Electrocardiographic Steering wheel for Fatigue and Drowsiness and Emotional Estimation

疲労・眠気・感情推定ステアリングシステム

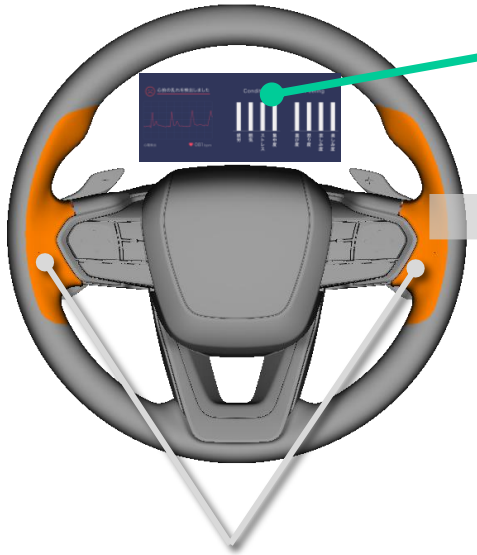
Purpose

A vehicle can monitor the driver's emotion and heath conditions during usual driving to watch over the physical condition and provide safe and comfortable solutions, contributing to the prevention of car accidents.

Outline

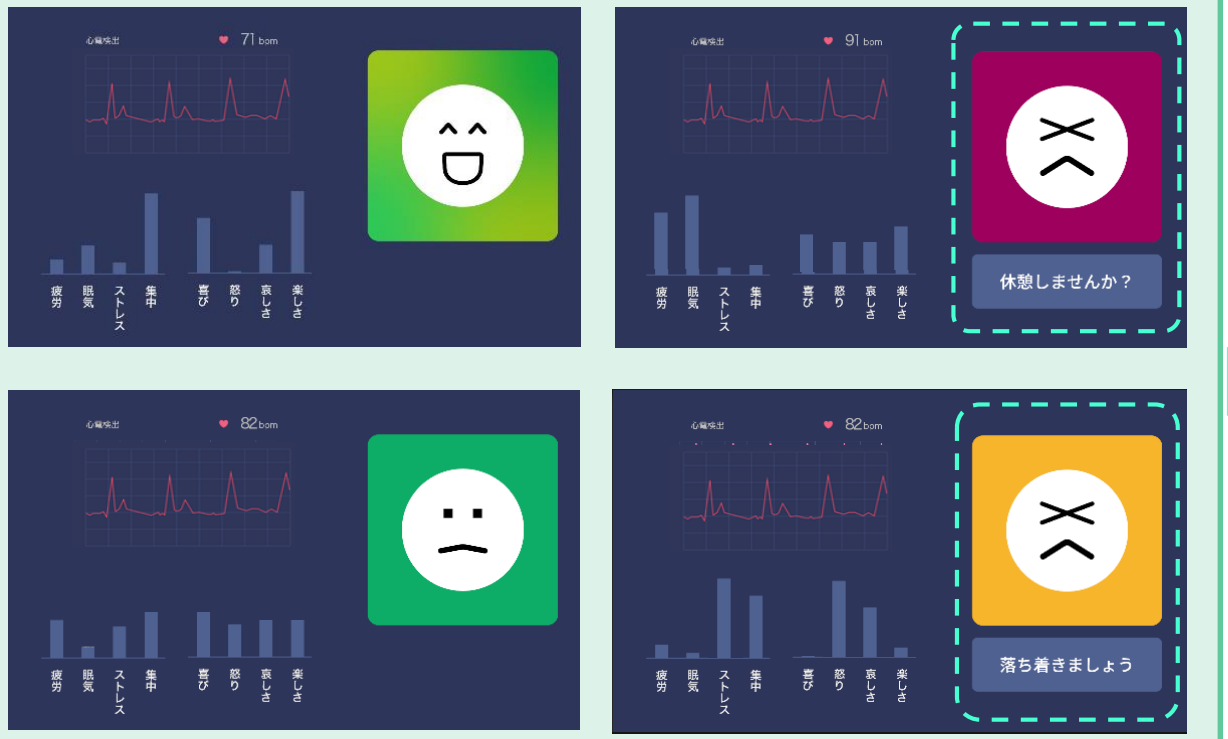
Sensors built in a steering wheel measure the driver's electrocardiogram and estimate fatigue, drowsiness, emotion, and atrial fibrillation to lead to the driver's health control service.

