Gaze Detection System

System Block Diagram

Camera Module **Control Unit**

I/F Board

12V

Image Recognition
Processor Board

| 12V |
| 5V |

DC/DC

12V
3.3V

Power

RS232C

RESET

Reset回路

DVI

MCLK

REFCLK

OSC

Image Data
R_LVDS_DATA+
R_LVDS_DATA−

DS92LV
1212A

PixelData[9:2]
Line Valid
Frame Valid
RCLK

VIIF

Camera
Module

Image Data
L_LVDS_DATA+
L_LVDS_DATA−

DS92LV
1212A

PixelData[9:2]
Line Valid
Frame Valid
RCLK

**Image Recognition
Processor Board**

I2C   SCLK
SDATA

I2C

R_Camera_Control
R_LED_DRIVE
L_Camera_Control
L_LED_DRIVE

3
3

GPIO

LED Control

CAN BUS   CAN H
CAN L

Transceiver

CAN TX
CAN RX

CAN

Note: Picture shown above is image.

Camera Module Block Diagram

Camera-L

- IR LED
- Lens Module
- Image Sensor
- IR LED
- LED Driver

LVDS → Image Data
I2C → Sensor Control
LED Control

Camera-R

- IR LED
- LED Driver
- Lens Module
- Image Sensor
- IR LED

LED Control
Image Data
LVDS
Sensor Control
I2C

Note: Picture shown above is image.

RS-232C

Power (+12V)
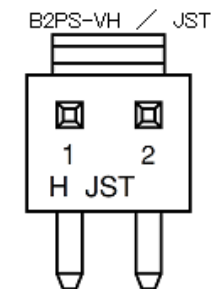
Pin No.	Symbol
1	GND
2	12V

DVI

CAN
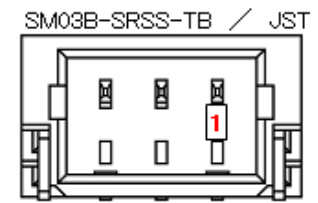
Pin No.	Symbol
1	CANH
2	GND
3	CANL

Serial Data Transfer Specification:
Out Put Only
Baud Rate : 115.2Kbps
Stop Bit : "1"
**Parity : none**
Flow : none
Data : 8bit

Tx: GDS
Rx: GDS Controller
Phy: UART
CAN ID : N/A
Interval : 16.6-33.3ms (periodic)
*) see "UART Data format" sheet for detail communication bit assingment.

| Message Name	Signal	bit length	range	Conversion
Gaze Data	Point Of Gaze – X/Y (float)	32	−1e38 to 1e38 pixel	
	Pupil Position R/L – X/Y/Z (float)	32	−1e38 to 1e38 mm	
	Gaze Vector R/L – X/Y /Z(float)	32	−1 to +1	unit vector
	Face Position – X/Y/Z (float)	32	−1e38 to 1e38 mm	
	Face Vector – X/Y/Z (float)	32	−1 to +1	unit vector
	User Name 0-10	8	00h – FFh	ASCII Code
	User Name 11	8	00h	ASCII Code (Null)
	UC#2	1	0 – 1	1=True , 0=False
	UC#3	1	0 – 1	1=True , 0=False
	UC#1	1	0 – 1	1=True , 0=False
	Name A	1	0 – 1	1=True , 0=False
	Name B	1	0 – 1	1=True , 0=False

Name A : Face Recognised result is displayed as "Hello, ○○".
Name B : Face Recognised result is displayed on the upper left.

