







# Battery-less Place Recognition System using Multiple Energy Harvesting Elements

Yuito Sugata <sup>1)</sup>, Yutaka Arakawa <sup>2) 3)</sup>, Keiichi Yasumoto <sup>1)</sup>

1) Nara Institute of Science and Technology 2) Kyushu University 3) JST PRESTO

## Motivation and Problem

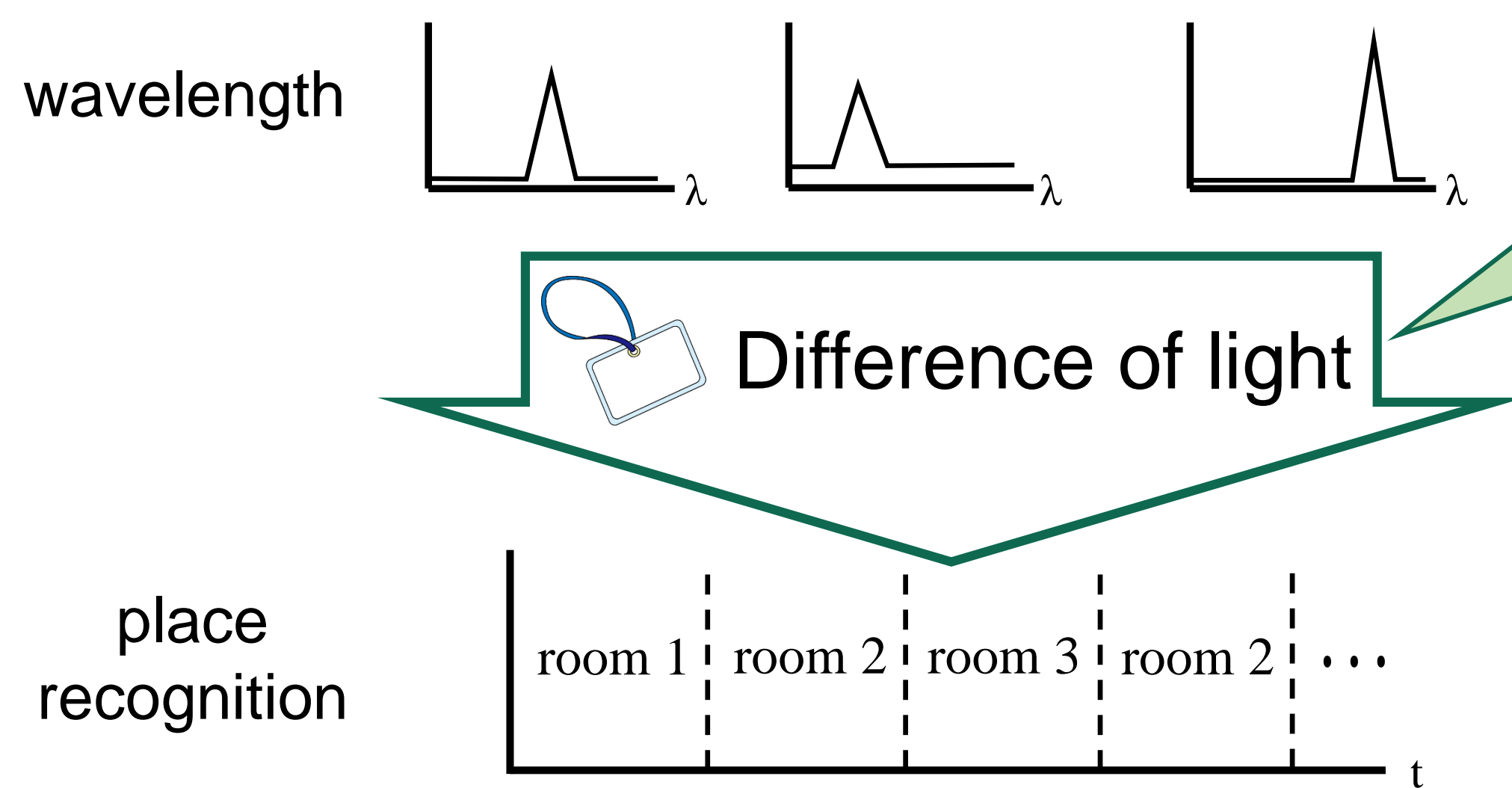
Our Target: **Room Level Localization** for lifelogging in workplaces

room 1	room 2	room 3	• Wi-Fi	APs don't always exist	: Bad
			• BLE Beacon	smartphone can receive	: Good
			• Light sensor	Installation cost	: Bad
<b>Lifelog</b>				Installation cost	: Good
				<b>Battery charging</b>	: Bad

