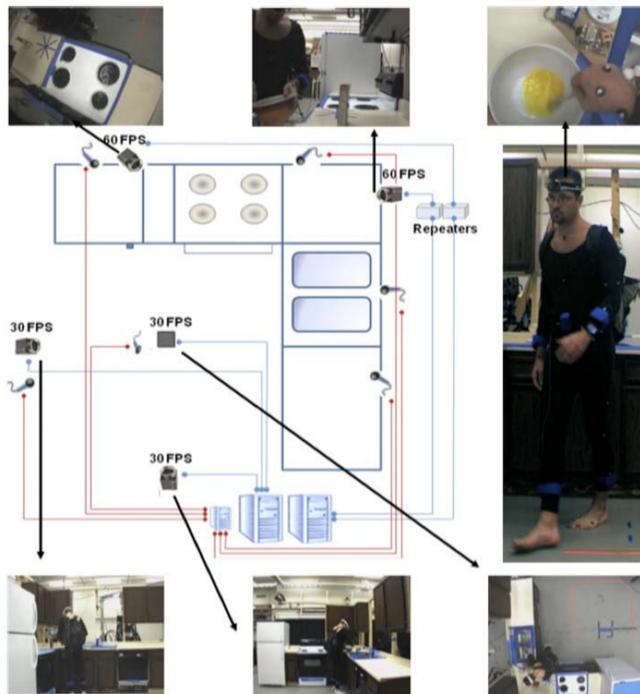


# Grand Challenge Data Collection: System Engineering & Technical Challenges

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## Environmental sensors



### CAMERAS



**6 Cameras**  
(5 static + 1 onboard)  
**Goal:**  
- 4 Cameras@30fps,1024x768  
- 2 Cameras@60fps, 640x480

### MICROPHONES



**5 Static microphones**  
-  $F_s = 44,1$  KHz  
-  $N_b = 16$  Bits per sample

The cameras are connected via IEEE1394b bus, streaming data at:

$$640 \times 480 \times 60 \times 2 = 36.84 \text{ Mbytes/sec}$$

$$1024 \times 768 \times 30 \times 3 = 77.78 \text{ Mbytes/sec}$$

Writing to file represents a bottle neck  $\Rightarrow$  **MISSING FRAMES**

**SOLUTION:** customized acquisition software optimizing performance

## Onboard sensors

### Difficulties:

- Multiple data sources
- Motion and possible vibrations
- Different power supply requirements
- Possible overheating
- Embedded systems monitoring

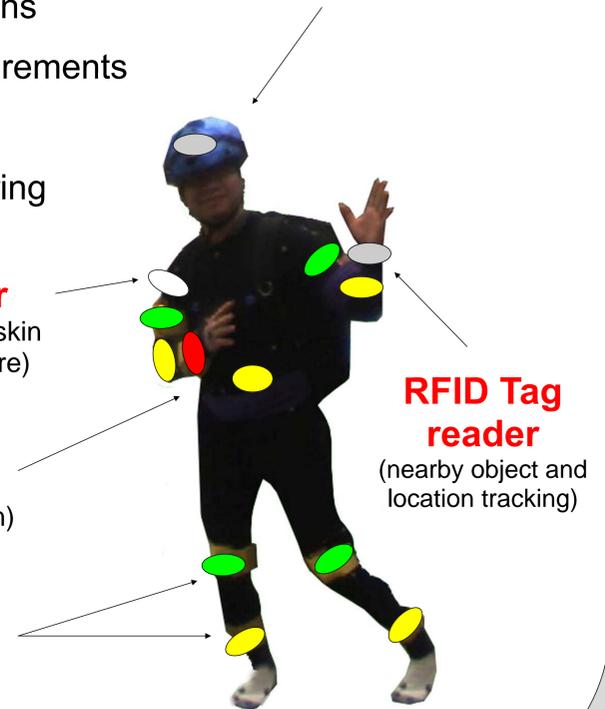
**Bodymedia Sensewear**  
(Heat flux, galvanic skin response, skin temperature, near-body temperature)

