White Paper

OMRON

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Image Sensor for Human Recognition Human Vision Components, "HVC-P2"

Introduction

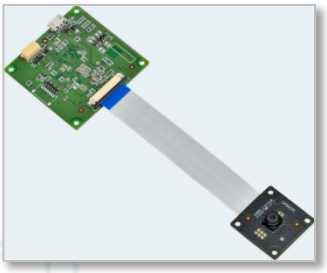
OMRON Corporation has been developing image sensing technology "OKAO Vision", for Human Recognition for over 20 years, which enables the detection of faces, facial features, -human bodies coupled with the estimation of age or gender of the humans in the captured images. Omron had licensed this technology into mainly digital cameras and smartphones, and consequently those have amounted to a total over 1.5 billion licenses. Furthermore, OMRON has launched Human Vision Components (commonly referred to as HVC) , which are modular solutions, and each incorporates 10 human sensing functions which are features of "OKAO Vision", including the functions mentioned above.

Human Vision Components "HVC-P2", Image Sensor for Human Recognition

Human Vision Components (HVC), the image sensor for Human Recognition, is a combination of Omron's own image sensing technology "OKAO Vision", which can recognize people's blinks, gaze direction, expression, gender or age, with a camera module.

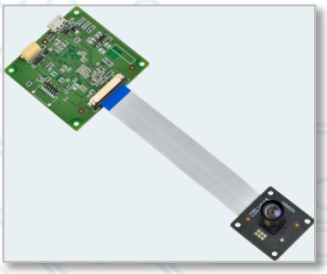
Response time has become 10 times faster than the first generation , HVC-P, at maximum rate.

Moreover, there are two types of lens options available, a long-distance 50 degree type (B5T-007001-010) and a wide-angle, 90 degree type (B5T-007001-020). This allows customers to make a choice depending on detection distance and FOV(Field of Vision). "HVC-P2" is able to detect and estimate the attributes or condition of the objects without notifying them of the presence of its camera, and realizes the optimal service which corresponds to users' needs.



Long-distance type (B5T-007001-010)

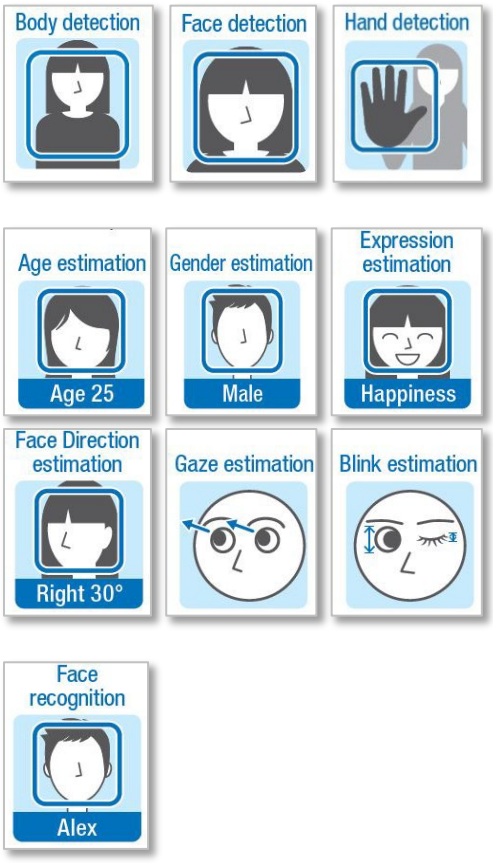
- This product can detect a human body as far as 17m, and also a face at a maximum distance of 6m.
- This product is for detection of human bodies or faces which exist in a little far away from the device.



Wide-angle type (B5T-007001-020)

- This product can detect human bodies and faces when they exist in the range between +90°and -90°horizontally.
- This product is for human body or face detection for a short distance and wide FOV.

The Installed Functions



- **Human Body Detection,**
- **Face Detection,**
- **Hand Detection**

It can output the sizes and position coordinates of the human bodies, faces or hands which are captured in the images.

- **Age Estimation**
- **Gender Estimation**
- **Expression Estimation**
- **Face Direction Estimation**
- **Gaze Estimation**
- **Blink Estimation**

It can analyze the facial data gathered from the images by its own algorithm and output the results respectively.

- **Face Recognition**

It conducts a matching check between the people who are captured in the images and the facial data (the amount of features) which had been inputted in advance to the main memory and outputs the results.

Development background of this product

The need for human recognition sensors has been accelerated recently to join in the development of analysis technology, coupling with advanced computing technology in the IoT market such as deep learning (machine learning). In addition, there has been an expansion in use and an increase in the objects for sensing; hence the needs have become more and more diverse. Moreover, under these circumstances, the needs for grasping the locations, attributes, or condition of end users become increasingly important in advanced analytics.

OMRON has been offering its own image sensing technology, "OKAO Vision", through its software library to the manufacturer of assembled products, and its technology has been installed mainly to the digital devices, such as digital cameras and smartphones.

