AsahiKASEI

AK9754 approach and departure detection Sample source code

ASAHI KASEI MICRODEVICES CORPORATION

Outline

- Introduction
- About source code files
- Operation flow
- Parameter settings
- Detail of departure detection algorithm

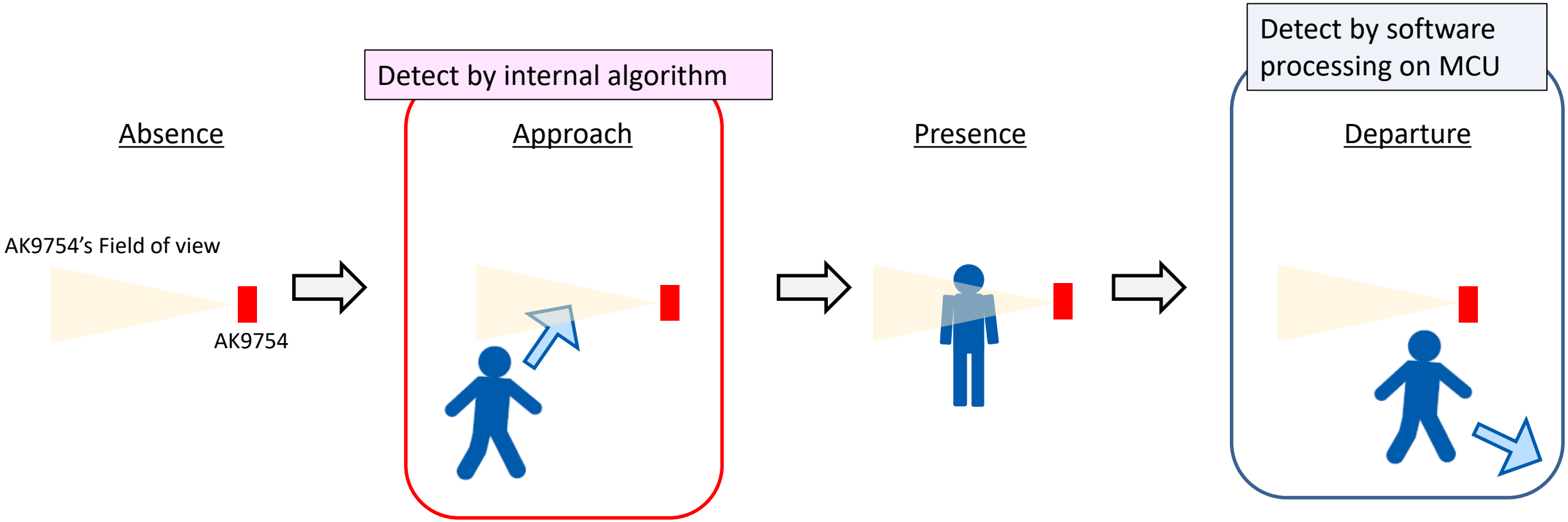
Introduction

Definition of words

- **Presence**
  - State that a person exists in FoV of the sensor
- **Absence**
  - State that no person exists in FoV of the sensor
- **Approach**
  - Event that the state changes from Presence to Absence
- **Departure**
  - Event that the state changes from Absence to Presence

Concept of the algorithm

- In these source codes, approach is detected by the internal algorithm of AK9754, and departure is detected by software processing on MCU.
- Detects the current state by detecting each action.

