

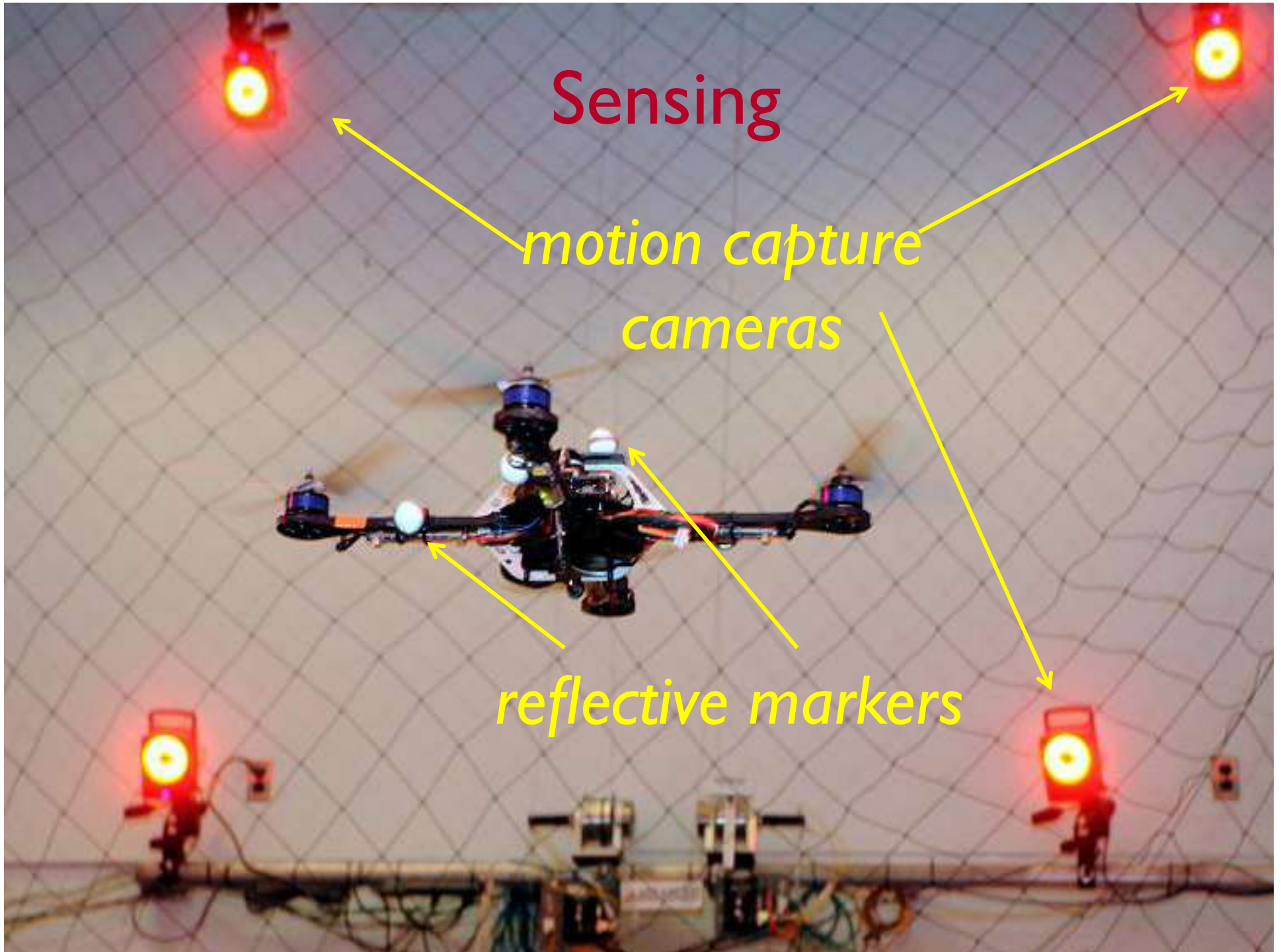
State Estimation

*obtain reliable estimates of
position and velocity*

Sensing

*motion capture
cameras*

reflective markers





X-47B Wins Popular Mechanics Magazine 2013 Breakthrough Award

Photograph by Joe McNally

A photograph of a modern glass skyscraper reflecting the surrounding environment, situated between older brick buildings. The text "Unreliable GPS" is overlaid in blue.