On the other hand, we have realized that this software has place in other applications in which a user does not have the processing to run an algorithm. Therefore, we have developed the new HVC-P2 which have become closer to hardware so that the customers can integrate OMRON image sensing technology into their system and bring their product to market faster.

The main board is compact and it can detect the human features up to four times per second by taking advantage of the features of "OKAO Vision" which enables high speed processing.

Installation examples

Digital Signage

- For an interactive experience which corresponds to the customers who stand in front of the digital signage. (Face Detection, Age Estimation, Gender Estimation)
- Utilization in the audience measurement and the advertising effect measurement by gathering the customers' attributes data, such as age and gender, who see the digital signage. (Face Detection, Age Estimation, Gender Estimation)
- Displaying an operation panel for content or touchscreens at the height of the person's face, which is estimated by the facial position data assembled by the machine. (Face Detection)

Vending machine

- Utilization in marketing activities by gathering the customers' attributes data, such as age and gender, and connecting them with the products purchased.
- Displaying the recommendable products corresponding to the customers' age or gender who stand in front of the machine. (Face Recognition, Age Estimation, Gender Estimation)

About the offering of the developing tool

Omron is offering the following developing tools for free to allow for ease of evaluation, in hope that this may accelerate development and materialize proof of concepts within a short term. Please visit our website for details.

AM：https://components.omron.com/us-en/products/sensors/B5T　AP：https://components.omron.com/sg-en/products/sensors/B5T

EU：https://components.omron.com/eu-en/products/sensors/B5T　KR：https://components.omron.com/kr-en/products/sensors/B5T

CN：https://components.omron.com.cn/products/sensors/B5T

Evaluation Software

- Corresponding to Windows 7 / 8.1 / 10, 32/64bit version
- Software which can be used handily on your personal computer and let you experience the basic functions and performance of the HVC-P2.

USB driver

- For Windows 7 / 8 / 8.1 (32/64 bit)
- If you operate the programs on Windows OS, you do not need to specially prepare another driver.

*If you are using Linux OS, you can use the driver attached as standard equipment.

Sample Code

- Currently C and Python languages are available.

URL: https://github.com/omron-devhub

Specifications

Item	Specifications	
	B5T-007001--010	B5T-007001-020
Detection resolution	1600×1200 pixel	1600×1200 pixel
Horizontal detection range (angle of view)	54°	94°
Vertical detection range (angle of view)	41°	76°

Item	Specifications
Output Image	<Options> No output / 160×120 pixel / 320×240 pixel
Image format	RAW (8bits, Y data)

Function	Output	Note
Human Body Detection Face Detection Hand Detection	• Number of the objects detected • Detected location (position coordinates) • Detected size • Reliability	• Maximum 35 objects • Coordinates (in pixels) from the top-left corner of the screen • The pixel size on the screen • Reliability of the results (0 - 1000, by 1 degree, larger number indicates higher reliability)
Face Direction Estimation	• Horizontal angle • Vertical angle • Tilt angle (roll) • Reliability	• Angle (in degrees) • Reliability of the results (0 - 1000, by 1 degree, larger number indicates higher reliability)
Gaze Estimation	• Horizontal angle • Vertical angle	• Angle (in degrees)
Blink Estimation	• Blink degree	• Output for both of the eyes • (1 - 1000, by 1 degree, • When the eye is closed tightly, the degree of confidence will become larger.

Specifications

Function	Output	Note
Age Estimation	• Age • Reliability	• 0-74, for those over 75, estimated by 1 year. • Reliability of the results (0-1000, by 1 degree,larger number indicates higher reliability)
Gender Estimation	• Gender • Reliability	• Male / Female • Reliability of the results (0 - 1000, by 1 degree, larger number indicates higher reliability)
Expression Estimation	• Scores for 5 expressions • Positive / Negative degree	• The degree of each expression (“neutral”, “happiness”, “surprise”, “anger”, “sadness”, 0 – 100, by 1 degree,the larger number indicates the higher likeliness of the expression) • +100 -—100, by 1 degree, stronger “happiness” would achieve near +100 score, and if the other expressions, such as “surprise”, “anger”,”sadness” are stronger, the “happiness” score would be near —100.
Face Recognition	• Results of individual identification/verification • Score	• Outputs either information, User ID of the person specified from the registered data or non-registered message. • Maximum registered profiles: 100 • The maximum number of registered users can be changed through a command to 500 users x 2 data or 1000 users x 1 data • 10 data per person can be registered • Facial images photographed by other cameras cannot be registered • Matching degree (0 – 1000, by 1 degree),outputs the result of a user who achieved the highest matching degree,the number close to 1000 indicates the high probability of correspondence

Specifications

■ Rating

Item	Rated Value	Item
Power Supply Voltage	DC5V±10%	Power Supply Voltage
Current Consumption	Under 0.4A	Current Consumption
Operating Temperature	0～+50℃ (without condensation or freezing)	Operating Temperature
Operating Humidity	Under 90%RH (without condensation or freezing)	Operating Humidity

■ Detection Distance (*reference value)

Function	Maximum Distance	
	B5T-007001-010	B5T-007001-020
Human Body Detection	17m	8m
Hand Detection	6m	3m
Face Detection	10m	5m
Face Direction Estimation, Gaze Estimation, Blink Estimation, Age Estimation, Gender Estimation, Expression Estimation, Face Recognition	3m	1.5m

*When attempted object detection distance is further than the above values, the level of accuracy will be lowered. In addition, the detectable distance will vary, dependent on component settings.