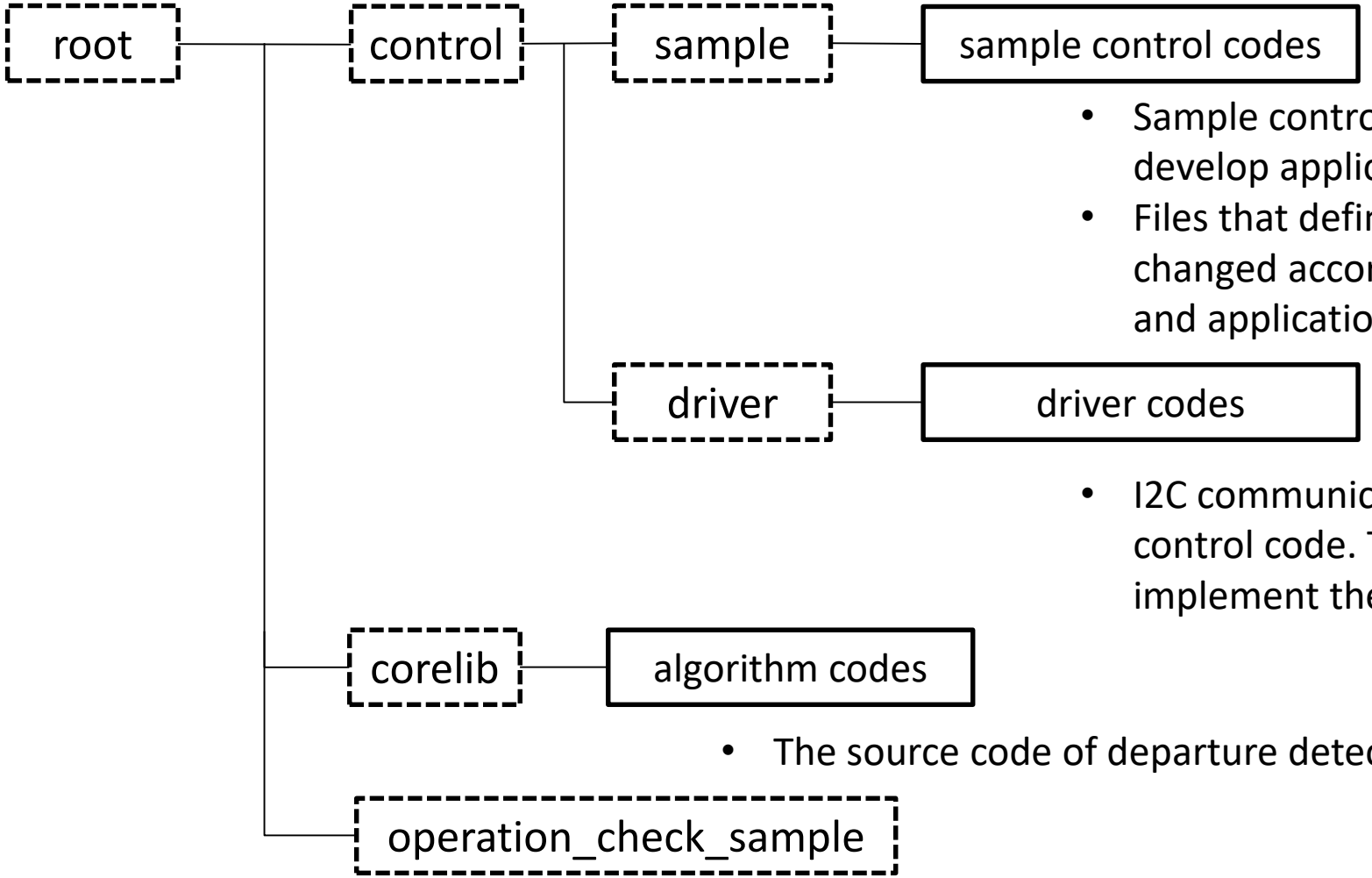


About source code files

Directory structure

directory

source files



- Sample control codes what customers can refer to develop applications.
- Files that define algorithm parameters to be changed according to the customer’s environment and application.

- I2C communication codes referenced in the sample control code. The customers are needed to implement them according to customer’s platform.

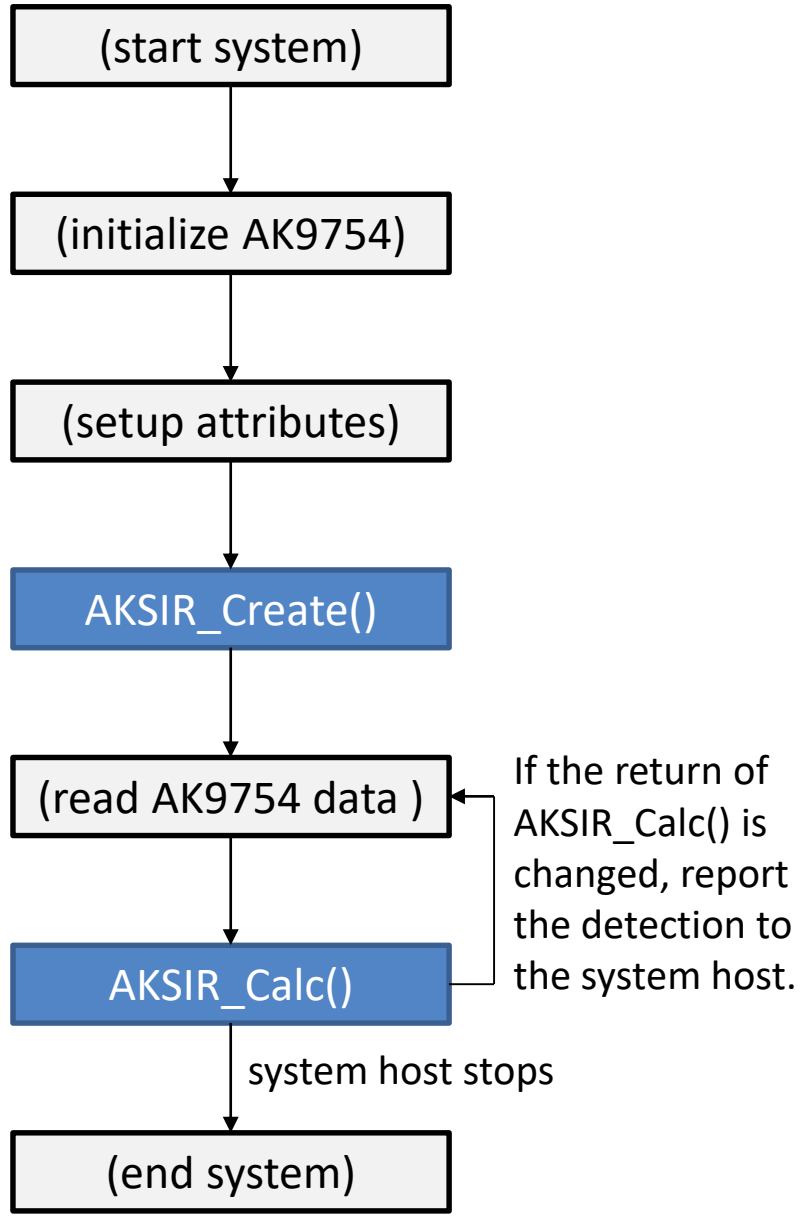
- The source code of departure detection algorithm.