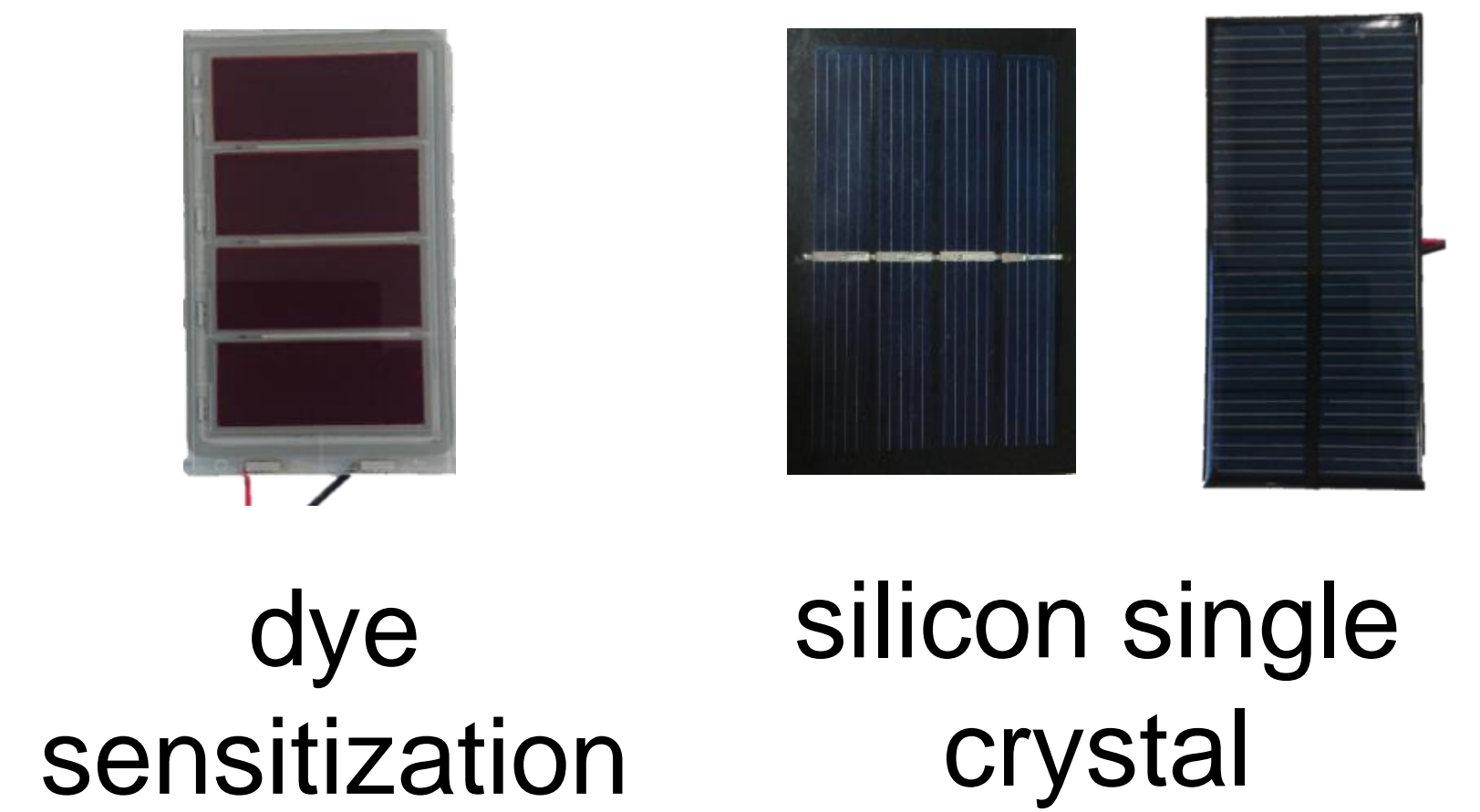
➔ **Our idea**

## Battery-less place recognition