Unreliable GPS

A photograph of a modern building's interior, featuring a multi-level design with stone walls, a glass-enclosed staircase, and a large window. The text is overlaid on the left side of the image.

Operate indoors and outdoors

No GPS

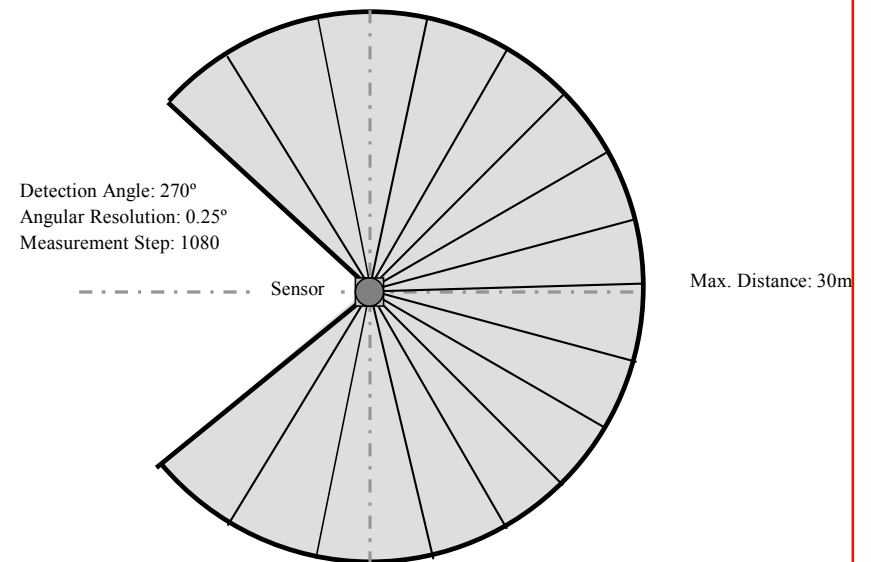
Small, maneuverable

Agile, fast

How to navigate without GPS or external motion capture cameras?



