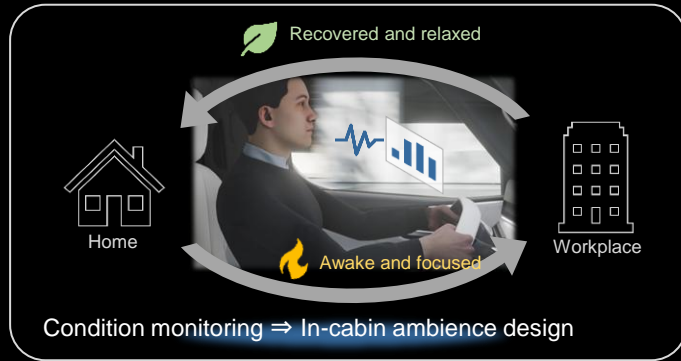





Vital signs sensing ~Detecting unnoticed changes to prevent accidents and health issues ~

Outline

Mobility that turns everyday driving into **a health-enhancing experience for all occupants.**



Challenges

- The importance of healthspan is increasing, but few people engage in health-conscious behaviors. 
- Detecting facial expressions and behaviors may reveal internal changes only after it is too late to act. 
- Accurate sensing may be difficult in the noisy environments characteristic of vehicles. 

Features

Pre-aware

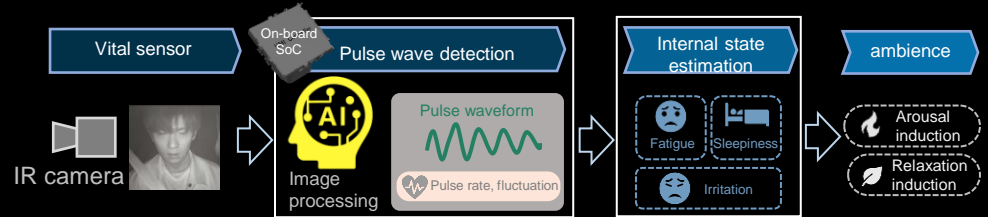
Using pulse waves to detect internal physiological changes

Anyone

Unobtrusive, **contactless** continuous monitoring

Anytime

Stable sensing under vibration and ambient light



AI learns pulse-wave features with reduced noise and detects pulse waves with high precision.

Applications

- Breathing guide for conditioning
- The service can apply to all occupants.

