

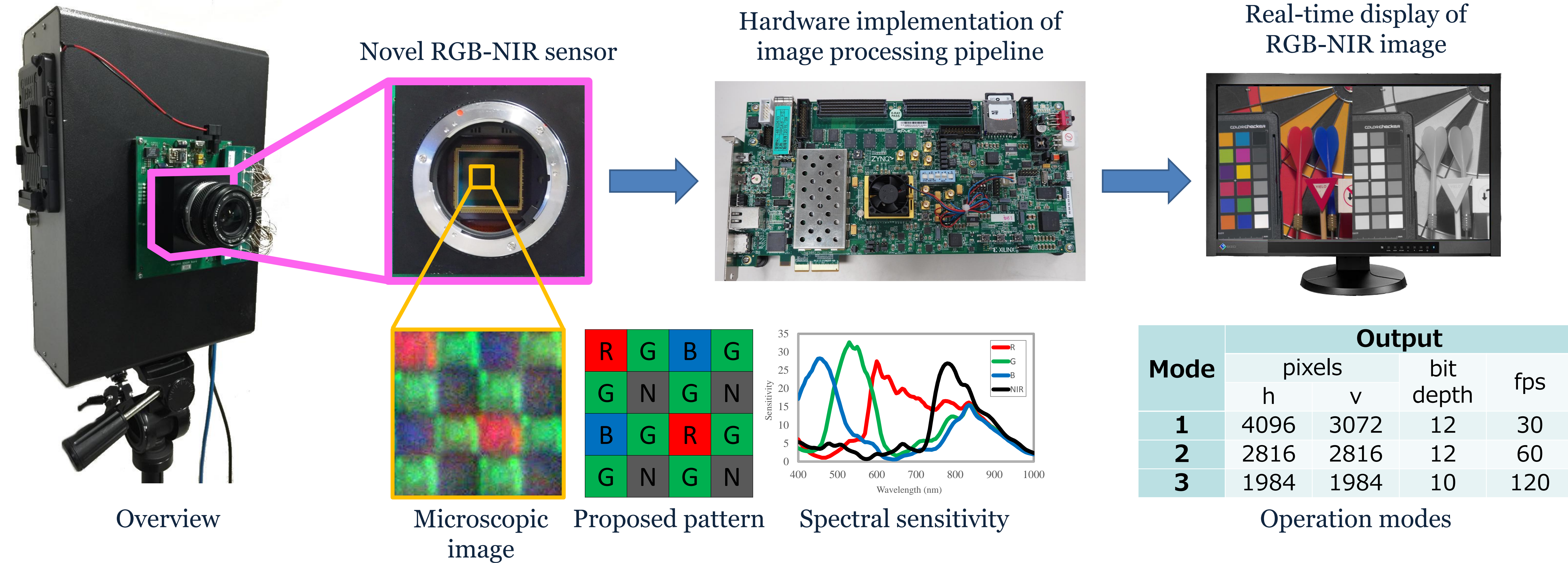
# A Real-Time RGB-NIR Imaging System Using a Single Image Sensor

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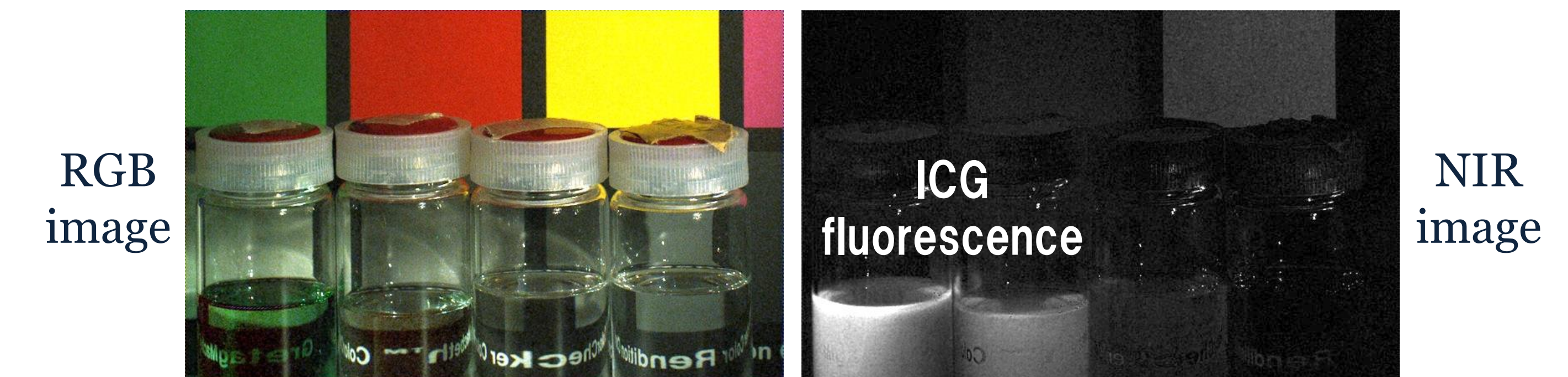
Website: [http://www.ok.ctrl.titech.ac.jp/res/MSI/MSI\\_e.html](http://www.ok.ctrl.titech.ac.jp/res/MSI/MSI_e.html)

