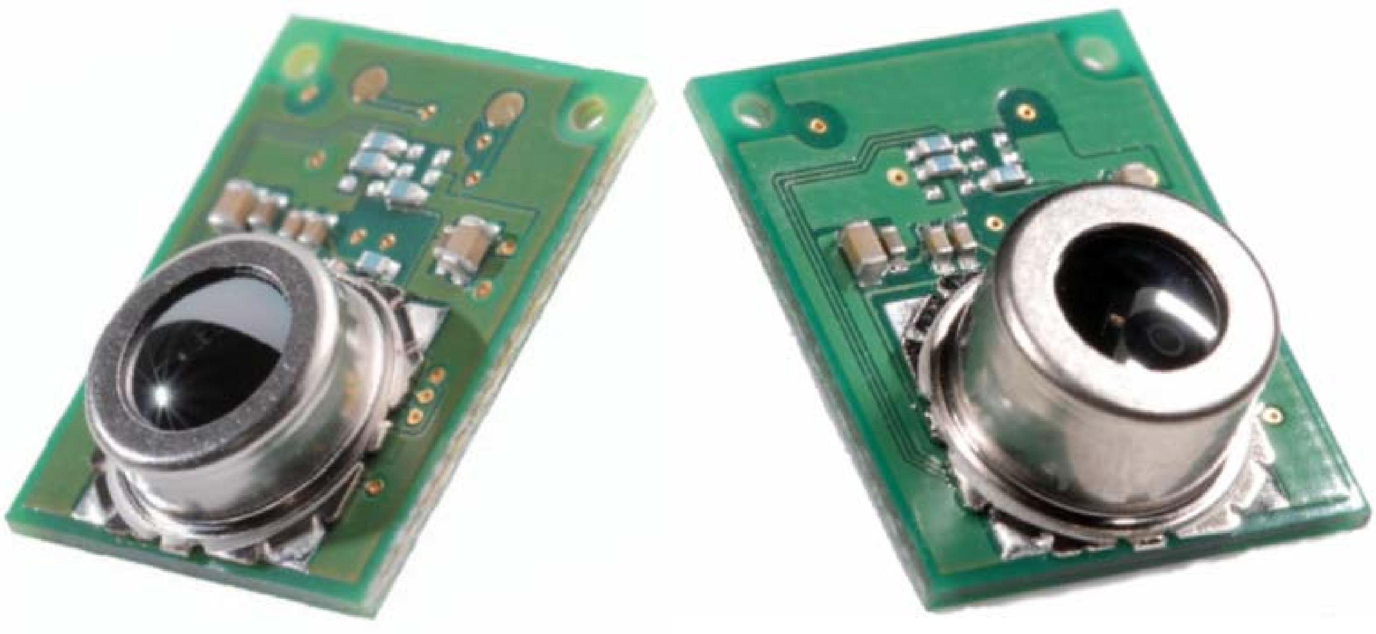
Usage of the D6T-44L / D6T-8L Thermal sensor