Development completion

• 2027

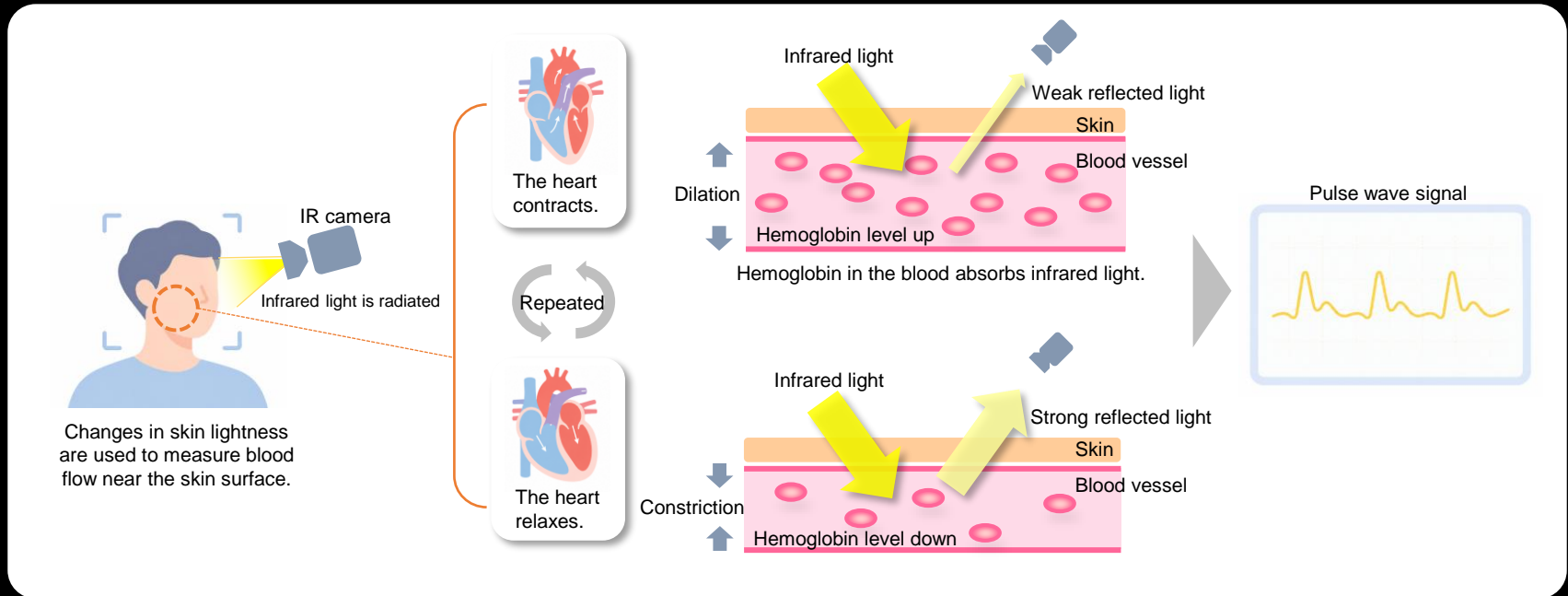
Patent pending



Vital signs sensing ~Detecting unnoticed changes to prevent accidents and health issues ~

Technical details

Principle of IR camera pulse wave sensing

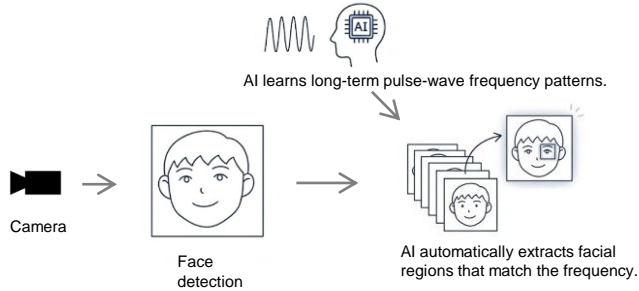


Vital signs sensing ~Detecting unnoticed changes to prevent accidents and health issues ~

Technical details

AI learns noise-reduced pulse-wave features from camera images and forms noise-resistant pulse-wave sensing.

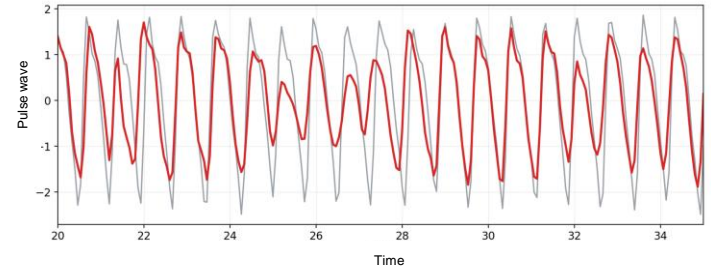
Suggested method



⇒ Robust to driver motions and illumination changes

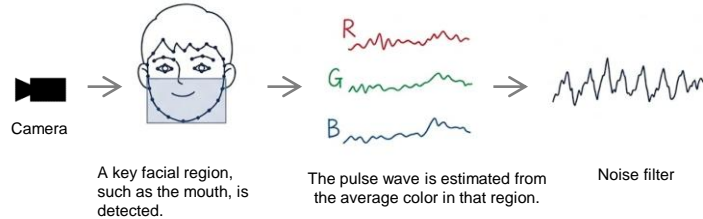


Comparison of facial movements in the cabin environment

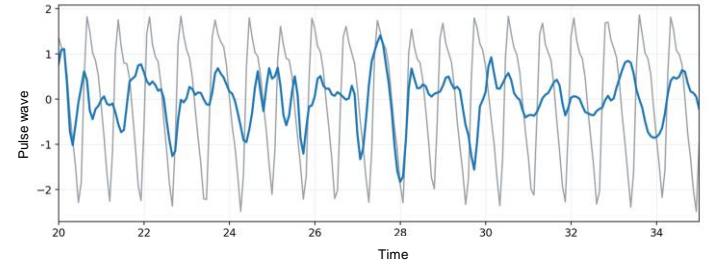


— Suggested method Pulse waveform — Target waveform (measured with a contact-type pulse-wave device)