**eWatch**  
(Light intensity, 3-axis acceleration)

**Inertial Measurement Units**  
(Motion: acceleration, angular rate and magnetic field)

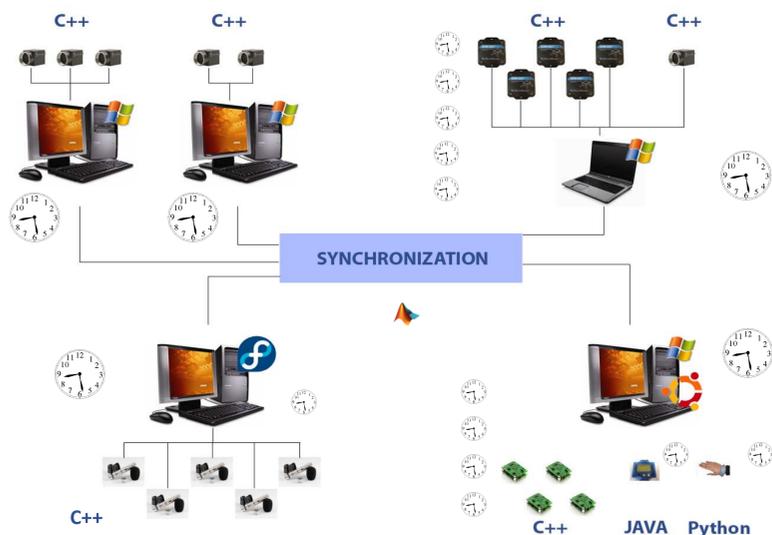
**Camera**  
(Inside-out view: 30fps,800x600)

**RFID Tag reader**  
(nearby object and location tracking)



## Multimodal Data Synchronization

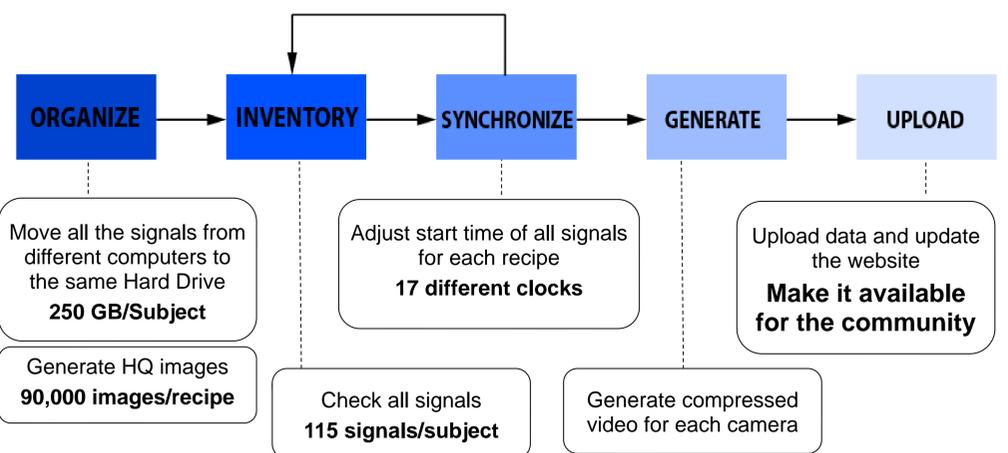
Synchronization between many data sources without absolute reference, some triggered by software but some others by internal clocks, running in different computers at different sampling frequencies and connected to different networks.



### Clocks to be synchronized:

- 5 x wired IMU: triggered at 125Hz by internal clock with small drift
- 4 x Bluetooth IMU: triggered at 62Hz by internal clocks
- 3 x cameras: triggered at 30Hz and 60Hz by software running in PC1 with Windows
- 2 x cameras: triggered at 30Hz and 60Hz by software running in PC2 with Windows
- 1 x camera: triggered at 30Hz by software running in onboard PC accessed wirelessly
- 5 x microphones: all connected to PC3 with Linux acquiring data at 44.1KHz
- 1 x RFID reader: connected to a Linux virtual machine inside PC4
- 1 x eWatch: triggered by internal clock
- 1 x Bodymedia physiological sensor: triggered by internal clock

## Post-Processing



## Tools for Synchronization, Visualization and Ground Truth Labeling

