Quick Start Guide

RA6M3 Group

Person Access System (PAS) for Artificial Intelligence Kit AIK-RA6M3 Quick Start Guide

Renesas RA Family
RA6 Series

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Rev 1.00 Jun 2024

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(Rev.5.0-1 October 2020)

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General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)

   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.
2. Processing at power-on

   The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.
3. Input of signal during power-off state

   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.
4. Handling of unused pins

   Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.
5. Clock signals

   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.
6. Voltage application waveform at input pin

   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).
7. Prohibition of access to reserved addresses

   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.
8. Differences between products

   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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Precautions

This Artificial Intelligence Kit is only intended for use in a laboratory environment under ambient temperature and humidity conditions. A safe separation distance should be used between this and any sensitive equipment. Its use outside the laboratory, classroom, study area, or similar such area invalidates conformity with the protection requirements of the Electromagnetic Compatibility Directive and could lead to prosecution.

The product generates, uses, and can radiate radio frequency energy and may cause harmful interference to radio communications. There is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off or on, you are encouraged to try to correct the interference by one or more of the following measures:

• Ensure attached cables do not lie across the equipment.

• Reorient the receiving antenna.

• Increase the distance between the equipment and the receiver.

• Connect the equipment into an outlet on a circuit different from that which the receiver is connected.

• Power down the equipment when not in use.

• Consult the dealer or an experienced radio/TV technician for help.

Note: It is recommended that wherever possible shielded interface cables are used.

The product is potentially susceptible to certain EMC phenomena. To mitigate against them it is recommended that the following measures be undertaken:

• The user is advised that mobile phones should not be used within 10 m of the product when in use.

• The user is advised to take ESD precautions when handling the equipment.

The Artificial Intelligence Kit does not represent an ideal reference design for an end product and does not fulfill the regulatory standards for an end product.

Renesas RA Family

Person Access System (PAS) for AIK-RA6M3

Contents

Figures

1. Introduction

This Quick Start Guide (QSG) provides:

- Instructions for running the “Person Access System (PAS) for Artificial Intelligence Kit (AIK) RA6M3” application example.

1.1 Assumptions and Advisory Notes

1. Prior to running the PAS project or programming the AIK RA6M3 board, default jumper settings must be used. Refer to the AIK RA6M3 user’s manual for the default jumper settings.
2. The screen shots provided throughout this document are for reference. The actual screen content may differ depending on the version of software and development tools used.

2. Overview of the “Person Access System (PAS) for Artificial Intelligence Kit (AIK) RA6M3” application example

PAS provides accurate person identification through face recognition and speaker identification. The compact and efficient TinyML model leads to low power and economic PAS modules for a wide range of IoT applications.

Features and Benefits:

- Multiple biometric detection functions are integrated into one TinyML model for a single MCU.
- High accuracy achieved with the cross-check of speaker identification and face identification.
- The four functions in PAS can be used either as a whole or in part for diversified IoT scenarios.
  - Three vision functions: visual wake words (VWW), face detection, and face recognition
  - One audio function: speaker identification.
- Focused customer features: easy registration, high efficiency/optimization, straightforward integration and modularity to enable complete solution.