system

### Key idea

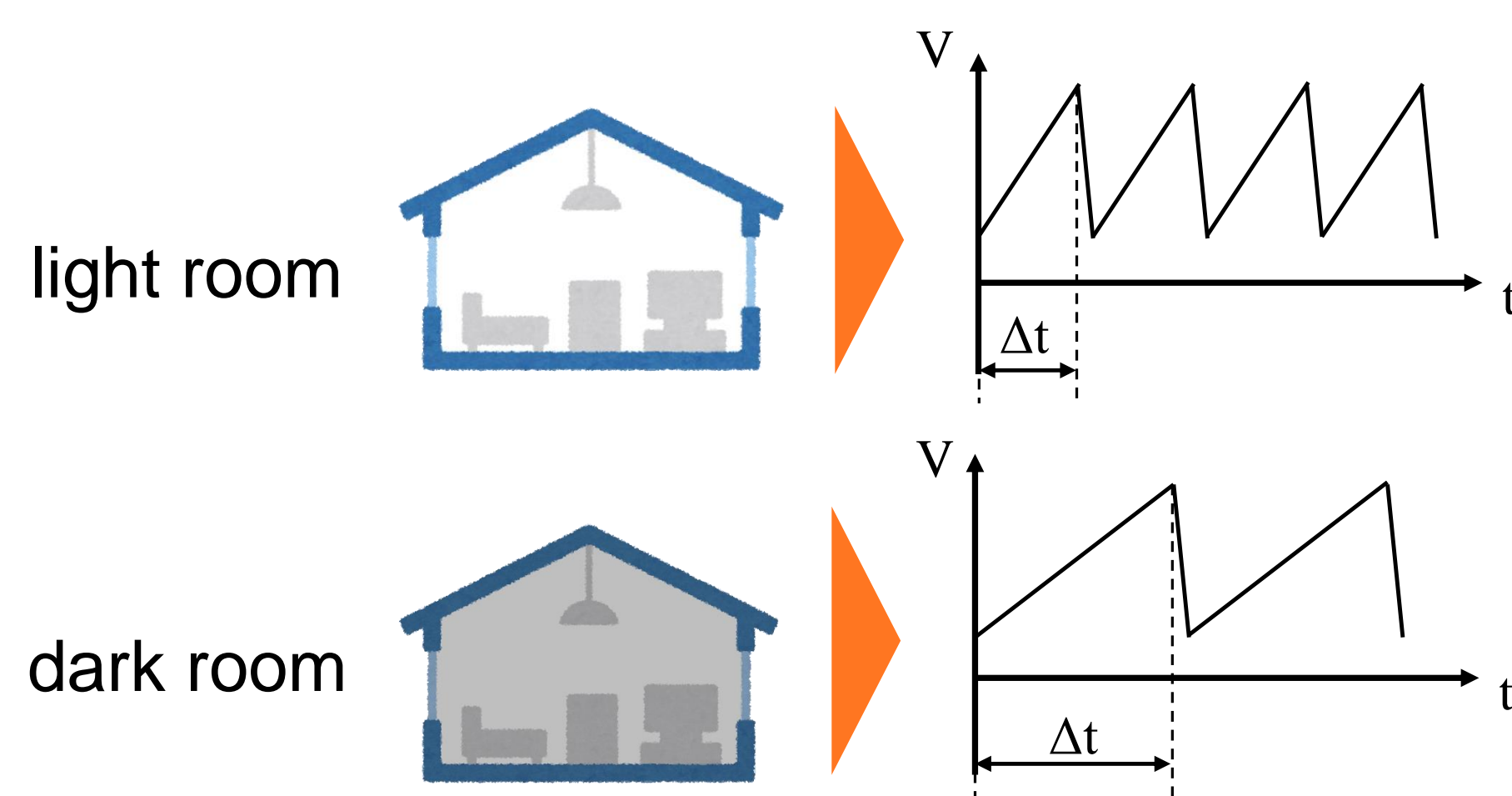


Use **Multiple Solar