Gaze Data	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Byte 0	Headder (AAh)							
Byte 1	Headder (55h)							
Byte 2	ID Code (01h)							
Byte 3	ID Code (00h)							
Byte 4	ID Code (00h)							
Byte 5	ID Code (00h)							
Byte 6-9	Point Of Gaze - X (float)							
Byte 10-13	Point Of Gaze - Y (float)							
Byte 14-17	Pupil Position R - X (float)							
Byte 18-21	Pupil Position R - Y (float)							
Byte 22-25	Pupil Position R - Z (float)							
Byte 26-29	Pupil Position L - X (float)							
Byte 30-33	Pupil Position L - Y (float)							
Byte 34-37	Pupil Position L - Z (float)							
Byte 38-41	Gaze Vector R - X (float)							
Byte 42-45	Gaze Vector R - Y (float)							
Byte 46-49	Gaze Vector R - Z (float)							
Byte 50-53	Gaze Vector L - X (float)							
Byte 54-57	Gaze Vector L - Y (float)							
Byte 58-61	Gaze Vector L - Z (float)							
Byte 62-65	Face Position - X (float)							
Byte 66-69	Face Position - Y (float)							
Byte 70-73	Face Position - Z (float)							
Byte 74-77	Face Vector - X (float)							
Byte 78-81	Face Vector - Y (float)							
Byte 82-85	Face Vector - Z (float)							
Byte 86-96	User Name 0 - 10 (ASCII Code)							
Byte 97	User Name 11 (Null : 00h)							
Byte 98	0	0	0	Name B	Name A	UC#1	UC#3	UC#2