Hokuyo UTM-30LX
Scanning Laser
Rangefinder

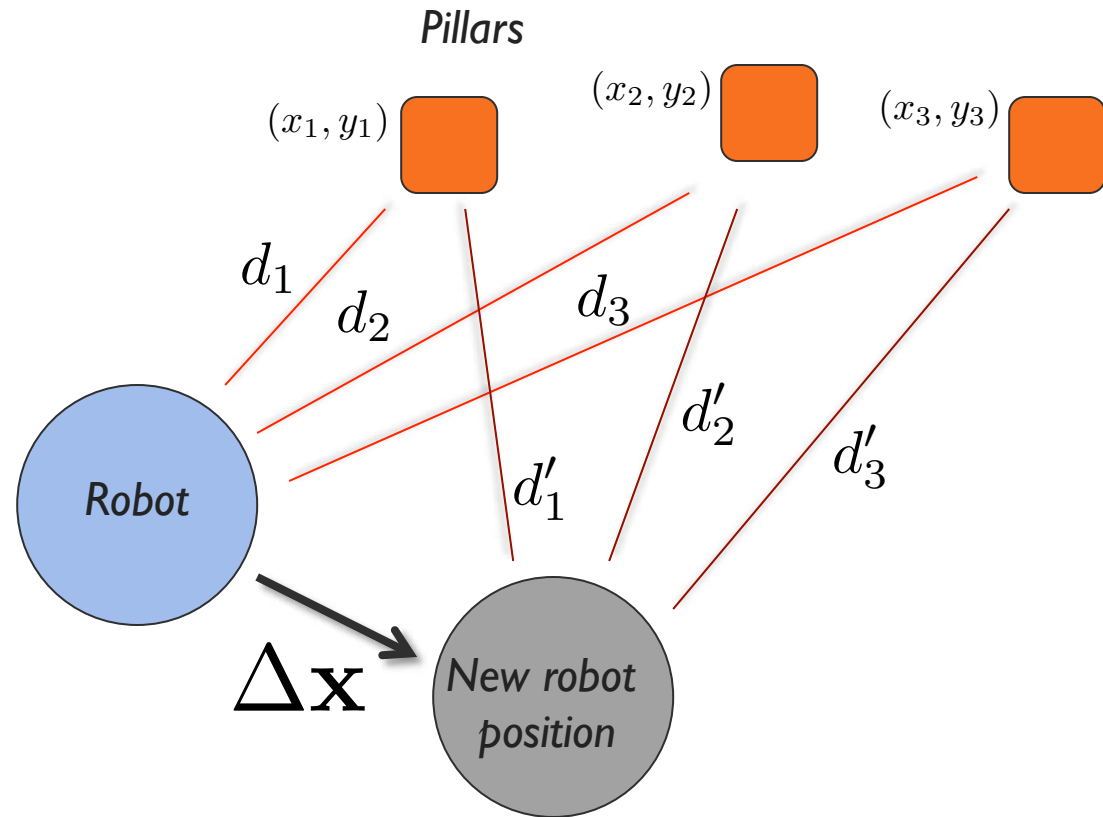


mvBlueFox USB
camera



Kinect sensor for
XBOX 360

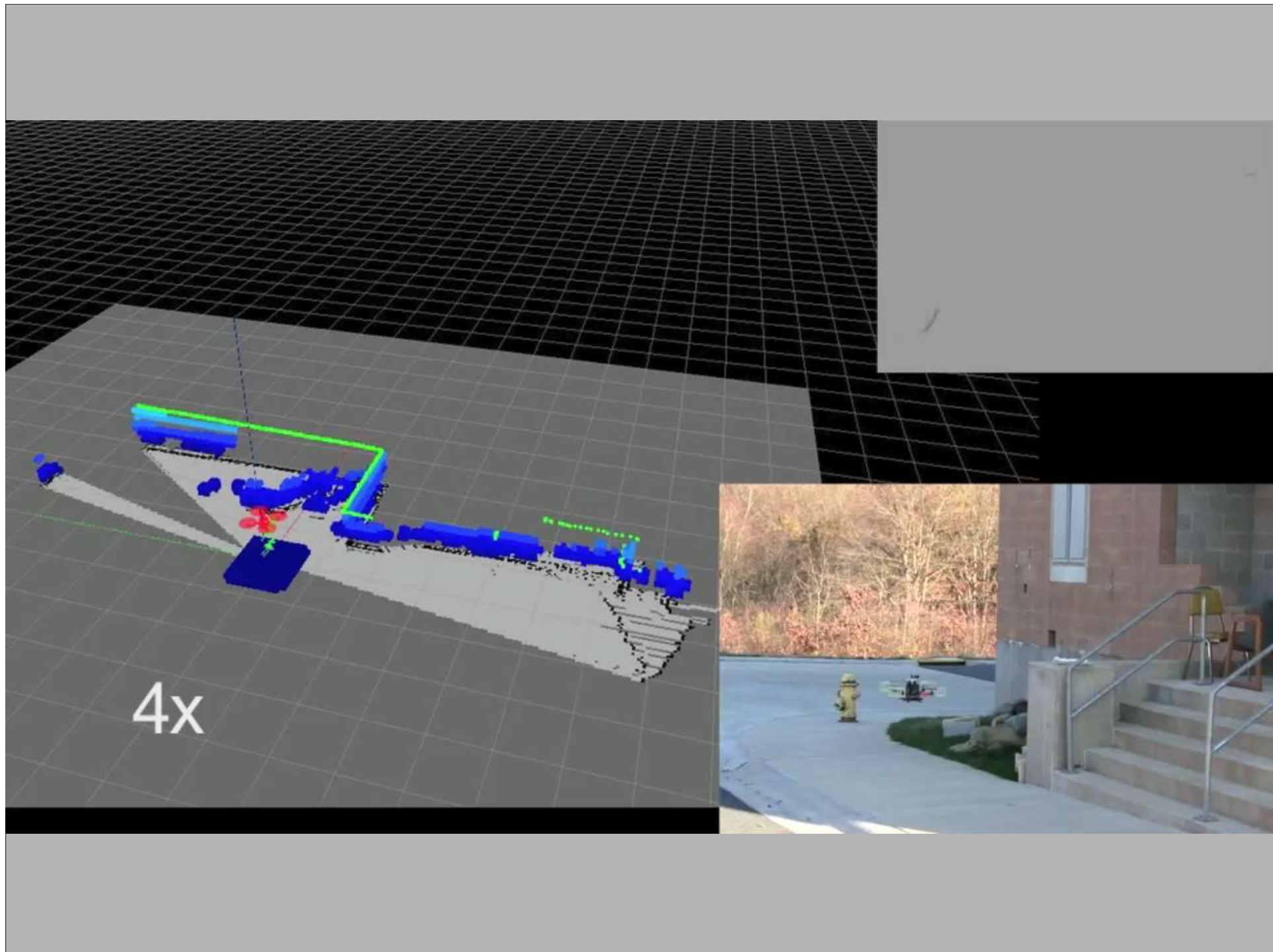
Simultaneous Localization And Mapping



Concurrently estimate

Locations of pillars (6)