- Sample source code to operation check.
- Please refer to “Operation_check_sample_en.pptx” .

Codes in corelib

- These are source codes of departure detection algorithm.
- Customer does not needed to modify the source codes in corelib directory.

- corelib/src/AKSIR.c
  - API functions that called by customer's system are defined in this code.
  - There are two functions, AKSIR_Create() and AKSIR_Calc().
  - Please use them as shown right.
  - Concrete example is in "main.c" described later.



Codes in control

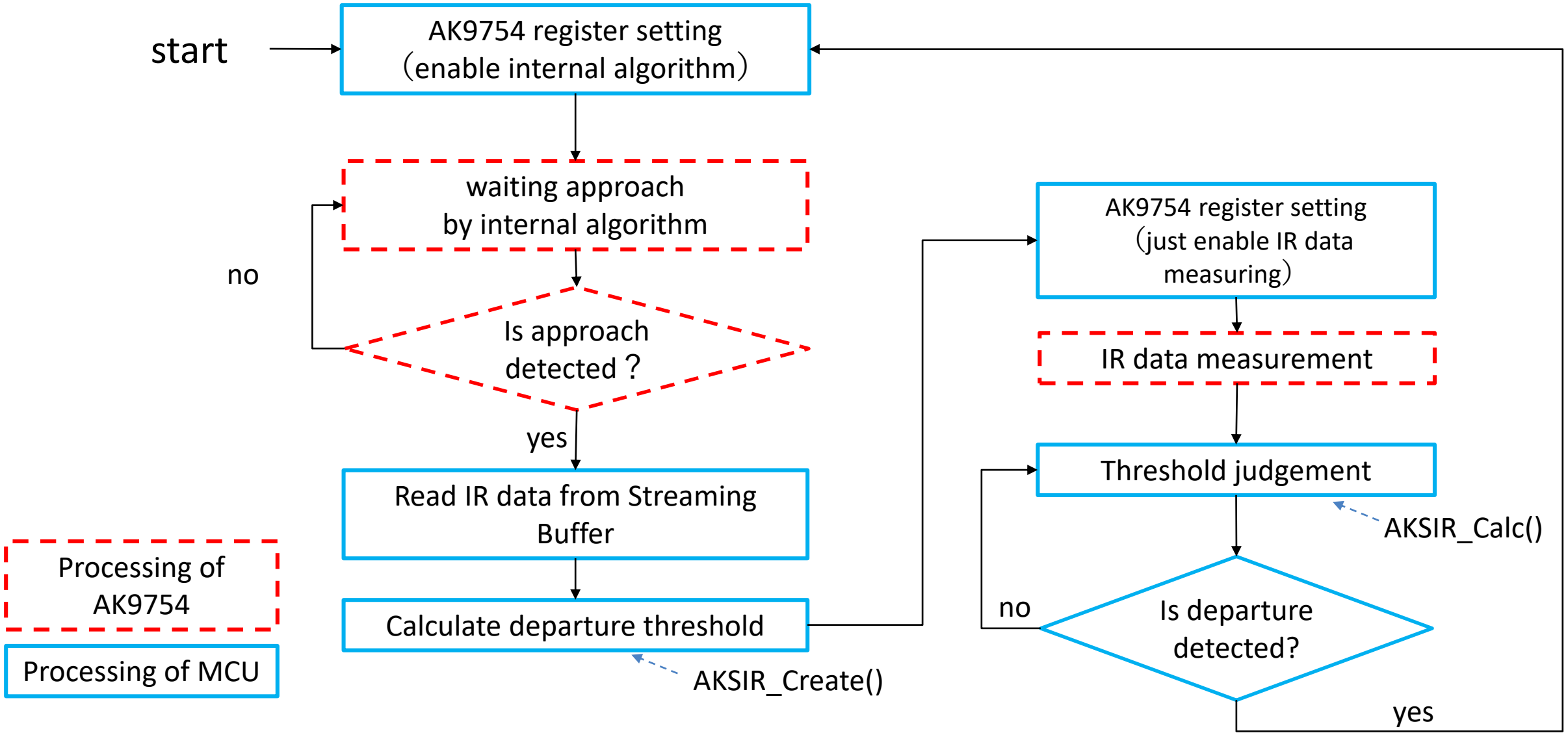
- control/sample/src/main.c
  - An example of control in customer's system.
  - Please refer to this for implementation.