cells** as **Power Source** and **Sensor**



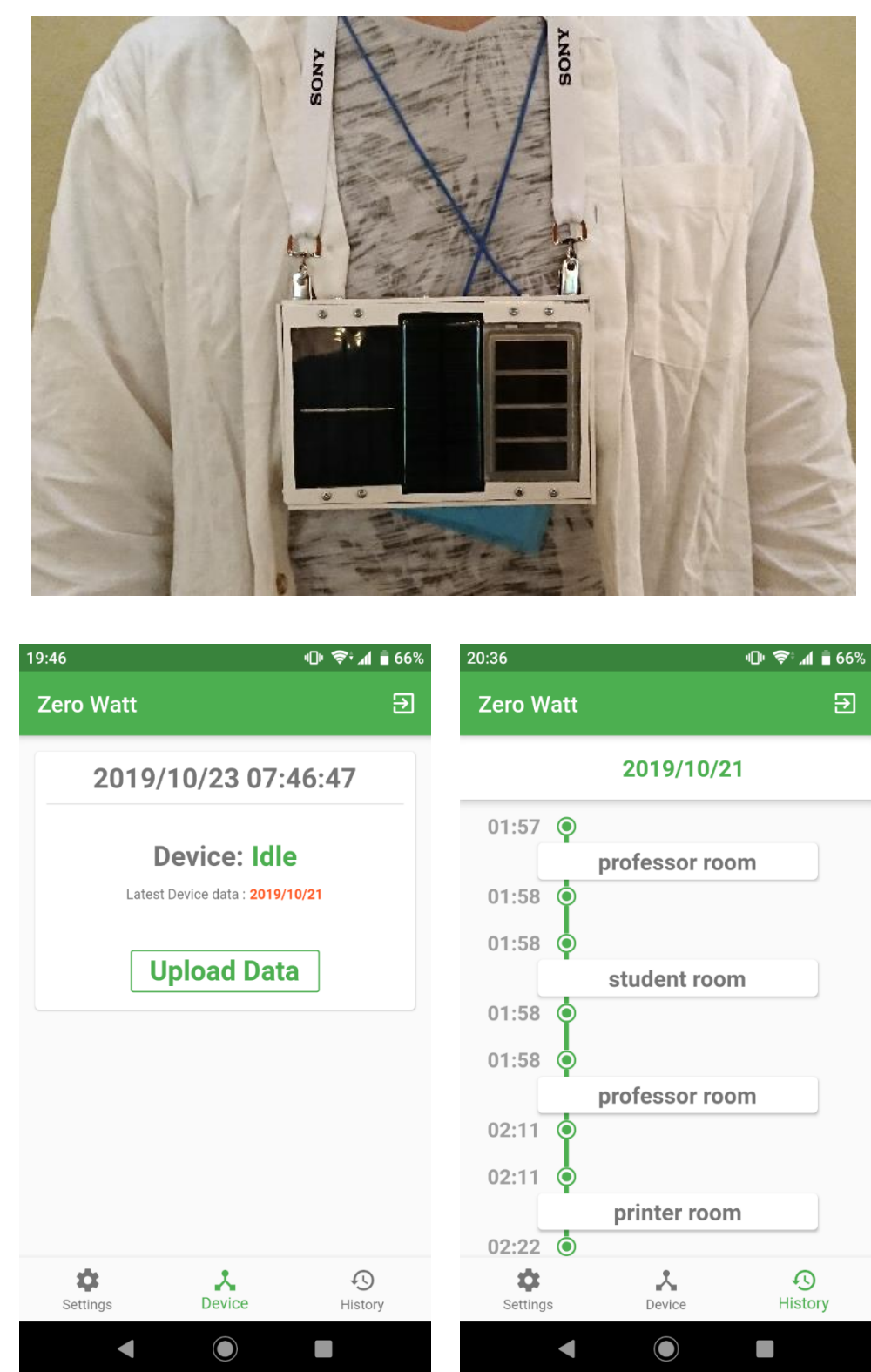