Displacement of the robot (2)





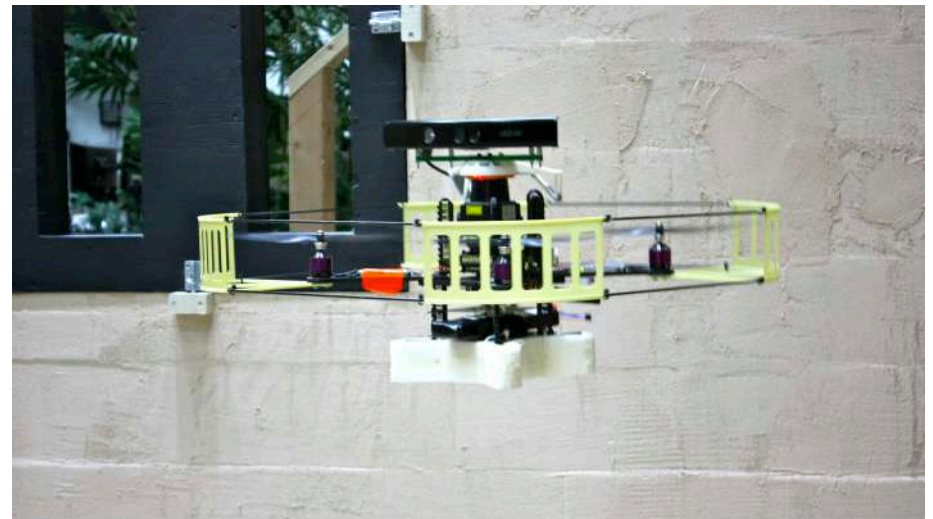
1750 g (laser, 3 cameras, GPS, IMU)



650 g (camera, IMU)

