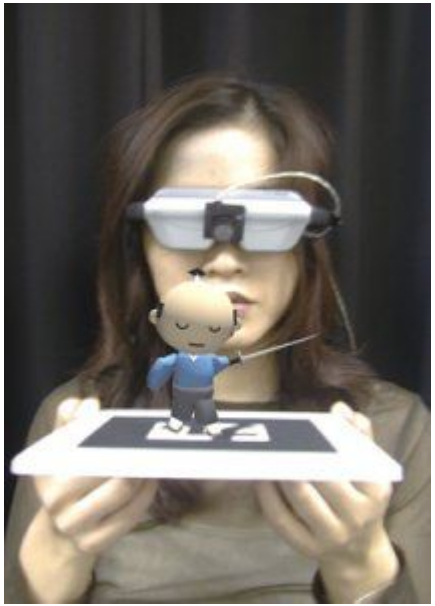
User movement

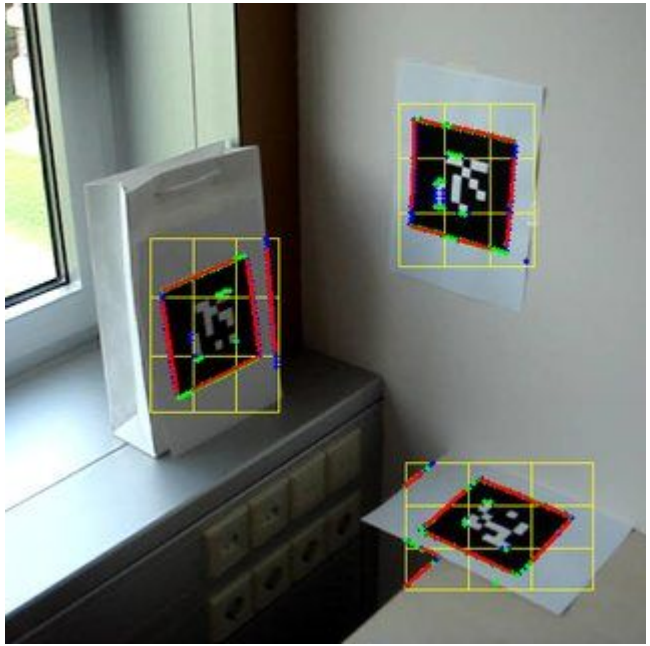
What user sees in headset

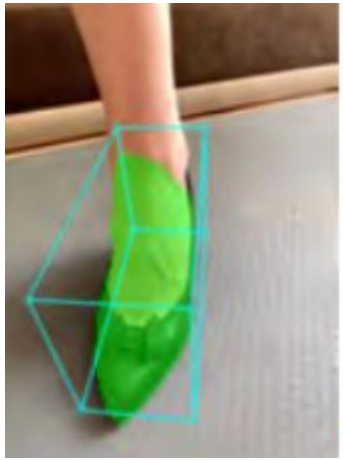
Headset stops tracking when user turns away from the sensor