	FPGA Box	SOC
H angle	32deg	45deg
V angle	20deg	30deg

Z：±30cm

Z

X：±20cm

30deg

Stereo Camera

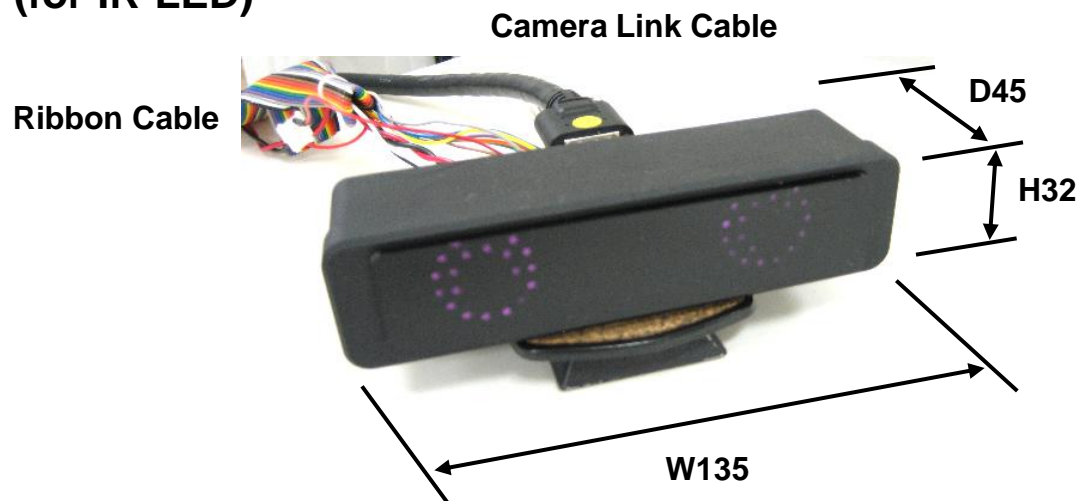Head

X

H-angle

Y

Y：±20cm

18deg

Z
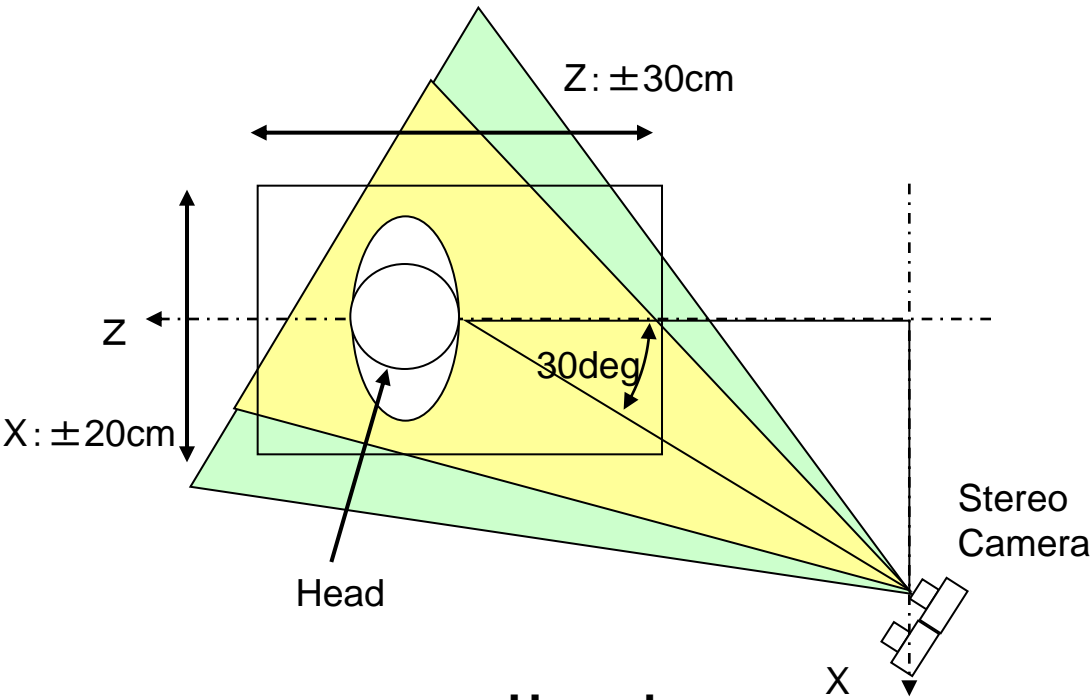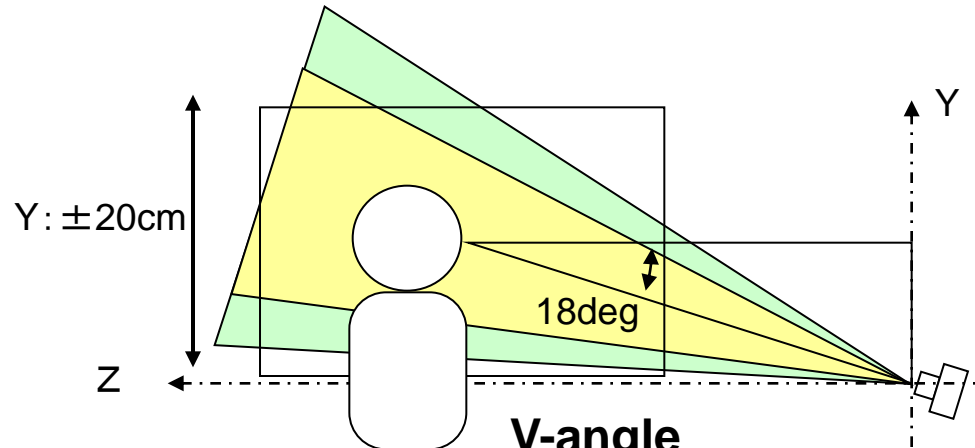
V-angle

Outline of Loaner System
(FPGA Box)

Loan Term: End of December, 2013

Stereo Camera Unit

W135 x H32 x D45 [mm]
AC100-240V (for IR-LED)

Camera Link Cable

Ribbon Cable

D45

H32

W135

PC

DELL PRECISION M4700
Windows7 Professional 64bit
CPU: Intel Core i7 (2.60GHz)
RAM: 8GB
AC100-240V

DELL-PC

FPGA BOX

FPGA BOX

W380 x D270 x H60 [mm]
AC100-240V

AC-Adaptor 19V
(for IR LED Power)