- control/sample/include/AK9754_param.h
  - This file describes parameters about departure detection algorithm and AK9754.
  - Please modify parameters according to customer's environment.
  - Detail of parameters is described in page "About parameters".

- control/driver/drivers.c
  - Functions such as I2C communication are implemented without any content.
  - Please implement contents of function according to customer's platform.

Operation flow

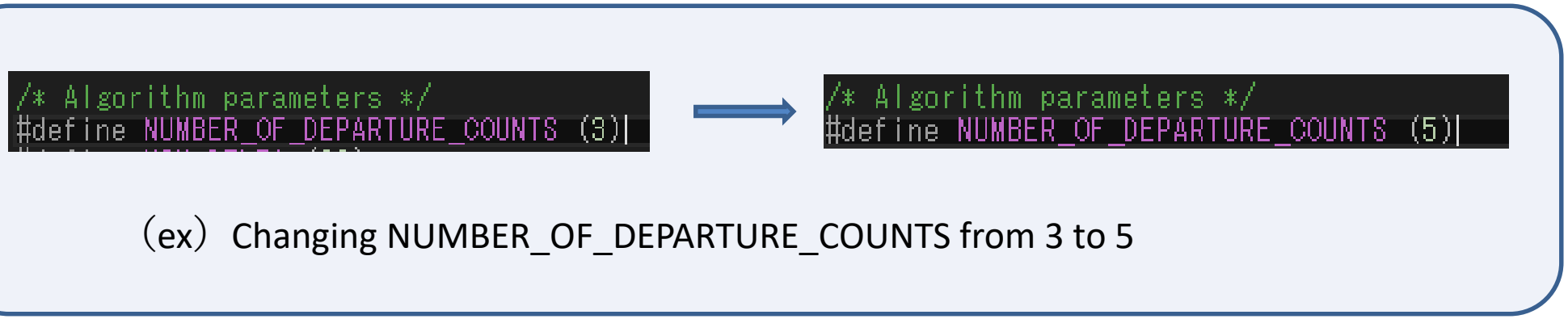
Operation flow



Parameter settings

How to set parameters

- Parameters to modified are described in control/sample/include/AK9754_param.h.
- Please change the value as necessary.



（ex） Changing NUMBER_OF_DEPARTURE_COUNTS from 3 to 5

About parameters (general)

AK9754_SLAVE_ADR

The I2C communication slave address from MCU to AK9754.

Please change according to setting of AK9754's CAD pins.

CAD1	CAD0	Slave Address
VSS	VSS	60H
VSS	non-connected	61H
VSS	VDD	62H
non-connected	VSS	64H
non-connected	non-connected	65H
non-connected	VDD	66H
VDD	VSS	68H
VDD	non-connected	69H
VDD	VDD	Do Not Use

About parameters (internal algorithm)

- AK9754_HBDTH_VAL

  Threshold of AK9754's human approach detection algorithm.

  Please change according to customer's environment, window materials and so on.

About parameters (departure detection)

- AK9754_ODR_VAL_DEP

  AK9754's data output rate in detecting departure.

  The lower the rate is, the longer the time to detect departure is.

- NUMBER_OF_DEPARTURE_COUNTS

  This is the number of samples from when the measured IR value fall below the threshold until judgment as departure.

  The larger the value is, the longer the time to detect departure is.