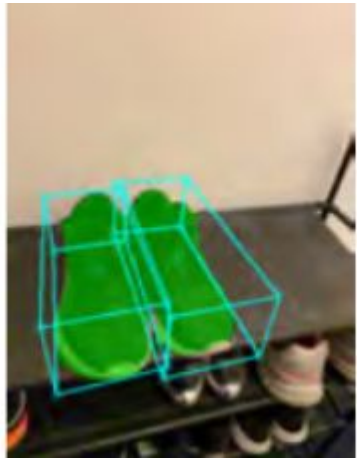
https://youtu.be/Qu-HuCk8guU

Object Tracking



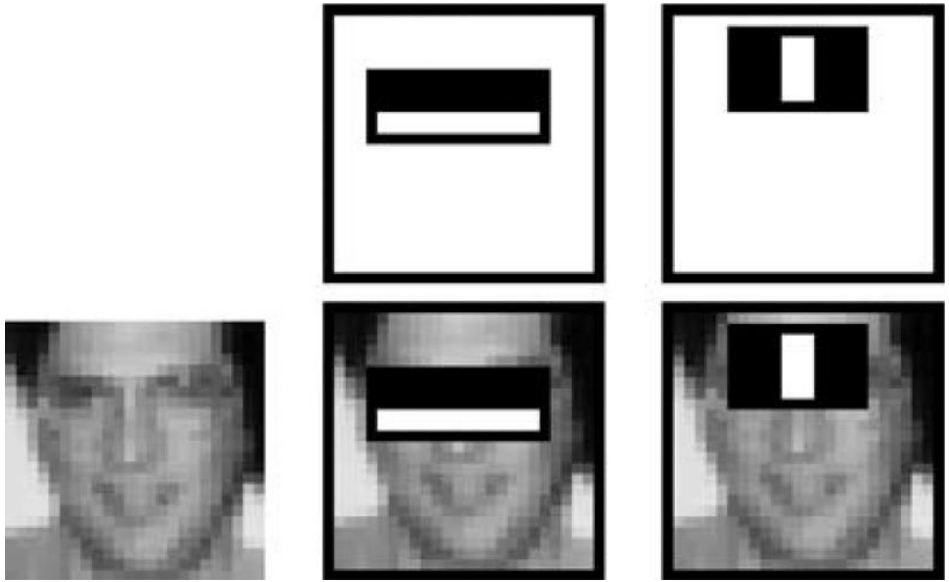






Face Detection

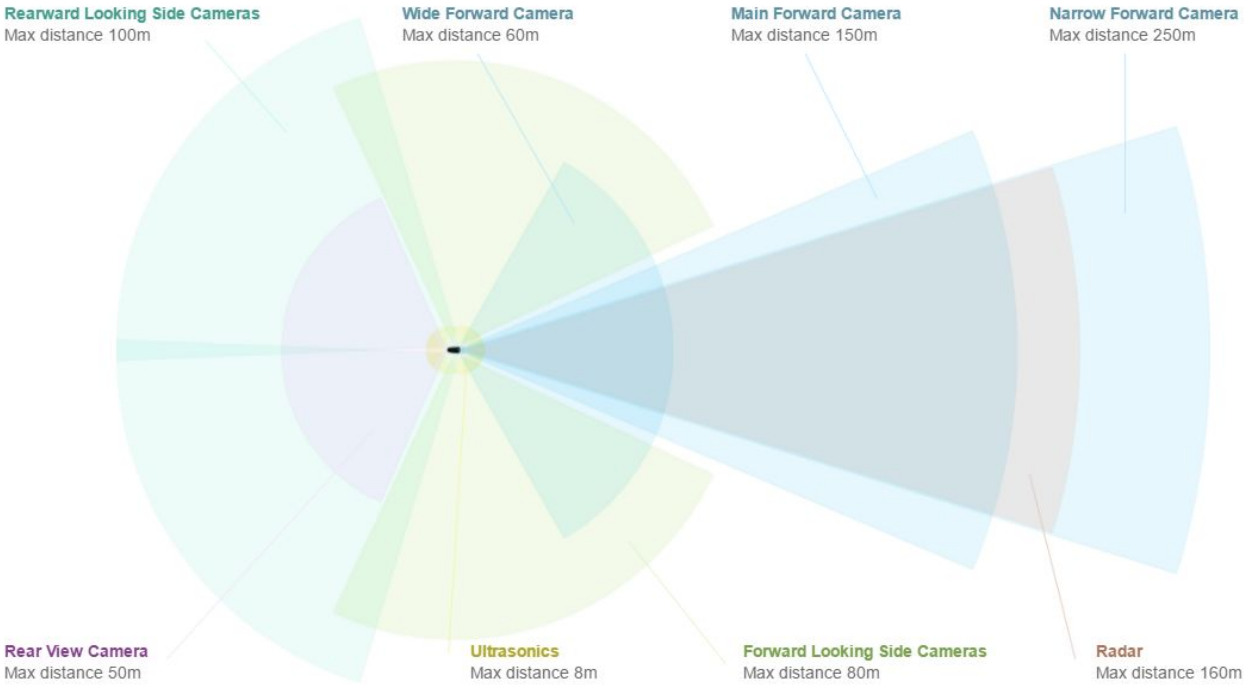
Viola–Jones Object Detection



Face Tracking

https://youtu.be/86-tHA8F-zU

Tesla's Case of Tracking without Depth Cameras



https://youtu.be/fKXztwtXaGo

Tesla's Case of Tracking without Depth Cameras

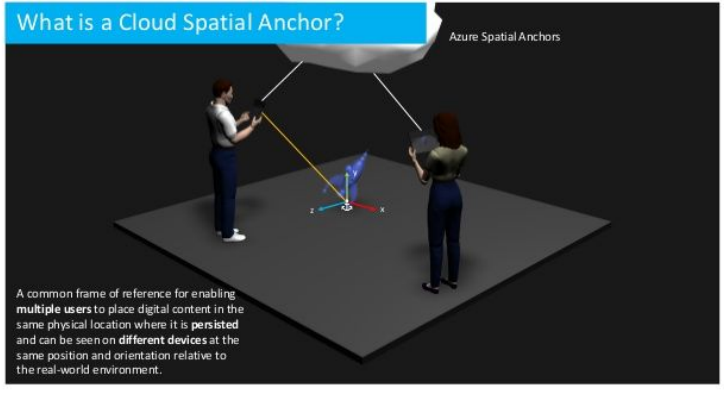
Accomplishment of a task does not require perfect tracking.

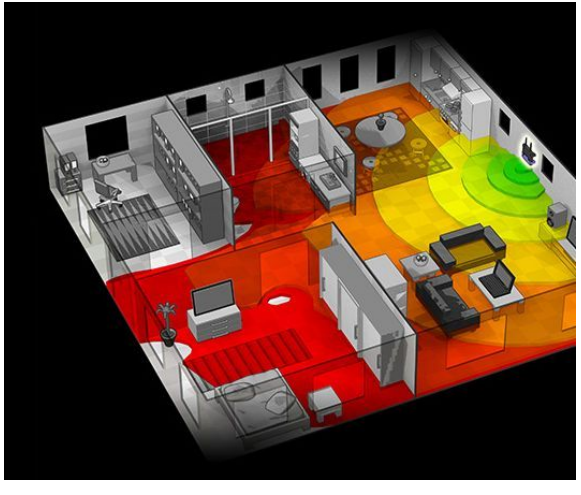
It requires tracking enough for the specific task.

Notice that we, people, are also not perfect at tracking but still alive.

Lesson: In terms of tracking, AR devices need the right amount of sensors, not everything. Deciding the right level of sensors require a well-defined goal, set of tasks.

A Possible Future for Tracking...





A Possible Future for Tracking...