AC100-240V

Camera Link Cable

Camera
Link
Cable

Ribbon
Cable

FPGA BOX

USB Cable

Monitor
1024x768

Stereo
Camera
Unit

Dell-PC

acer
Tablet

ALPS Dongle

EPIX Card

USB Serial
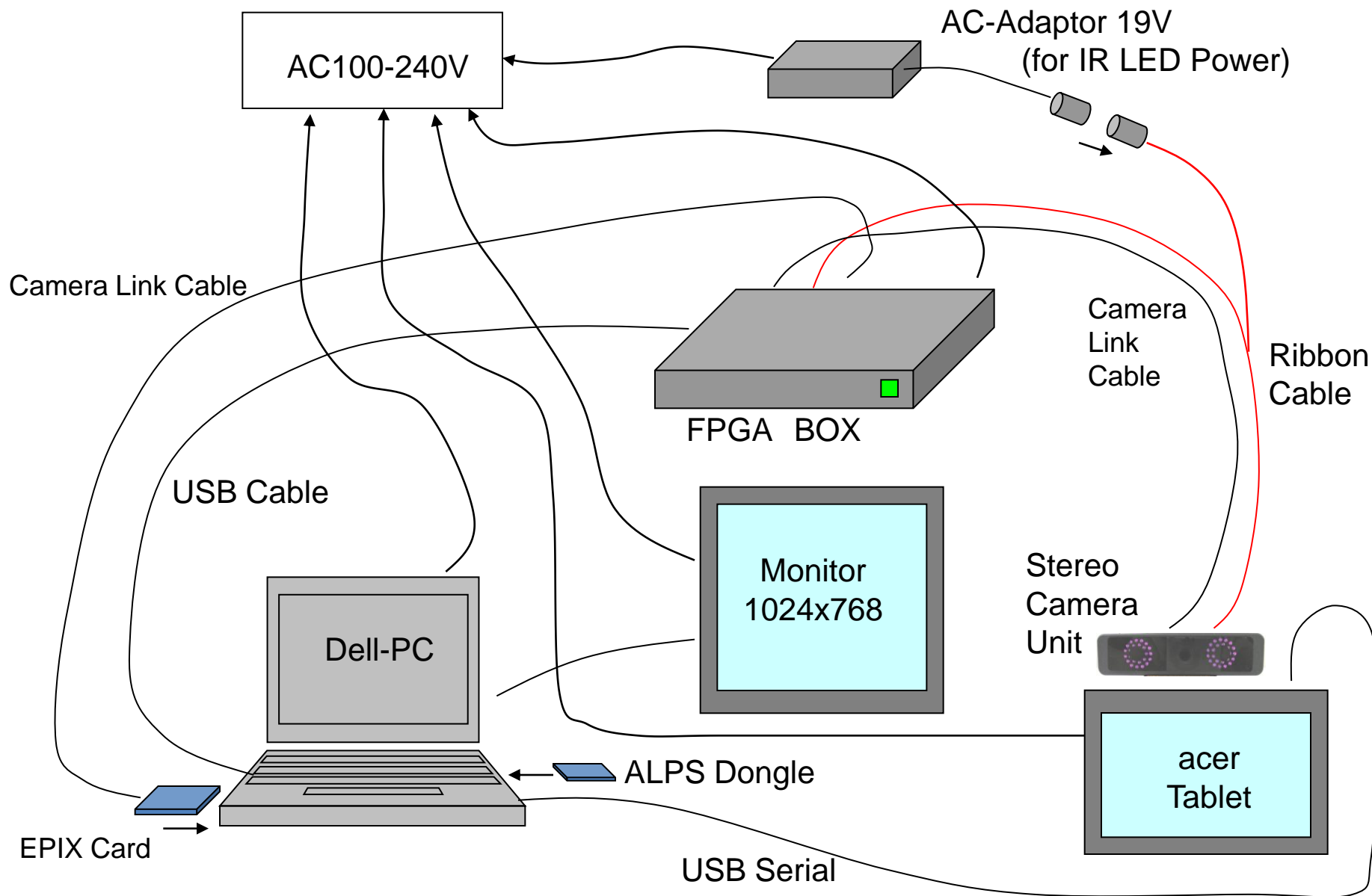
Embedded System

1st unit: Delivery on 12/2/2013

Stereo Camera Module

D:75mm

H:11mm

W:132mm

HDMI Cable x2

Control Unit (I/F + SoC Box)

D:130mm

H:40mm

W:180mm
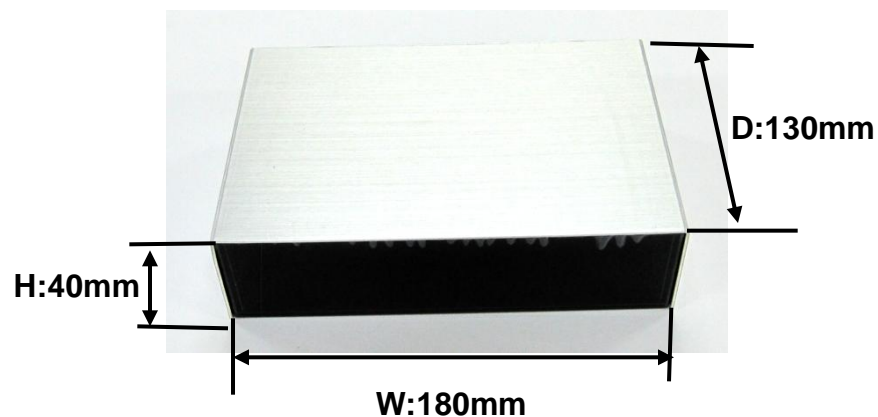
AC(100V-240V) Adapter

Note: Pictures shown above are image.