--- Basic algorithm ---

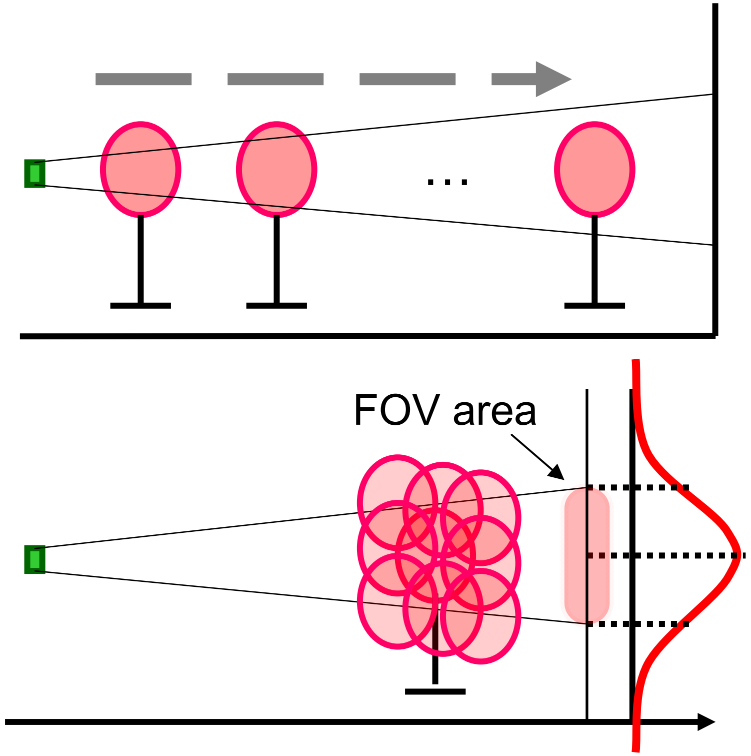


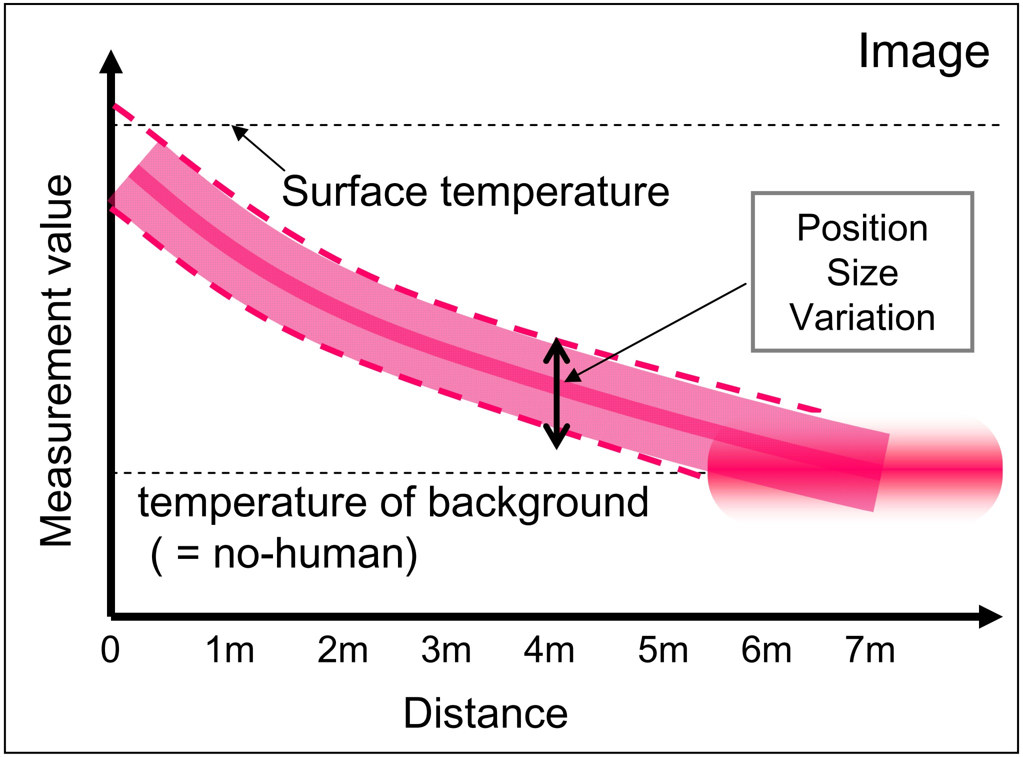
MDMK-12-0407

1. Measurement value at various conditions

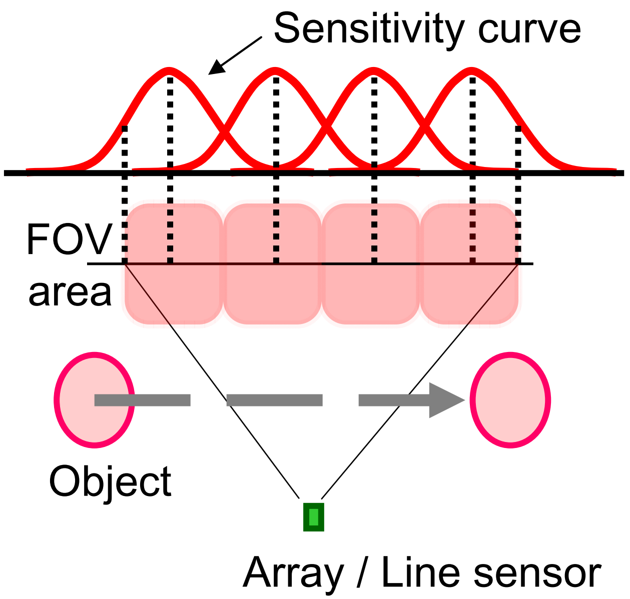
In the measurement of the object warmer than the background,
Measurement value is changed at various conditions.