## Our Prototype RGB-NIR Imaging System

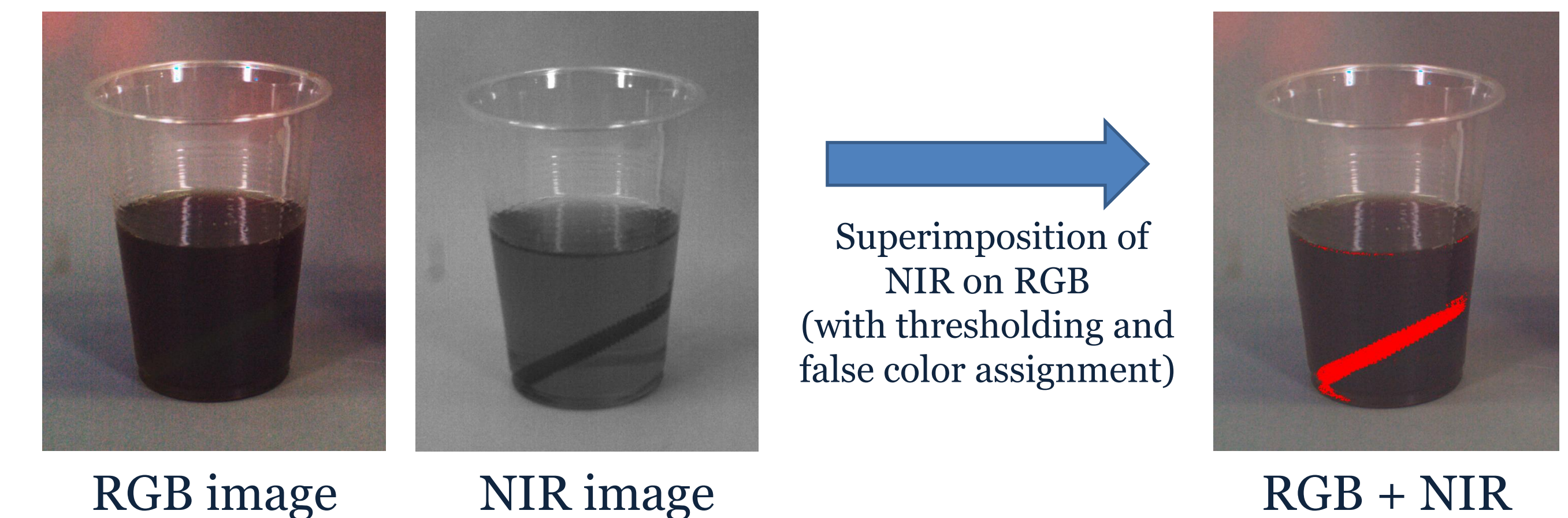


## Example Applications

### Medical Imaging (ICG fluorescence observation)

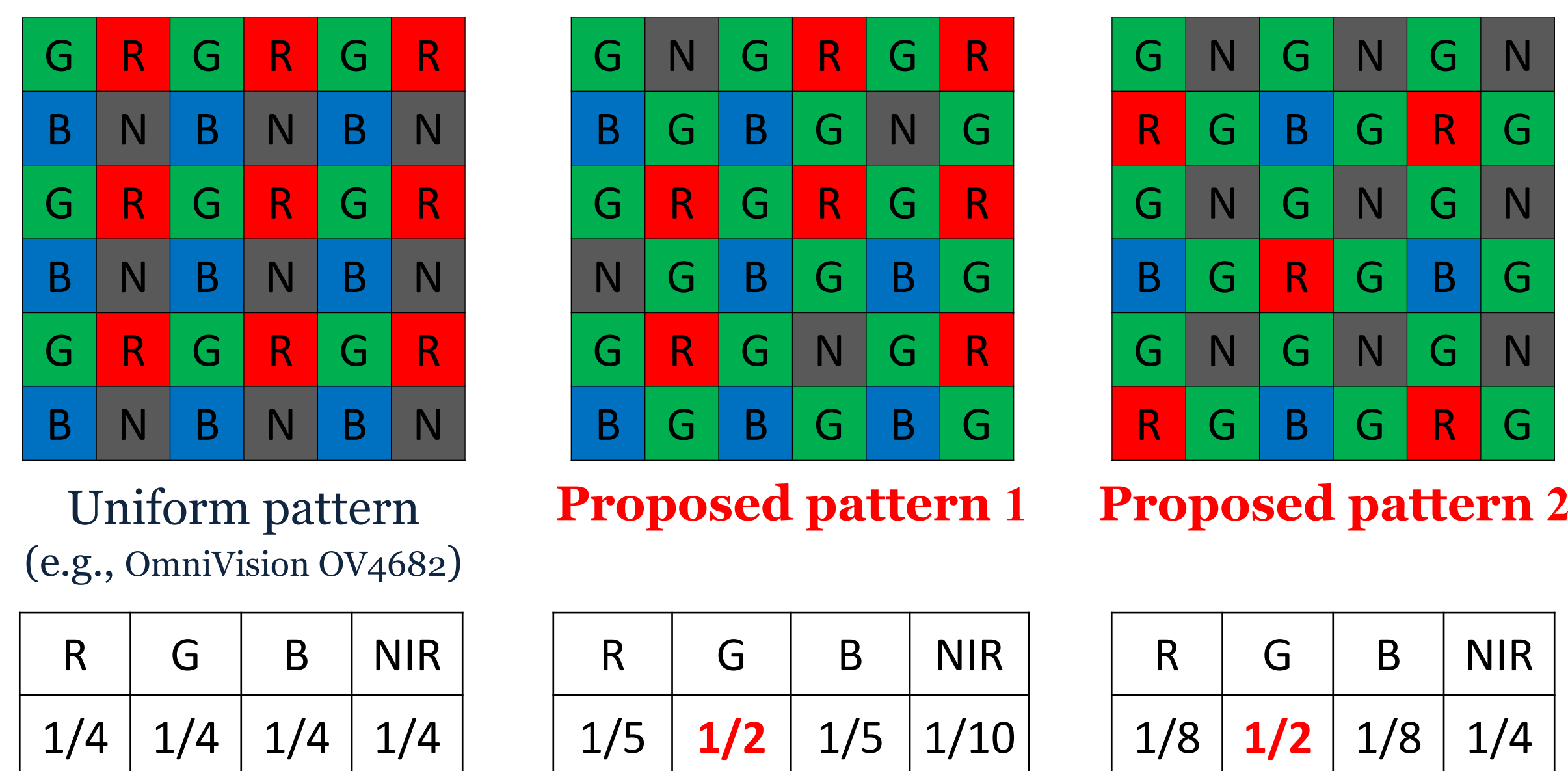