- MIN_DELTA

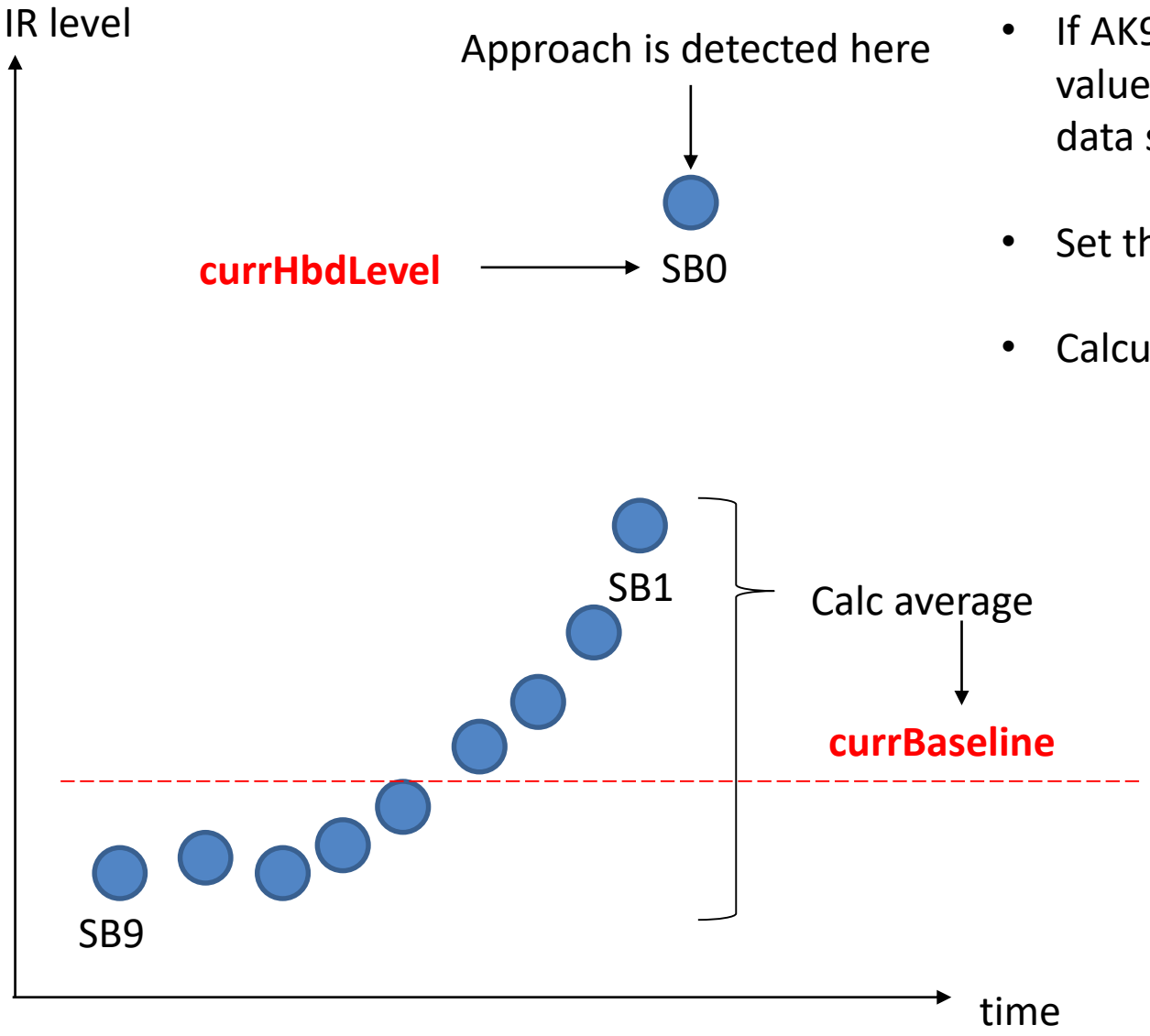
  The constant value used to determine departure threshold.

  The larger the value is, the easier to detect departure.

  However, it is possible that misdetection of departure increases in presence state.