Steering wheel



Electrodes

Display view



Examples of displays for physical and emotional conditions

Service examples

Linked with a car

Fatigue and drowsiness detection Decreased Concentration

Warning　Break

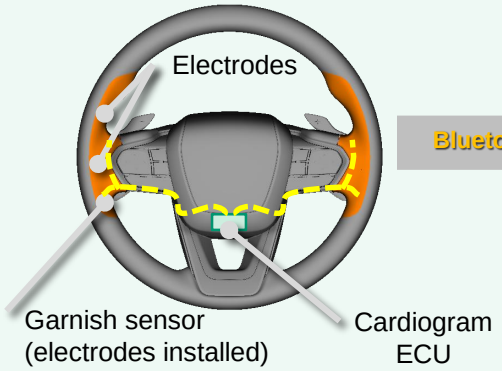
Anger and Sadness Detection Stress Detection

Aroma Relaxation

Technology

Steering wheel

A driver holds a steering wheel with two hands



Bluetooth

- **A contact sensor built in garnish (Tokai Rika's first-ever technique)**
  →High-precision detection than an optical sensor
- **Installed on a steering wheel with snap-fit joints (Tokai Rika's proved technique)**
  →Easy to be installed
  Available for urethane steering wheels

ECU, multimedia, gauges, etc.

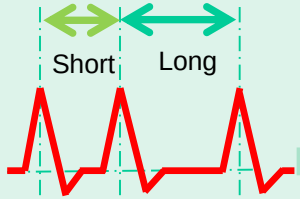
Denoising

Running car vibration noise filter

Tokai Rika original

Cardiogram

Heartbeat interval



Heart rate

Heart rate variability index

HRV index is extracted from heartbeat interval

HRV:
- Low-frequency components
- High-frequency components

Overall HRV:
- Ratio of low frequencies
- Frequency components, etc.

Algorithm

Fatigue and drowsiness estimation algorithm using machine learning

Tokai Rika original

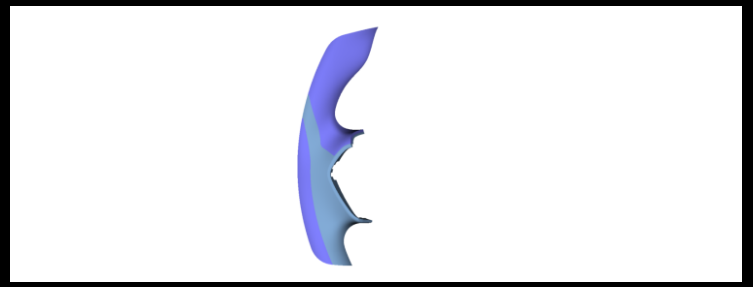
Emotion estimation algorithm

Judgment results

- Fatigue level
- Drowsiness level
- Stress
- Concentration level
- Emotions

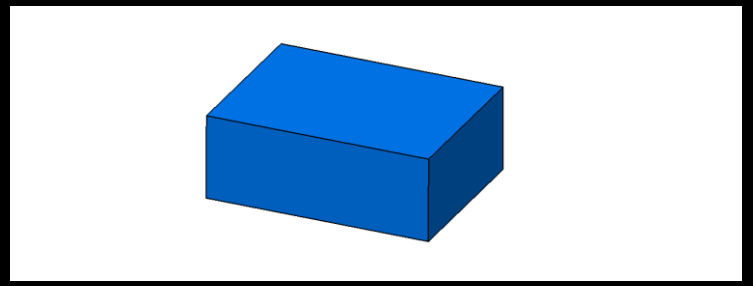
Specifications

- Garnish sensor with electrode



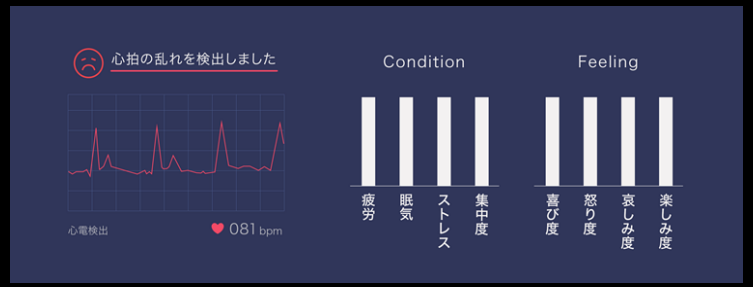
Insulation material	Nylon ?
Electrode	Conductive resin
Dimensions	180 x 45 x 30

- ECU module



Wireless communication standard	Bluetooth 5.0
Operating temperature range	-30 ℃ to 85 ℃
ECU dimensions	75 L × 40 W × 20 H mm

- Measurement and estimation functions



Electrocardiogram measurement, heart rate
Fatigue, drowsiness
Concentration
Stress
Emotions
Atrial fibrillation

Future use

- This system can be provided for business operators as a retrofit steering wheel cover that can be installed later.

Driver

Steering wheel cover
(electrodes built inside)

ECU, battery
(communication device installed)

Bluetooth

(Cardiogram)

Smartphone
(App)

Installed later easily

A very tired or drowsy driver

Notification
(View, voice or vibration)

An administrator is informed

Administrator

An alert is sent through SNS

Information about two-handed steering, fatigue, and drowsiness can be used for driving instructions.