Bench Review for Use Case#1, #2, #3

Table top setting

Use case (Bench Review structure)
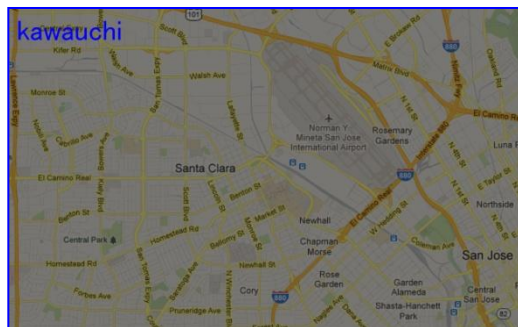

Monitor as Road

Stereo Camera Module

LED:870nm

Camera

Camera

LED:870nm

FPGA

IR Light Timing Control

Exposure Timing Control

AE

Image decoder

Image Data

PC

Gaze detection
Use Case detection

Tablet as CID

USB to UART
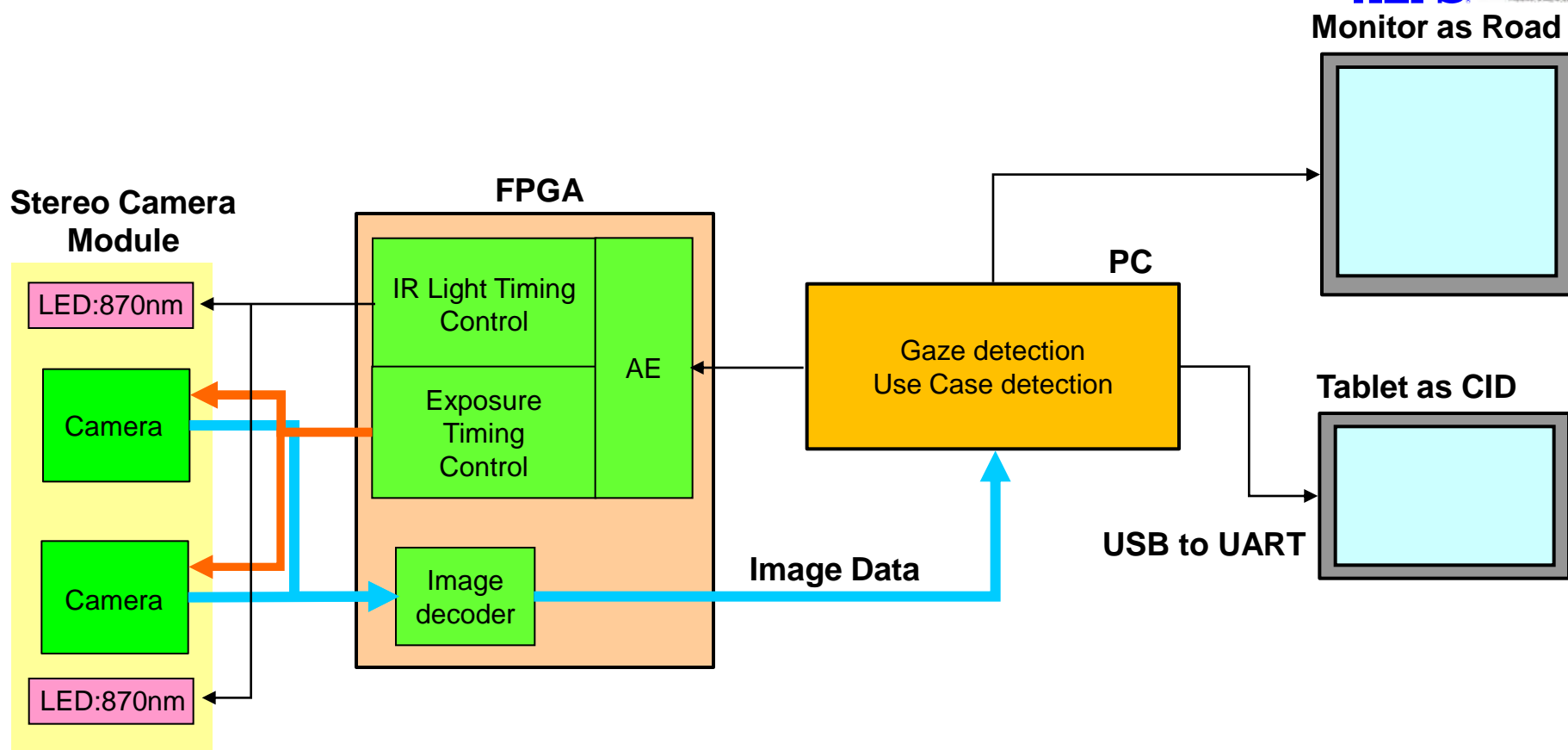
Function
・Gaze detection
・Use Case #1,#2,#3 detection
・Face recognition