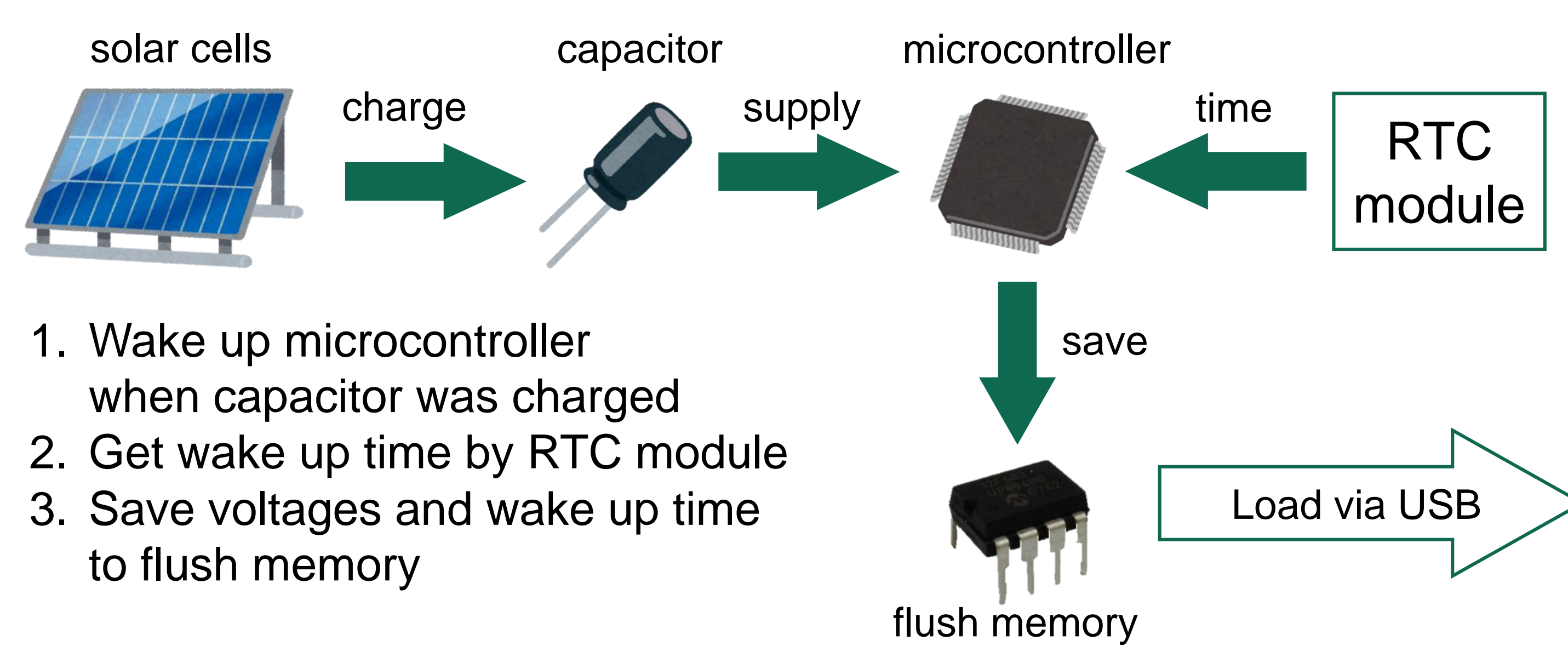
We measure a **charging time** of a capacitor