Detail of departure detection algorithm

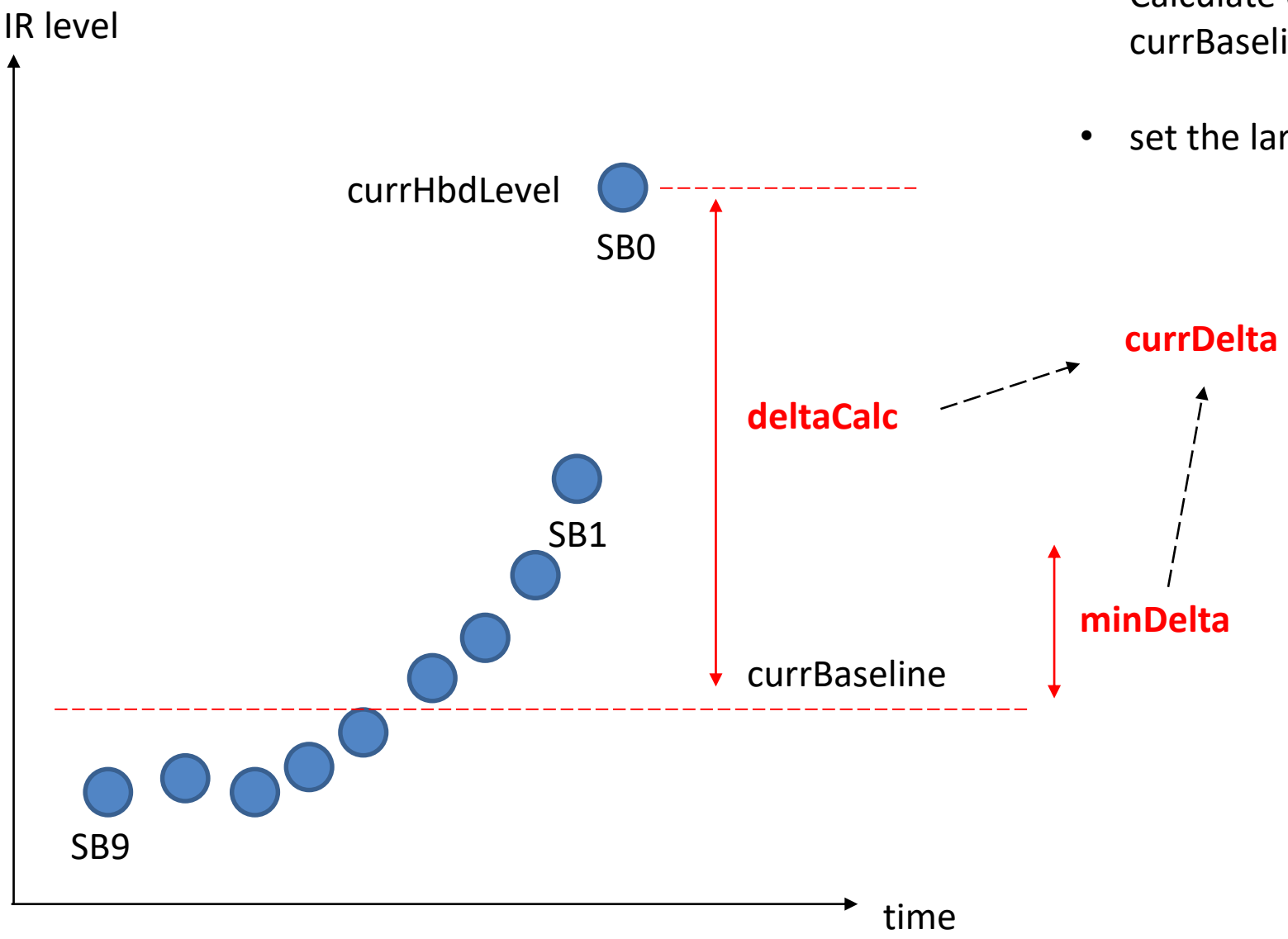
Setting departure threshold



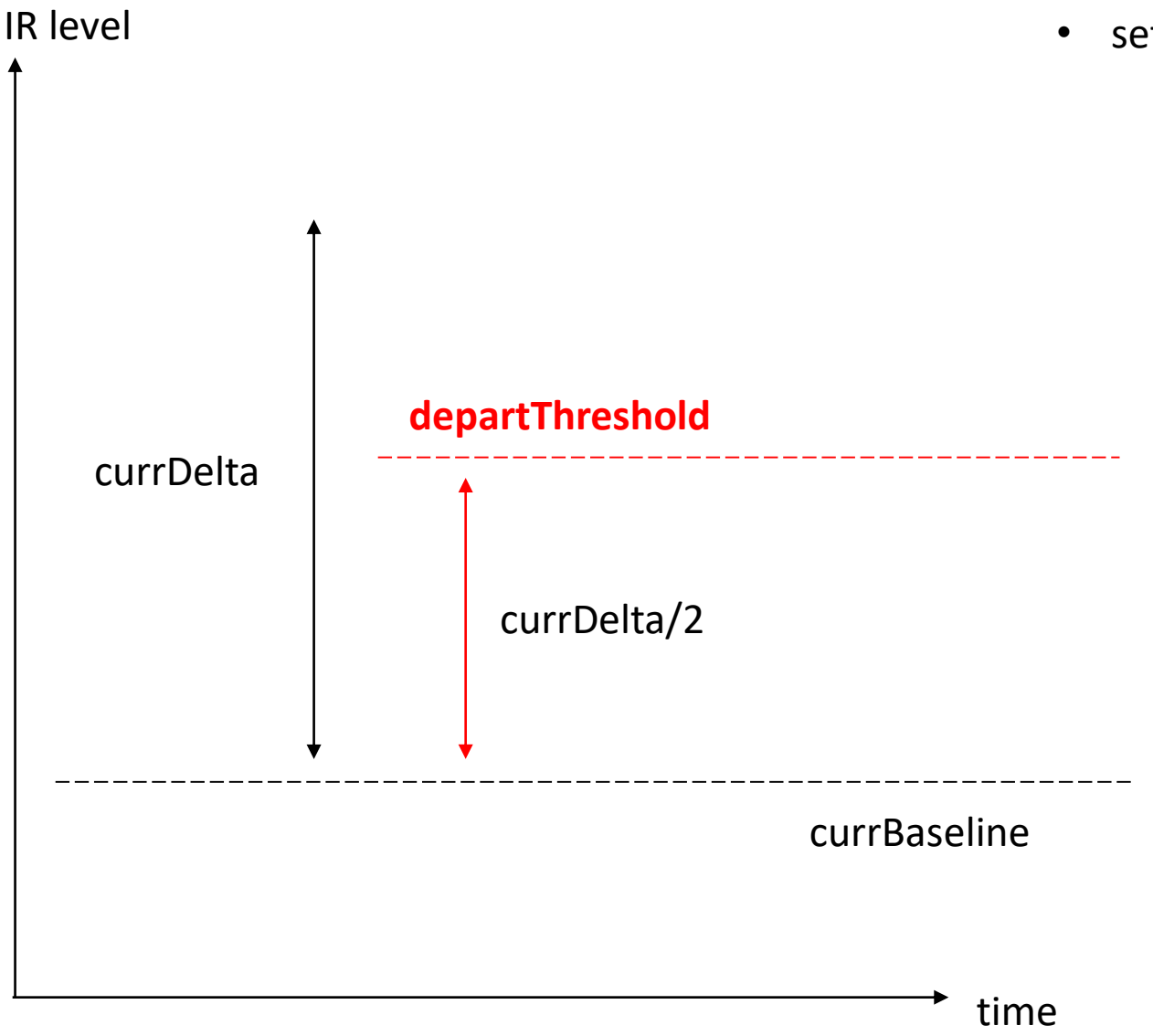
- If AK9754's internal algorithm detects human approach, read IR values in the streaming buffer (SB0 ~ SB9). Please refer to AK9754's data sheet about the streaming buffer.
- Set the IR value (SB0) when approach is detected as currHbdLevel.
- Calculate average of IR values except for SB0 as currBaseline.