### Food Inspection



## RGB-NIR Sensor Design

- We investigated the performance of three patterns.

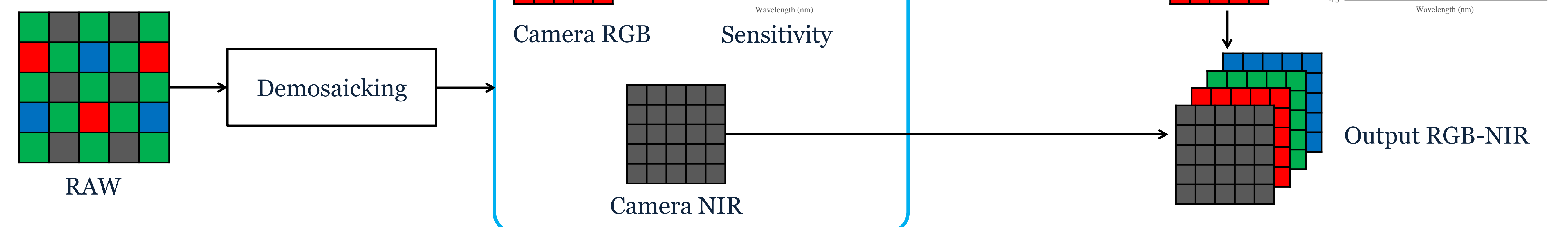


- Simulation performance for noise-free case (see [4] for details)