Conventional method



⇒ Sensitive to driver motions and illumination changes



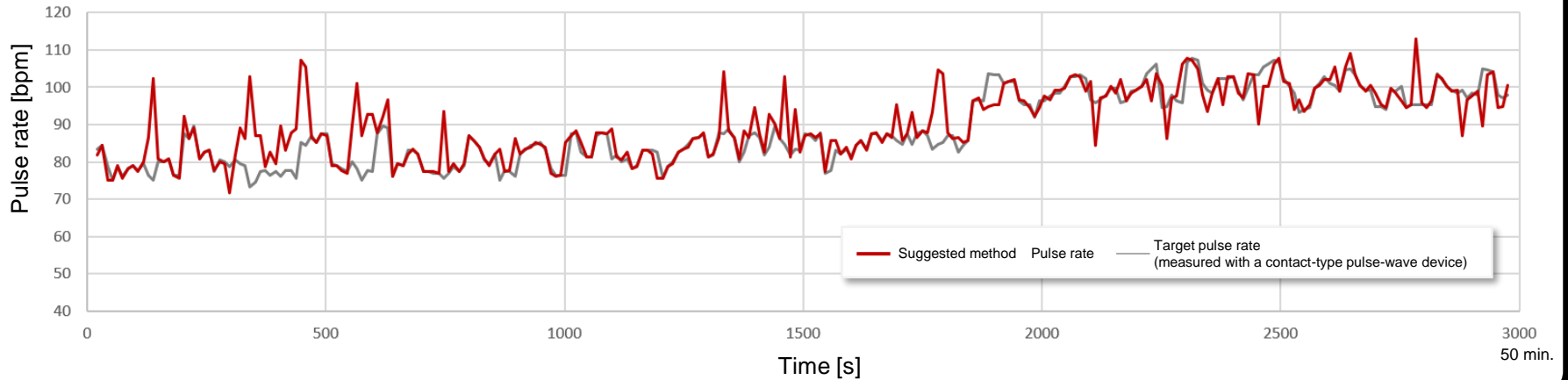
— Conventional method Pulse waveform — Target waveform (measured with a contact-type pulse-wave device)

Vital signs sensing ~Detecting unnoticed changes to prevent accidents and health issues ~

Technical details

Detection performance in a moving vehicle

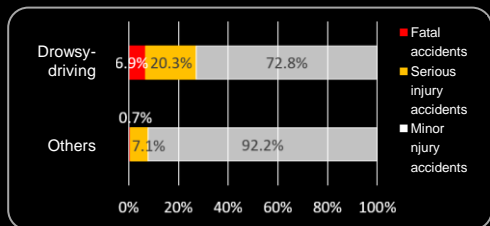
Data from a male in his thirties during nighttime driving



Vital signs sensing ~Detecting unnoticed changes to prevent accidents and health issues ~

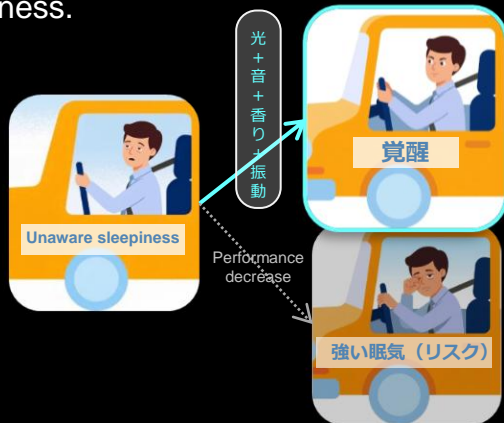
Example applications

Reduction of car accidents caused by drowsy-driving

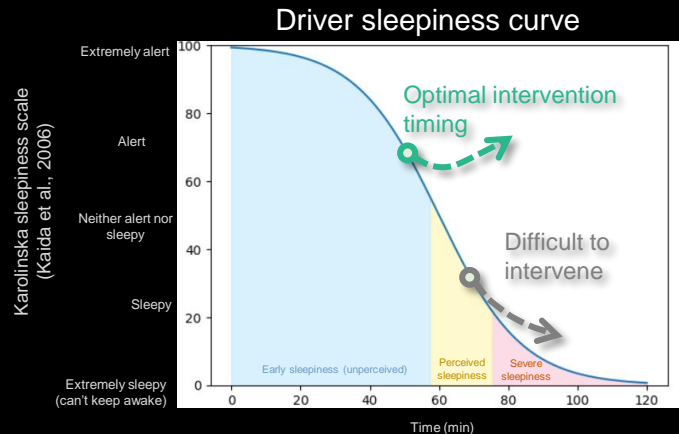


Reference : July-September 2025 data published by Ministry of Land, Infrastructure, Transport and Tourism

Detecting early signs of sleepiness to promote wakefulness.