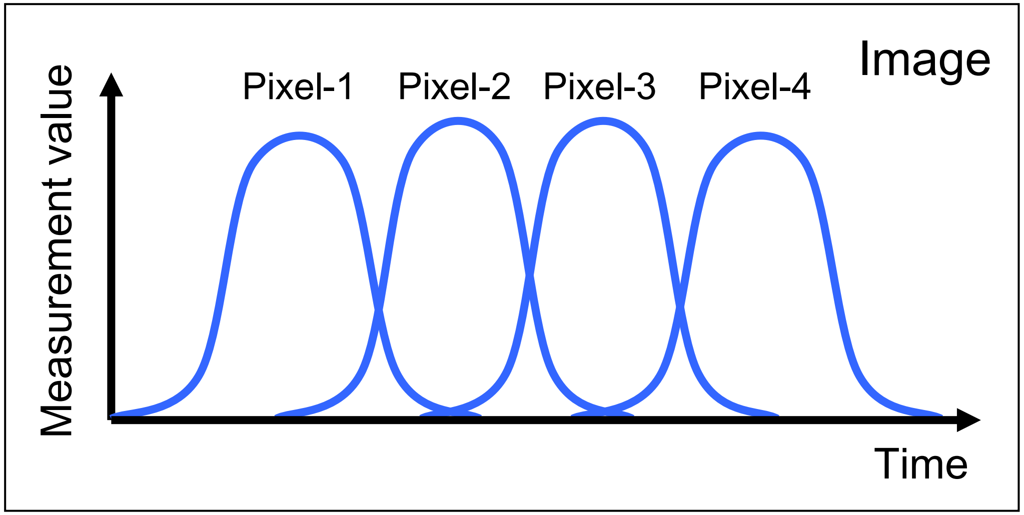
Size of object is smaller than the sensitivity area, the measured value has deviated.
Peak point is center of sensitivity area. FOV specification is peak-50% sensitivity area.
Measured value varies depending on the positioning in the FOV.