UseCase OutPut (1byte)
bit0 : UseCase#2 detected
bit1 : UseCase#3 detected
bit2 : UseCase#1 detected
bit3 : Face Recognition result (Display message)
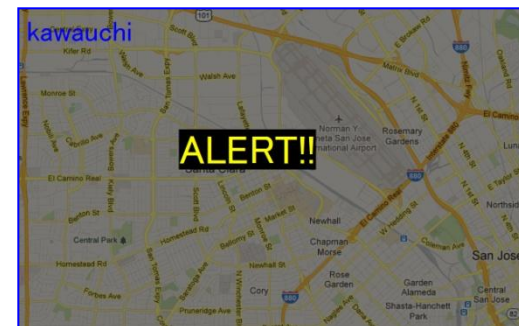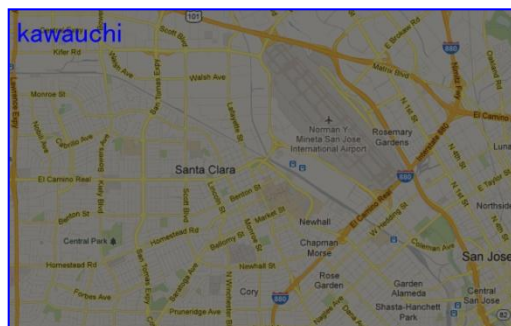bit4 : Face Recognition result (Display message)
bit5-7 : 0