Early intervention in driver sleepiness can help restore alertness **comfortably and sustainably.**



Wakefulness decreases in a non-linear manner.

- After a threshold, the decline becomes rapid rather than gradual.

Severe sleepiness is a physiological drive and is difficult to suppress.

- External stimuli such as sound, light, and vibration become less effective.
- The driver becomes uncomfortable when woken up forcibly.

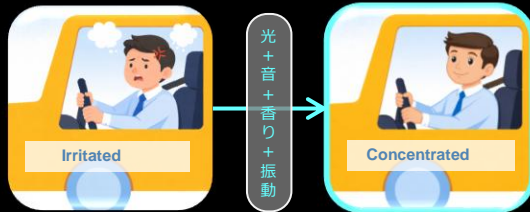
References

- Kaida et al., 2006 Validation of the Karolinska Sleepiness Scale against performance and EEG variables
- Driver sleepiness prediction study, 2023
- Pykkönen et al., 2018, Accident Analysis & Prevention
- 目片ら, 内発的動機づけの誘発による覚醒維持手法における最適な情報提示タイミングの探索, 2020

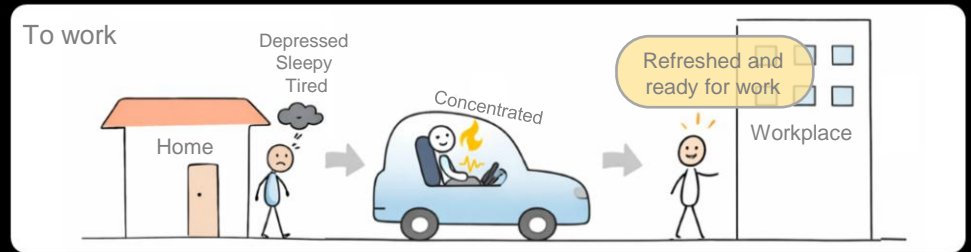
Vital signs sensing ~Detecting unnoticed changes to prevent accidents and health issues~

Example applications

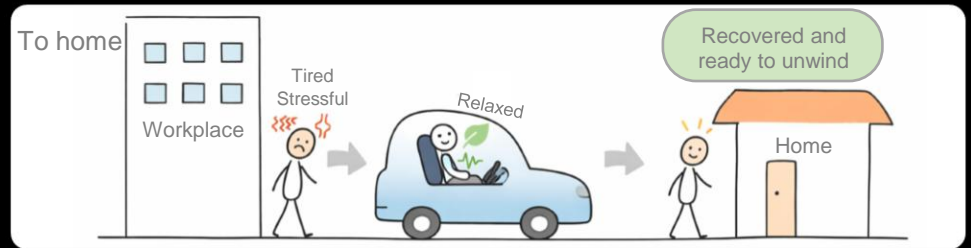
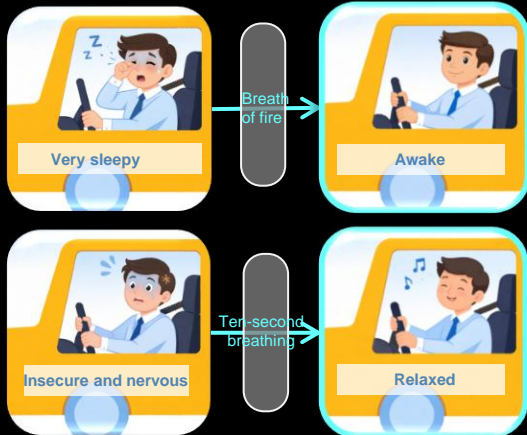
Reducing irritation and promoting driver relaxation



Routine driving time during the commute can become an opportunity for the driver to refresh their psychophysiological state.



Breathing guide for conditioning



The sensing system helps drivers notice long-term changes and improve their behavior at work and in daily life.

Vital signs sensing ~Detecting unnoticed changes to prevent accidents and health issues ~

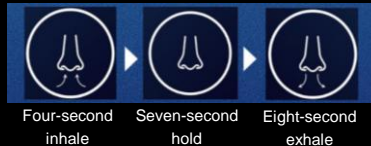
Example applications

Mental and physical conditioning

Breathing techniques are one of the few ways to directly influence the autonomic nervous system and effectively shift emotional and physiological states.