### Mechanism



Charging time varies depending on the brightness

### Device and application



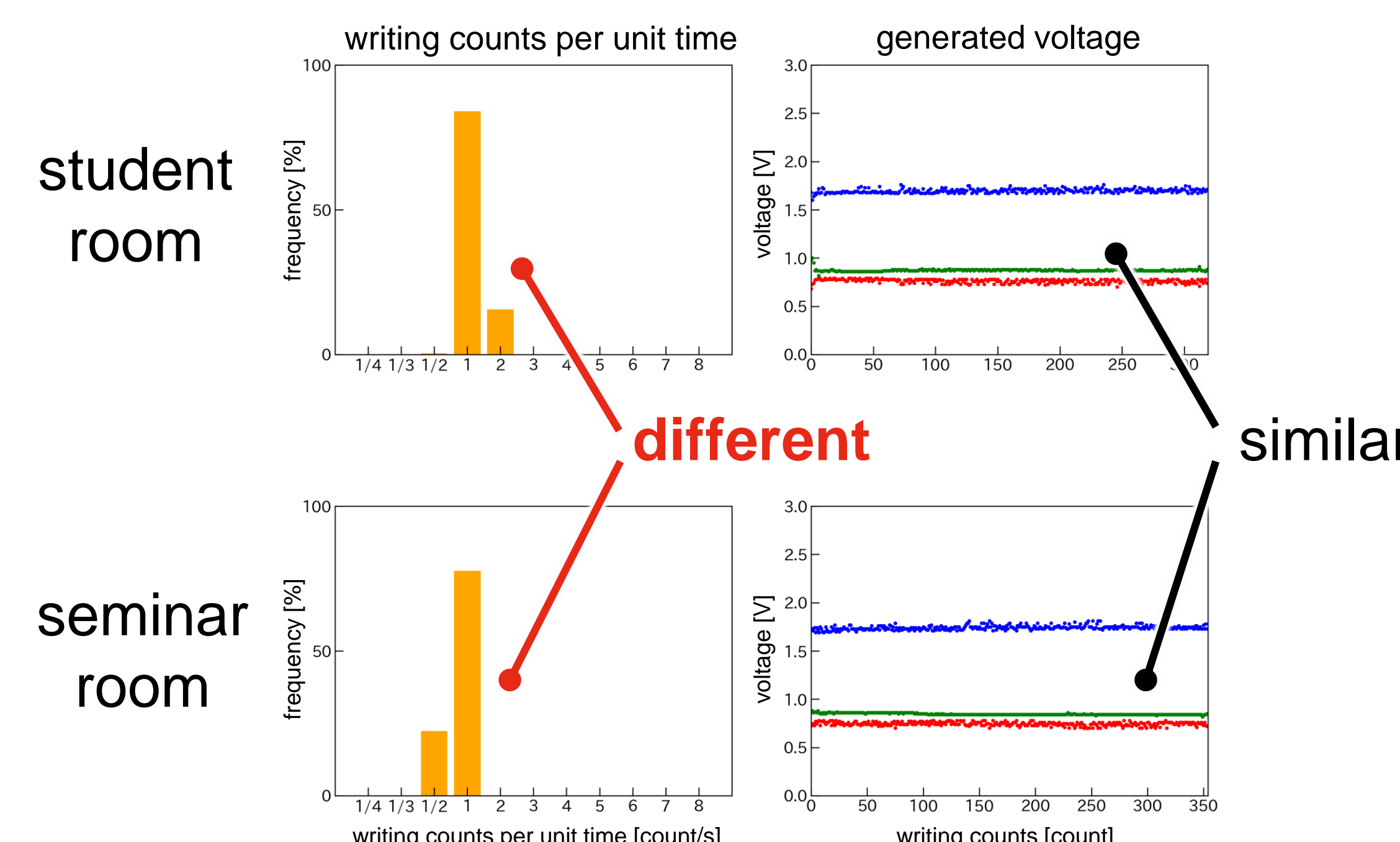
## Place recognition based on a machine learning

### Data collection

Experiment in 8 places

- toilet, printer room, student room, seminar room, professor room, secretary room, convenience store, cafe
- Measure for 3 minutes at each location
- Estimate by calculating **writing counts per unit time** from the time stamp

### Measured data



### Accuracy

place	precision	recall	f1-score
toilet	0.99	0.99	0.99
printer room	0.83	0.91	0.87
student room	0.93	0.78	0.85
seminar room	0.74	0.78	0.76
professor room	1.00	1.00	1.00
secretary room	1.00	1.00	1.00
convenience store	1.00	0.94	0.97
cafe	0.94	1.00	0.97
average	0.93	0.92	0.92