Vertial screen

（0,0）

Road area

200mm

PC Monitor

400mm

Camera

18deg

CID （Tablet）

800mm

30deg

（1024,768）

CID area

< Default / Dimming >

< Use Case#1 >
Display warning message on CID
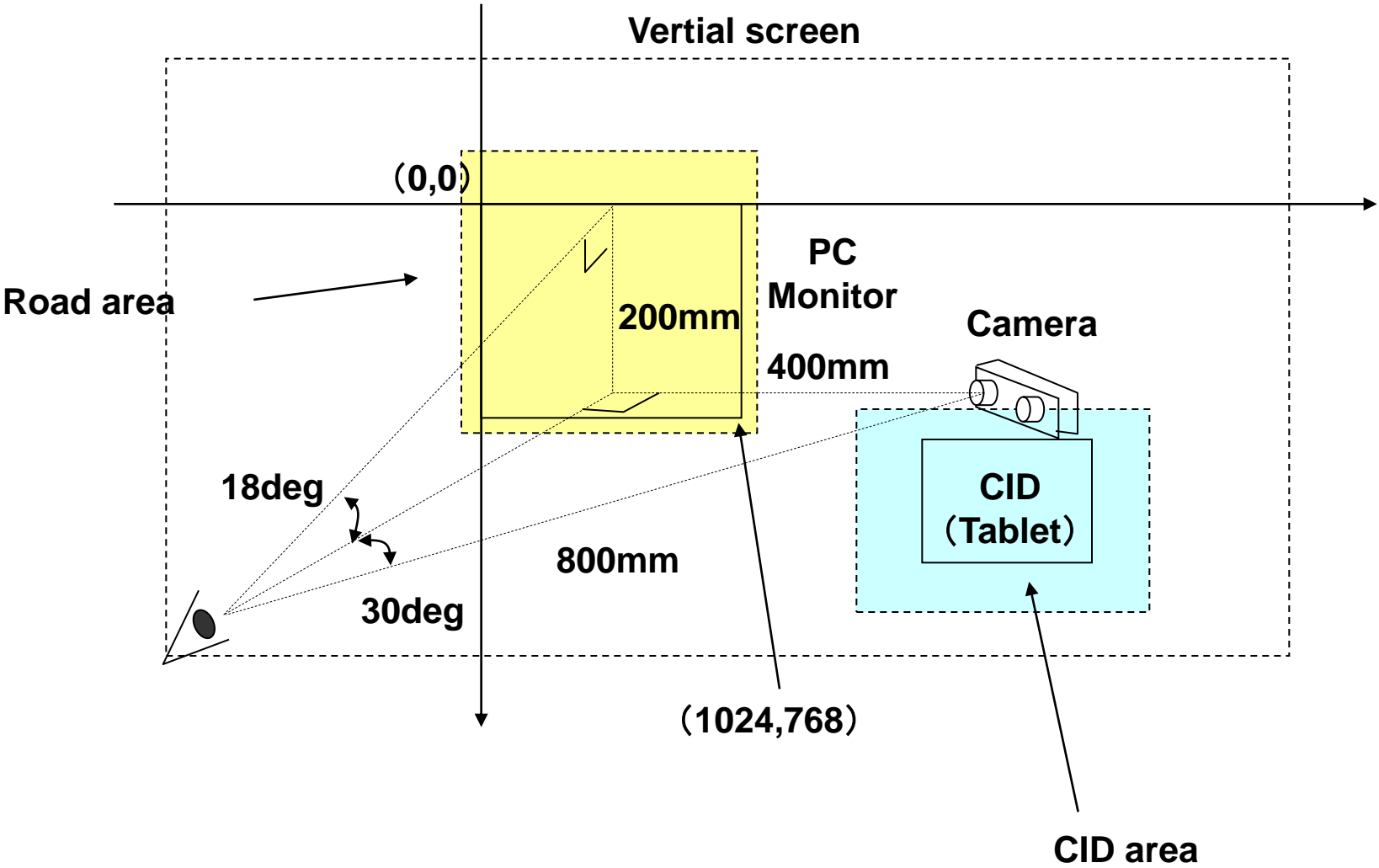
Eyes off the road for ≥ 2 secons

Eyes return on the road

< Default / Dimming >

Looking at CID

After 3000ms

After 1000ms

Looking at CID twice within 3 seconds
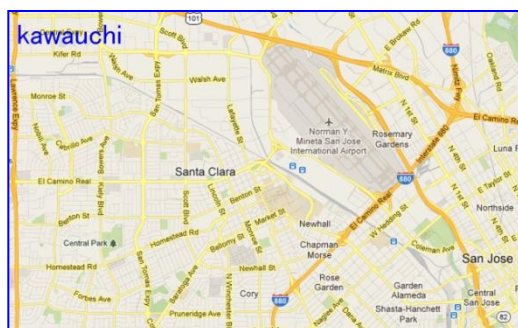
< Use Case #2 >
Brighten up CID backlighting immediately
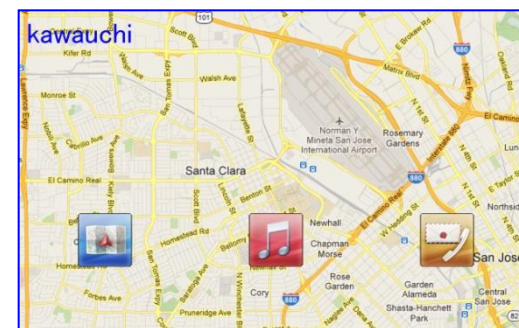
< Use Case #3 >
Popping up menu immediately

Mutual Success