■ Communication with Host (for both B5T-007001-010 and B5T-007001-020)

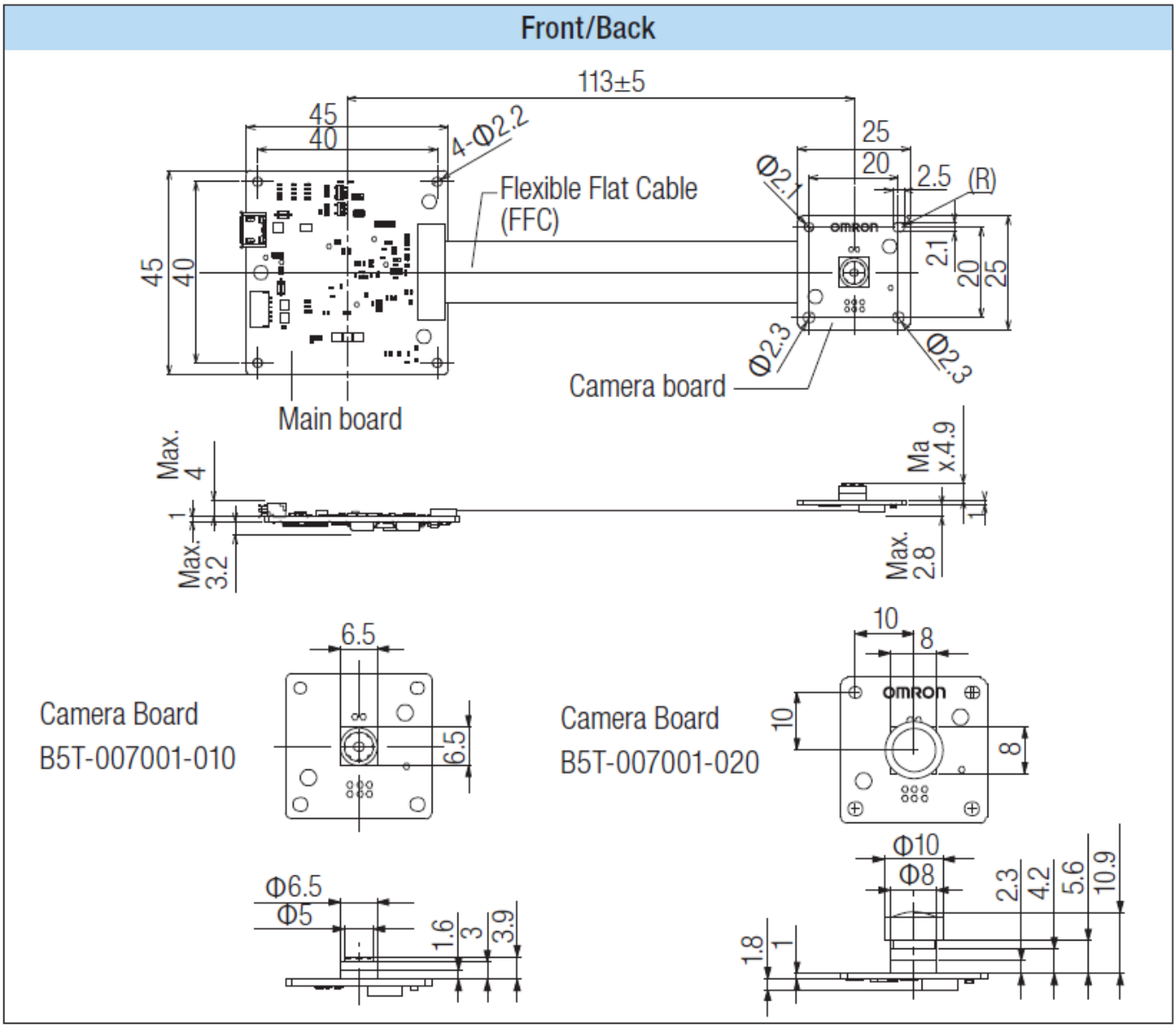
＜UART＞	Specification
Outline	Receives the commands controlling the module from the host, and sends the results detected by the module and other information
Communication Protocol	Non-procedural
Synchronization Scheme	Asynchronous method
Data format	Start: 1 bit, Data: 8 bit, Stop: 1 bit, no parity

＜USB＞	Specification
Outline	Receives the commands controlling the module from the host, and sends the results detected by the module and other information
Communication System	USB 2.0 *Using CDC class

Specifications

■ External Dimentions

Front/Back



* "HVC" is an abbreviation of the Human Vision Components.
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* Windows is either a registered trademark or a trademark of Microsoft U.S. in the United States and/or other countries.

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