Setting departure threshold

- Calculate difference between currHbdLevel and currBaseline as deltaCalc.
- set the larger of deltaCalc and MIN_DELTA as currDelta.

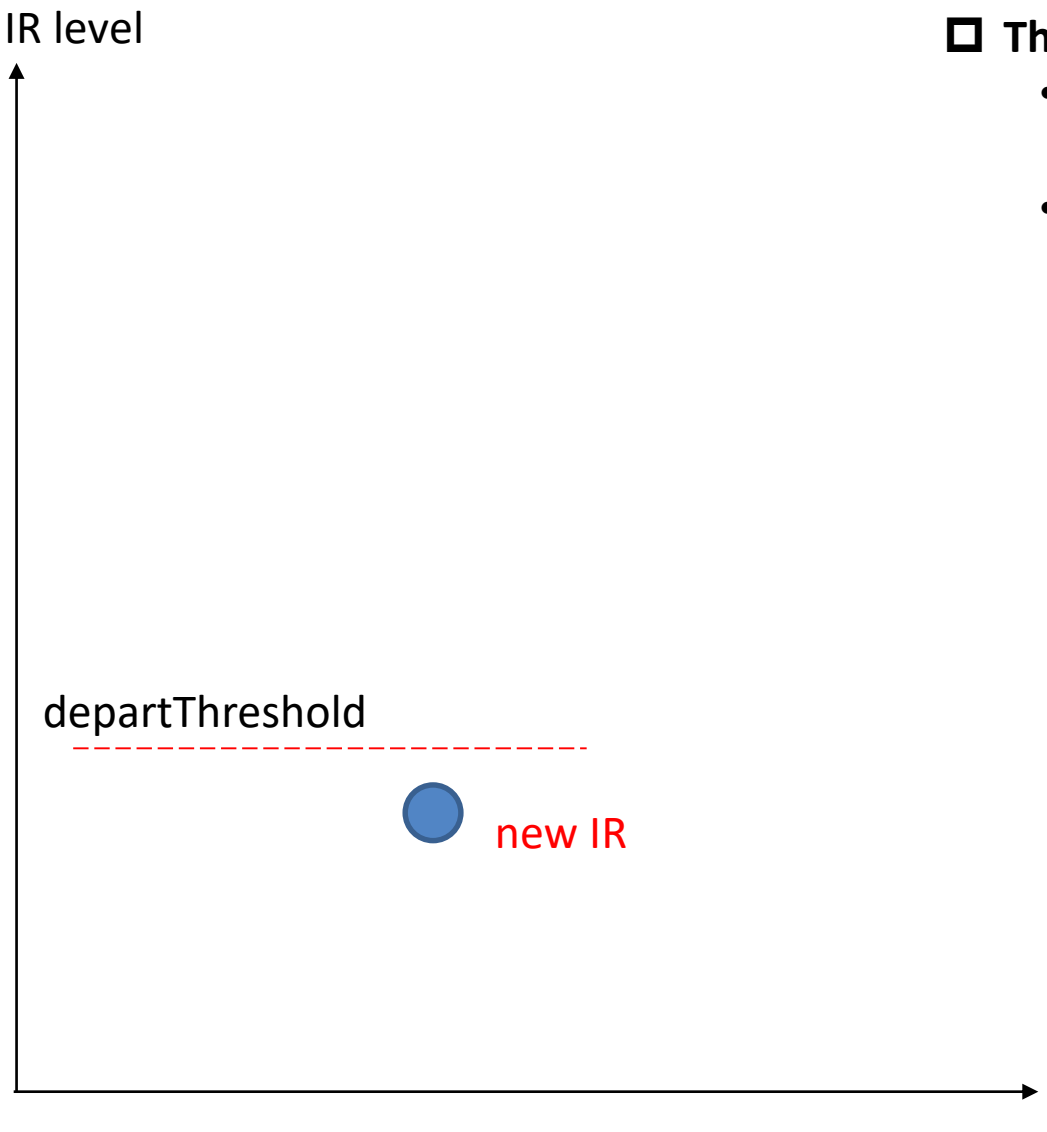


Setting departure threshold



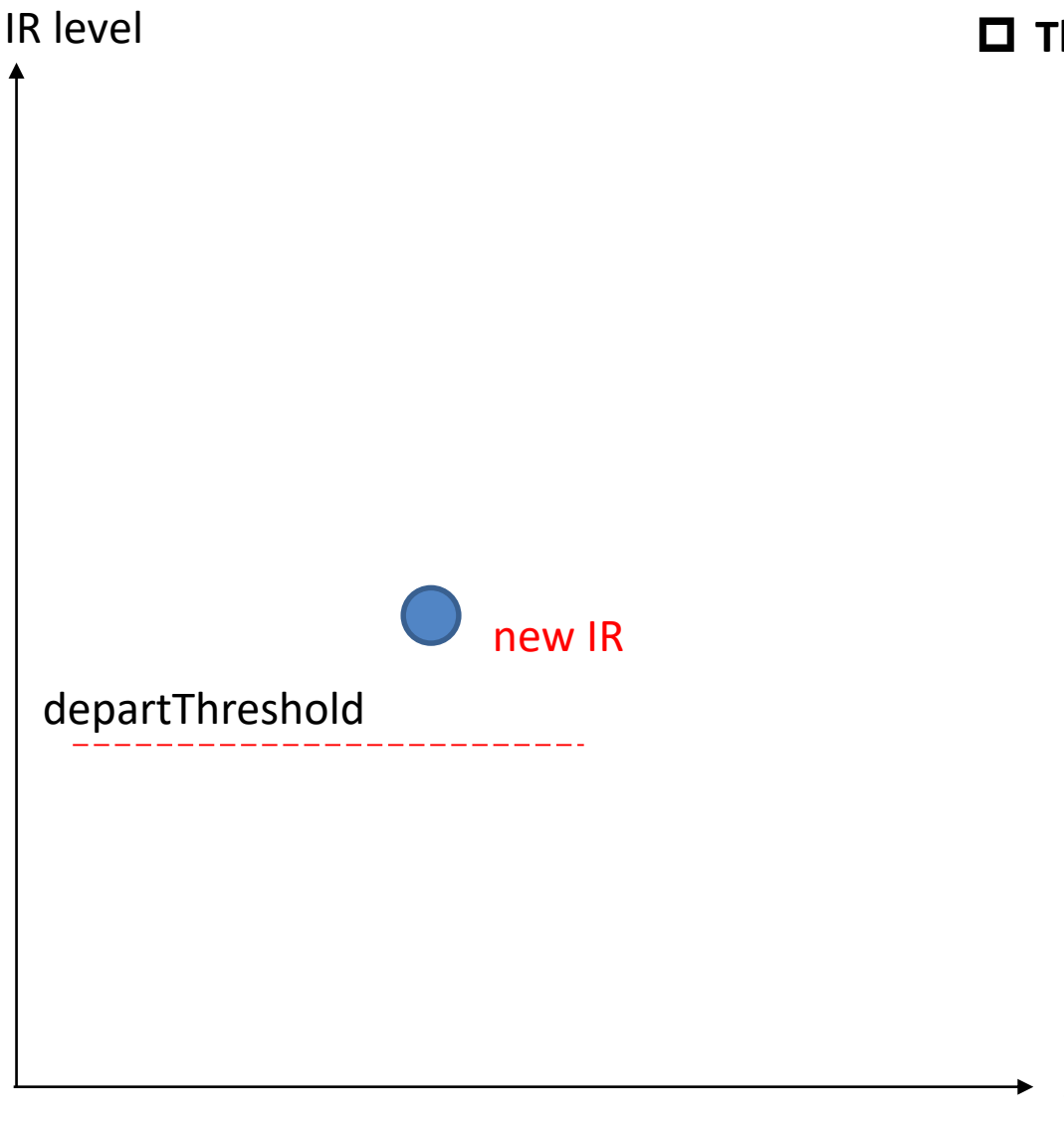
- set currBaseline + currDelta/2 as **departure threshold**.

Judgment of departure



- **The case that new IR value is lower than or equal to departure threshold.**
  - Increase departure counter by 1.
  - If the departure counter becomes greater than or equal to NUMBER_OF_DEPARTURE_COUNTS, it is **judged as departure**.

Judgment of departure



- **The case that new IR value is greater than departure threshold.**
  - Set the departure counter as 0.

Precaution

Precaution

- This is an example source code of the approach and departure detection algorithm by combining the internal algorithm function with the software processing on MCU.
- When the algorithm starts with state that a person exists in FOV of the sensor, the first detection may not be performed correctly. Once person leaves to the out of FOV, It works properly.
- When the background temperature rises during the state of presence, if the value of IR output signals go higher than the threshold value, It might cause false departure detection.
- IR(heat) sources except the human body in the FOV might cause false detection.
- To avoid fatal error caused by the detection failure, system fail-safe function such as timer control is recommended.

Creating for Tomorrow

The commitment of the Asahi Kasei Group:
To do all that we can in every era to help the people of the world
make the most of life and attain fulfillment in living.
Since our founding, we have always been deeply committed
to contributing to the development of society,
boldly anticipating the emergence of new needs.
This is what we mean by “Creating for Tomorrow.”

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