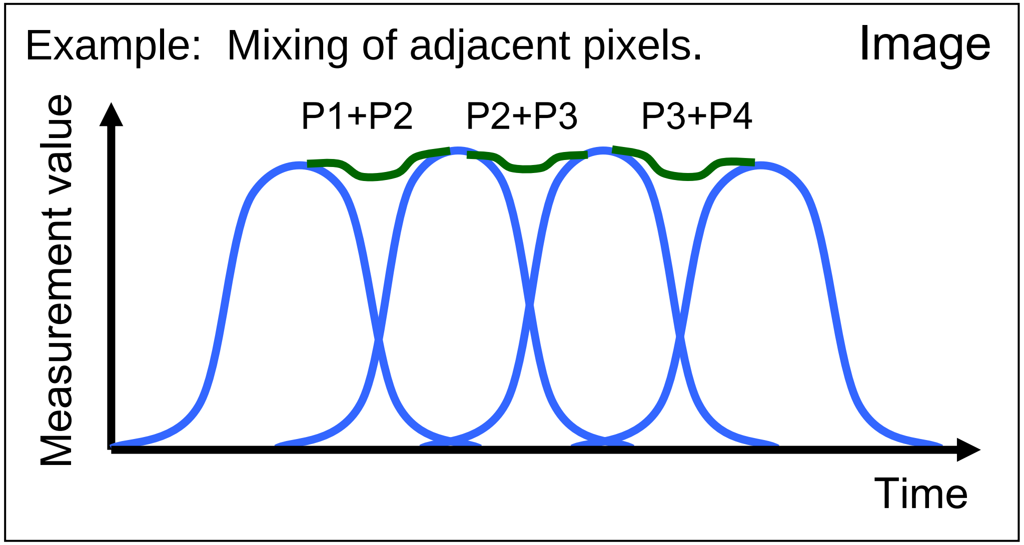




2. Measurements of moving object






Example: Mixing of adjacent pixels.

In the case of an object that is off-center, we may be able to use the mixing value of adjacent pixel.

3. Human detection (fundamental)

Most Basic Determination method is a search of the highest point.
If you use only one measurement result, takes up little memory.
Your processing power does not also require more.

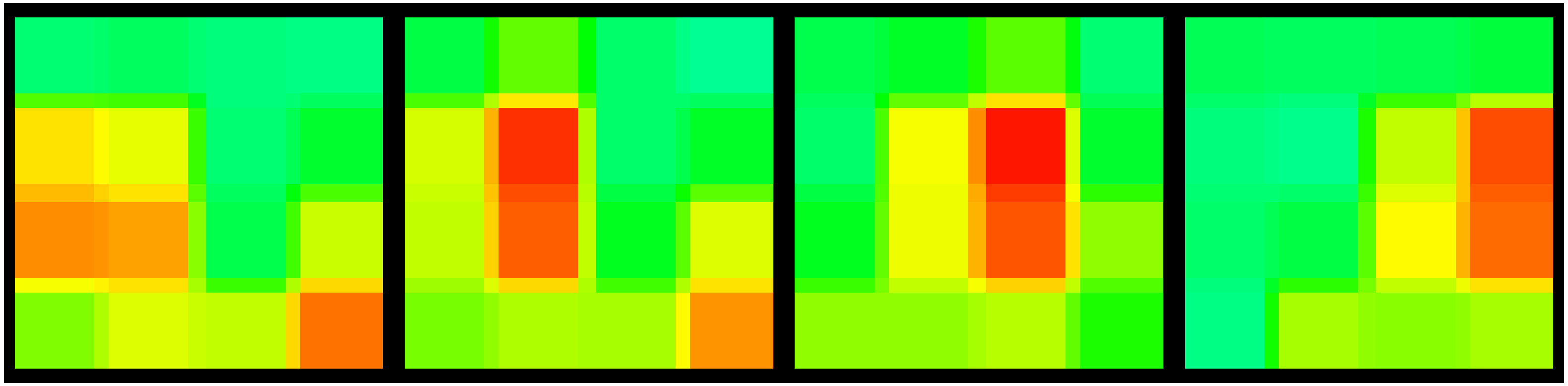
Improvement of correctness

●Higher than the normal human skin : not human? Hot equipment?
Example. >36degC point is rejected. <15degC is not human.

●If the distance range can be limited : Using Warm pixel number. (size of object)
Example. Face size < 2pixel. 1pixel peak point might human. 2pixel peak is not human.

●Temperature-range of background can be limited : Warm point can detect easy.

Use only one measurement, often incorrect determination occurs.