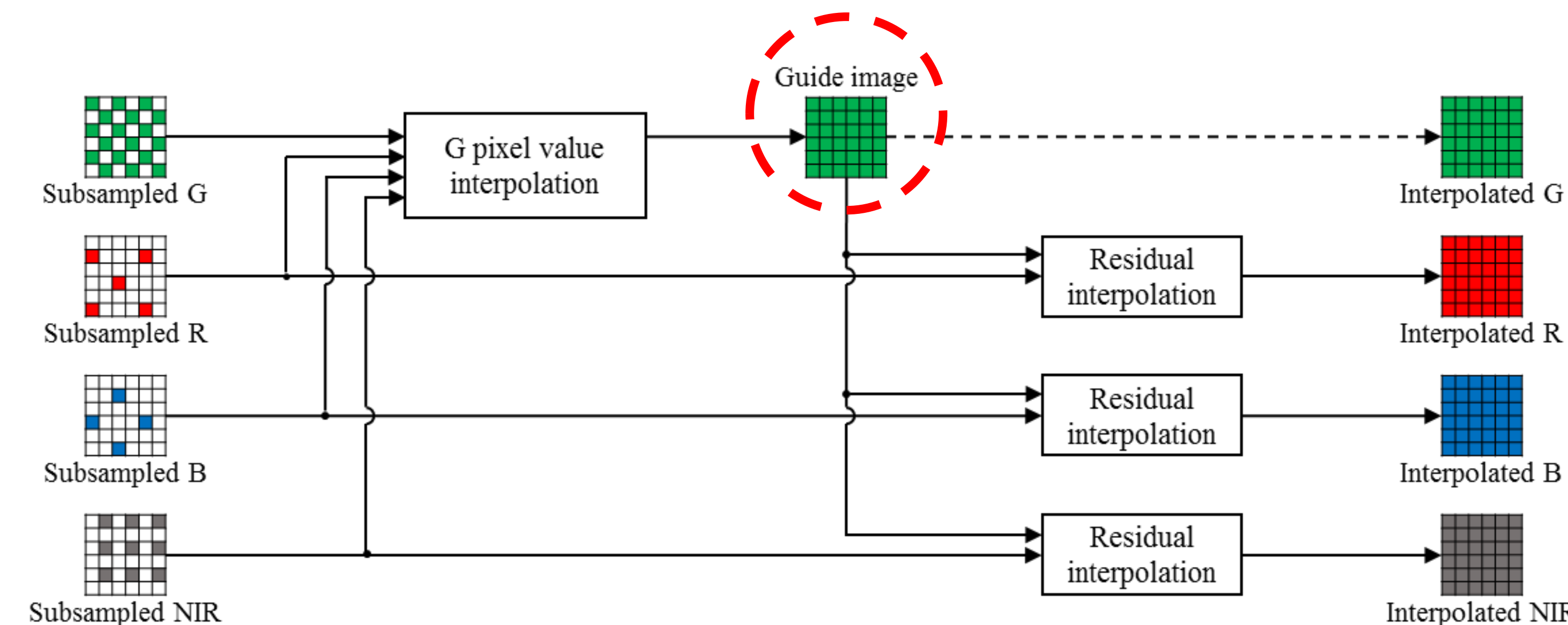
	Uniform	Proposed 1	Proposed 2
Color PSNR (sRGB)	32.25	34.48	34.02
PSNR (NIR)	33.87	38.37	40.22
Average	33.06	36.43	37.12

## Image Processing

### Overall pipeline



### Proposed Demosaicking Algorithm [3,4] (to be implemented on hardware)



### Linear Color Correction

$$\begin{bmatrix} sR \\ sG \\ sB \end{bmatrix} = \begin{bmatrix} m_{11} & m_{12} & m_{13} & m_{14} \\ m_{21} & m_{22} & m_{23} & m_{24} \\ m_{31} & m_{32} & m_{33} & m_{34} \end{bmatrix} \begin{bmatrix} R \\ G \\ B \\ NIR \end{bmatrix}$$

- [1] Kiku et al., "Simultaneous Capturing of RGB and Additional Band Images Using Hybrid Color Filter Array," IS&T/SPIE Electronic Imaging 2014.
- [2] Monno et al., "N-to-sRGB Mapping for Single-Sensor Multispectral Imaging," ICCV Workshop (CPCV) 2015.
- [3] Kiku et al., "Beyond Color Difference: Residual Interpolation for Color Image Demosaicking," IEEE TIP 2016.
- [4] Teranaka et al., "Single-Sensor RGB and NIR Image Acquisition: Toward Optimal Performance by Taking Account of CFA Pattern, Demosaicking and Color Correction," IS&T Electronic Imaging 2016.