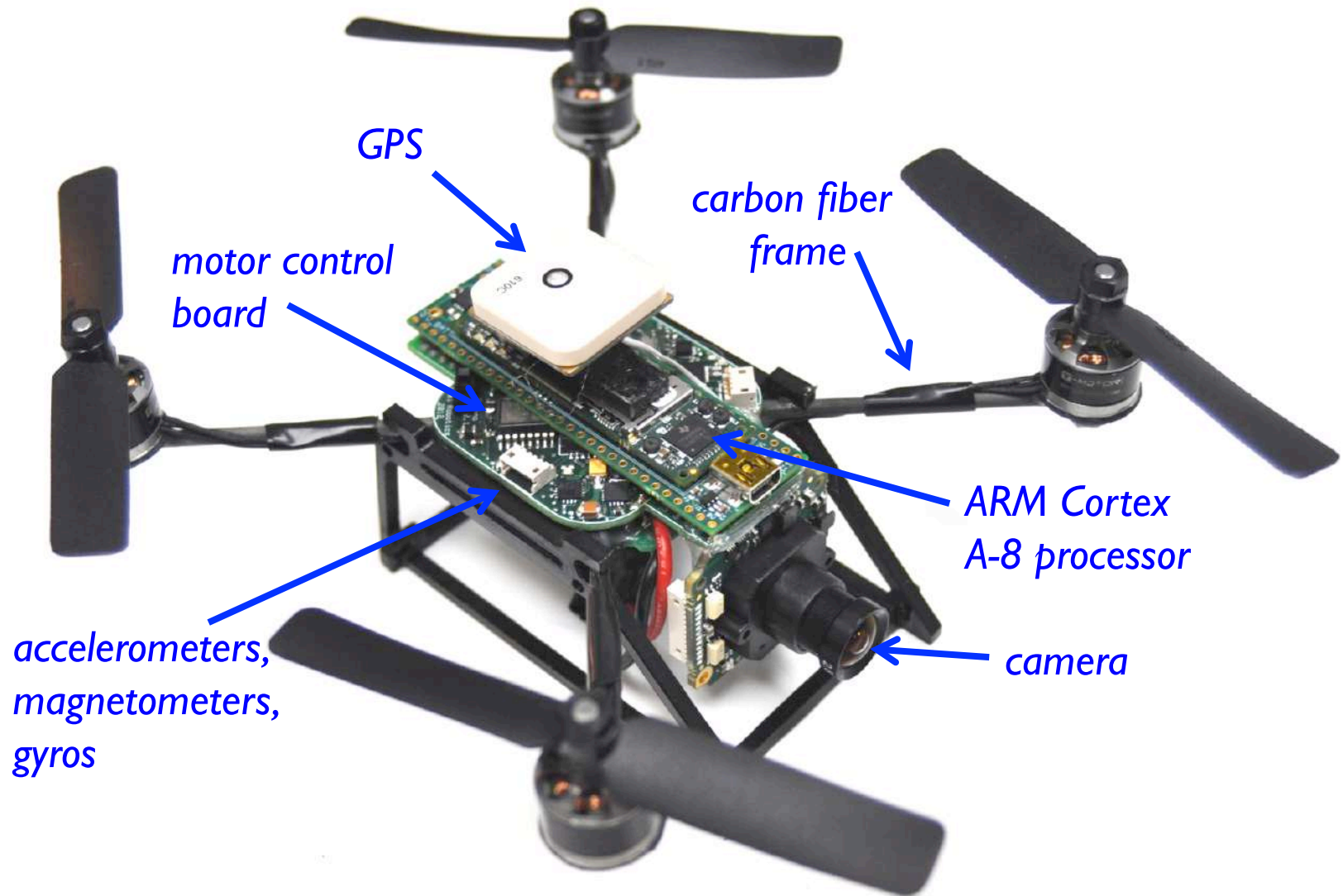


740 g (2 cameras, IMU)



1800 g (laser, Kinect, IMU)

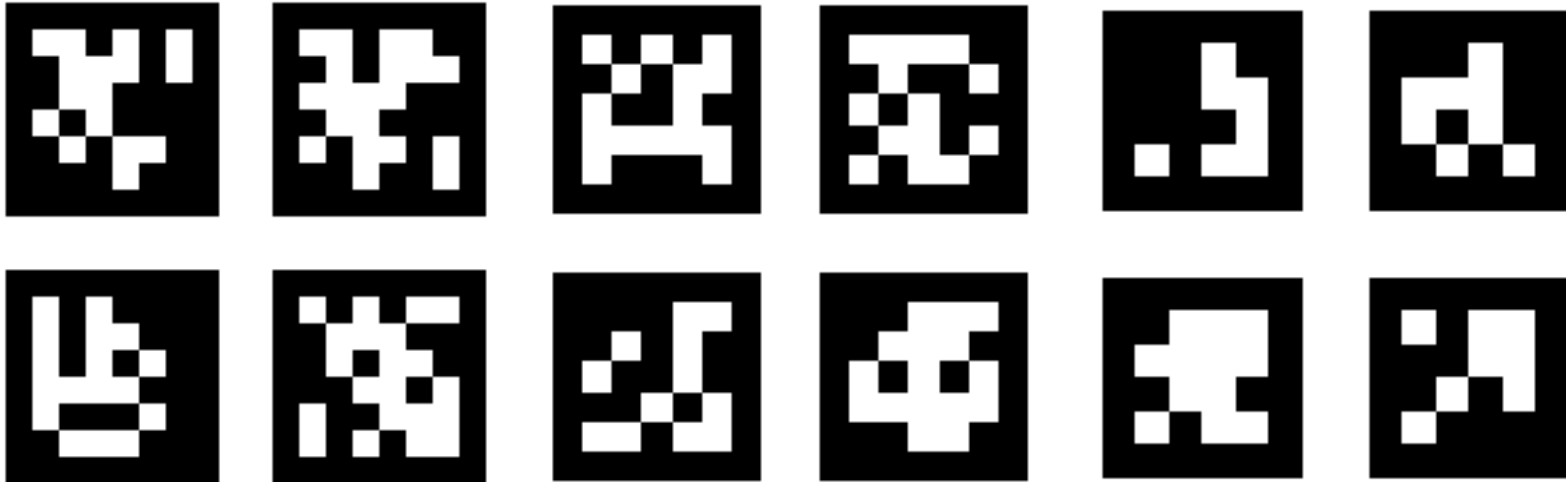
Experimental Platform



KMel Robotics

www.kmelrobotics.com

Beacons that are easy to recognize



<http://april.eecs.umich.edu/wiki/images/9/94/Tagsampler.png>