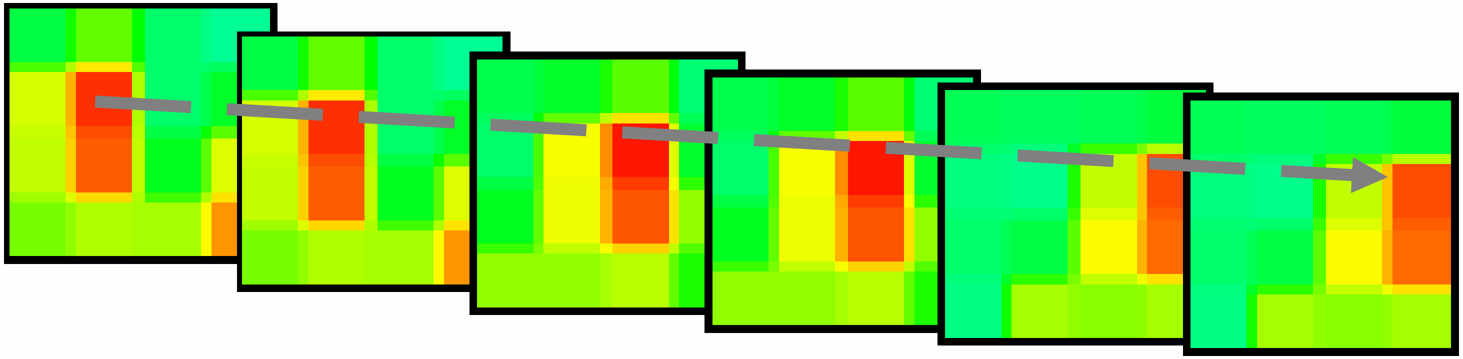


4. Human detection (experimental)

By using historical data and the learning function, you can improve the accuracy.
You will need the power of the processor and the memory.

Improvement of correctness

- Detection of moving object : Using historical data. Check-In/out from area.
- almost unchanged point : not Human? Background? Artifact objects?
- Position is not constant (Fluctuation) : Human? Dog?
- Transition information of the day : Floor? Wall? Window? Fireplace? Sun-light?
- Library matching : TV-equipment? Fireplace? Sun-light? Heater? Kitchen corner?
  (must be prepared in advance.)



5. Example - Processing flow

```
// Detection sub routine
extern  void  get_data(); // Getting data from Sensor. Output: raw_data
extern  void  preproc();  // Pre-process : raw_data -> det_data. Convert resolution.
extern  int   search_human();  // Warm point search (with BASIC detection). Output: human_x,_y,_p,index_human
extern  int   search_human2();  // Moving object search (using historical data). Output: human_x,_y,_p,index_human
extern  int   search_nonhuman();  // Non-human search (using historical data). Output: nonhuman_x,_y,_p,index_nonhuman
extern  int   reject();  // Judge of Non-human point rejection & sort by Probability.
extern  void  store_mem();  // store historical data.

// Data var.
int  raw_data[pixelVraw][pixelHraw];
int  det_data[pixelV][pixelH];  // Correction and interpolation
int  human_x[maxHuman],human_y[maxHuman]; // Position
int  human_p[maxHuman]; // Probability
int  index_human;
int  nonhuman_x[maxNonHuman],nonhuman_y[maxNonHuman]; // Position
int  nonhuman_p[maxNonHuman]; // Probability
int  index_nonhuman;

int detection(){
   preproc();
   index_human = search_human();
   index_human = search_human2();
   index_nonhuman = search_nonhuman();
   store_mem();
   index_human = reject(index_human,index_nonhuman);
   return  index_human;
}
```

6. Reference source code

```
Searching routine

for(h=1;h<pixelH;h++){
    for(v=1;v<pixelV;v++){
        if(det_data[h][v] - det_data[h-1][v] > delta_h1
        && det_data[h][v] - det_data[h+1][v] > delta_h1){
            if(det_data[h][v] - det_data[h][v-1] > delta_v1
            && det_data[h][v] - det_data[h][v+1] > delta_v1){
                add_human_point(h,v,pSmall1); // small peak point
            }
            if( other detection1 ){
                add_human_point(h,v,pSmall2); // Candidate detection
            }
        }
        if( other detection2 ){
            add_human_point(h,v,pLarge1); // Candidate detection
        }
        if( other detection3 ){
            add_human_point(h,v,pLarge2); // Candidate detection
        }
    }
}
```

Input : Array data

Searching Small peak point.
(1 pixel width)

Searching Small peak point.
(for 1 to 2 pixel width)

Searching Large peak point.
(for 3 pixel width)

output : human point data
and Probability value