Relaxation

4-7-8 breathing



The parasympathetic nervous system becomes dominant and induces deep relaxation.

Stress reduction

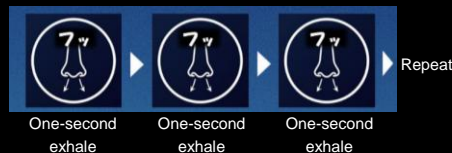
Ten-second breathing



Heart rate returns to normal, and the autonomic nervous system stabilizes.

Concentration

Breath of Fire

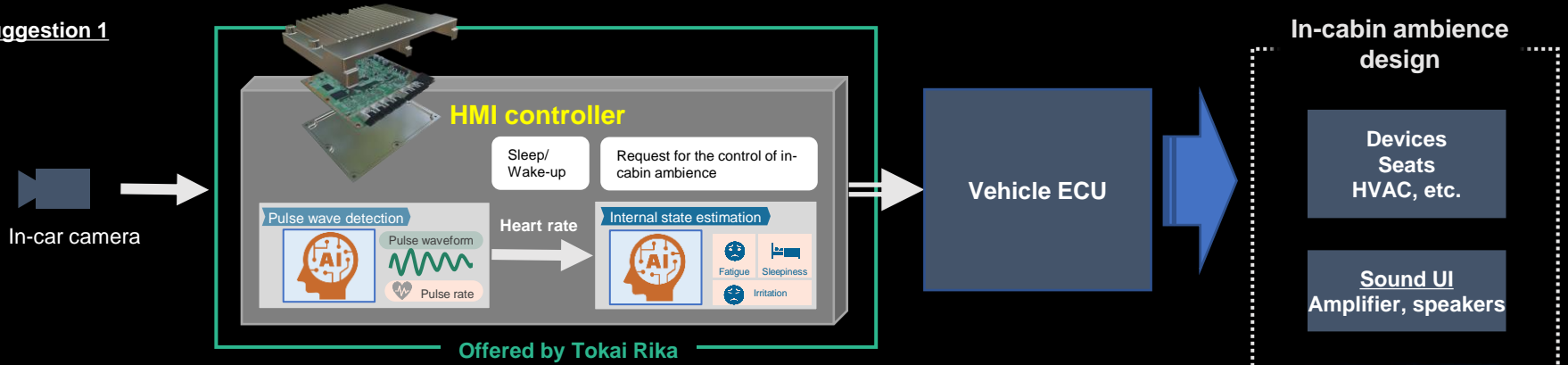


The sympathetic nervous system is activated, boosting energy and sharpening concentration.

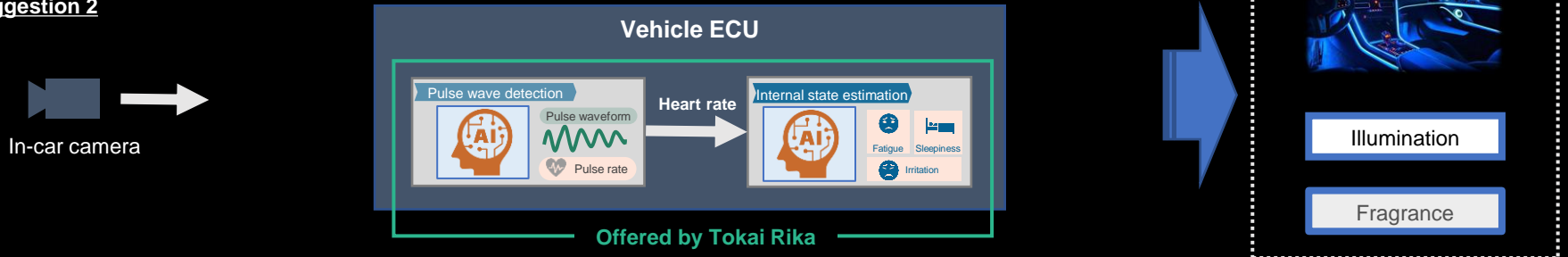
Vital signs sensing ~ Detecting unnoticed changes to prevent accidents and health issues ~

System configurations

Suggestion 1



Suggestion 2



Tokai Rika can also separately offer a pulse-wave detection system, an internal state estimation system, or individual software applications.