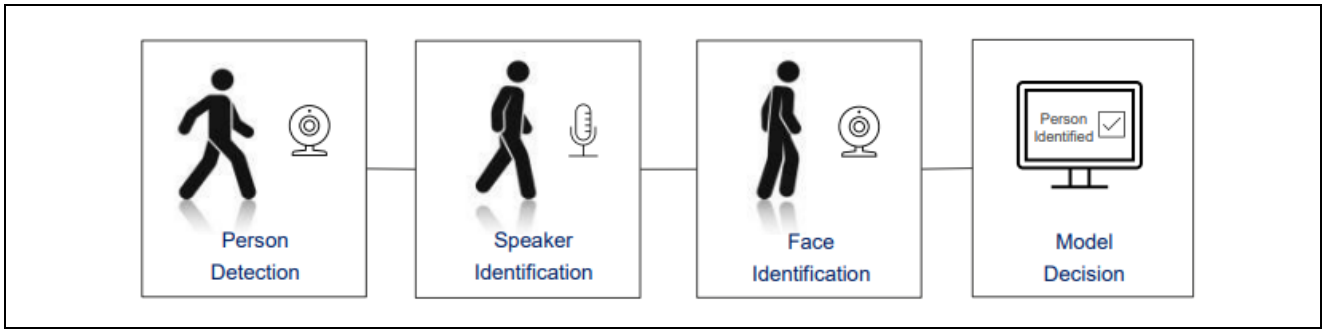

Figure 1. Overview of PAS

2.1 Quick Start Guide Project Flow

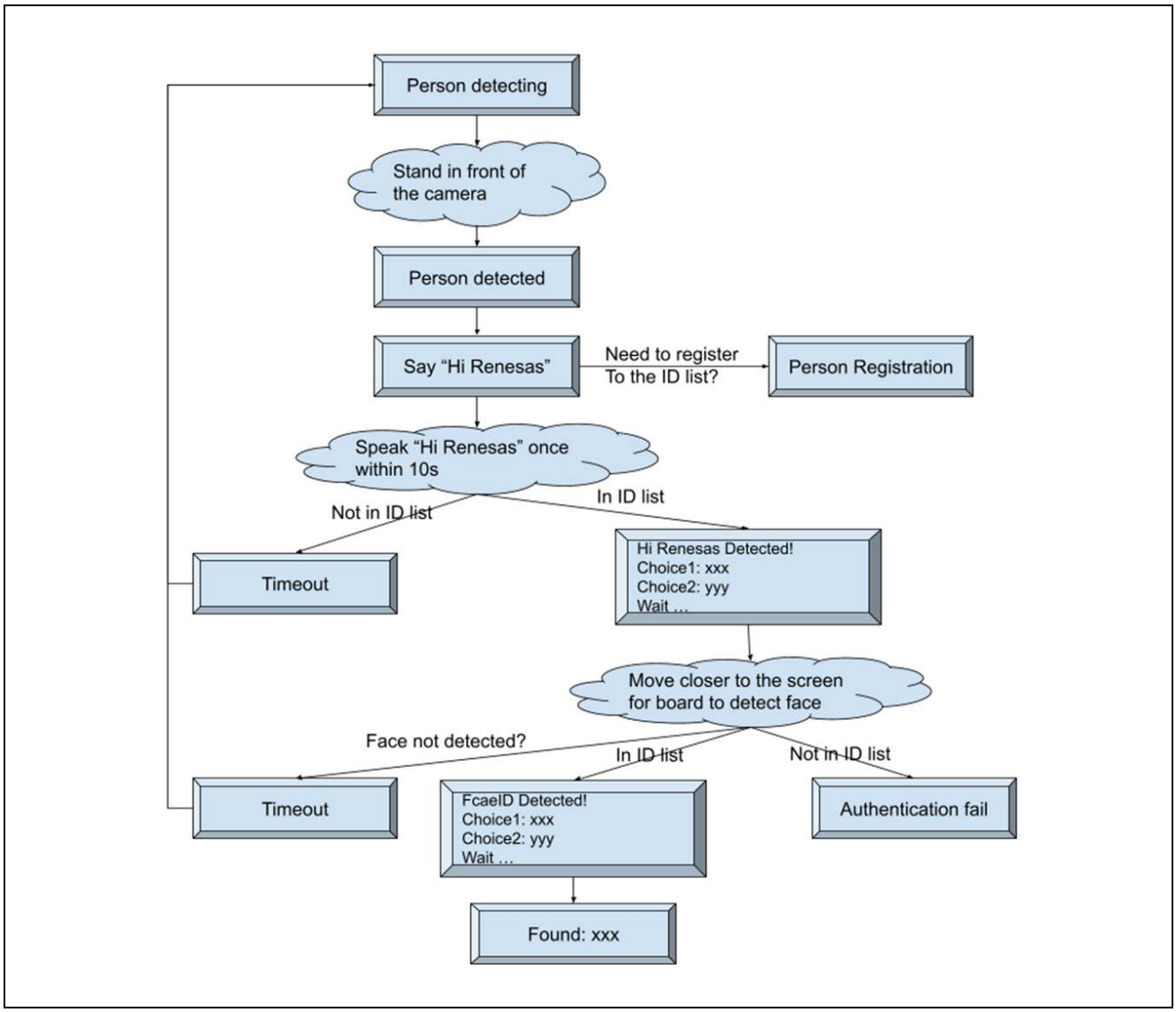

Figure 2. Quick Start Guide Project Flow

There are three phases for the system to act and provide results:

Person detection: When a person is detected in range of the camera, the system is "woken-up" to provide person recognition. One visual woke word (VWW) model is used for person detection in this step.

SpeakeID: The approaching person is prompted to say "Hi Renesas". The model compares its voice features against the voice recorded in the ID list to identify the speaker.

FaceID: As the person approaches the camera, their face is captured and located by the AIV model and then performs the recognition task and compares it against the list of registered users.

3. Running the “Person Access System (PAS) for Artificial Intelligence Kit (AIK) RA6M3” application example

This section lists the requirements and instructions to power up the AIK RA6M3 board and run PAS project

Hardware Requirements

- AIK RA6M3 board with the TFT Display and the camera attached. They are all included in the box
- Micro USB device cable
- A PC with at least 1 USB port

Software Requirements

- Windows® 10 operating system
- J-Link tools

3.1 Connecting and Powering Up the AIK RA6M3 Board

1. Connect the AIK-RA6M3 kit to the PC using USB micro-B cable and J-Link OB USB port (J10) in the bottom left corner of the board.
2. Connect the other end of this cable to the USB port of the host PC.
3. Connect Display patch module to PMOD 3 and the other end to the display.
4. Connect the camera to “J6” Auxiliary Port (align to pin 1 for 18-pins camera module)

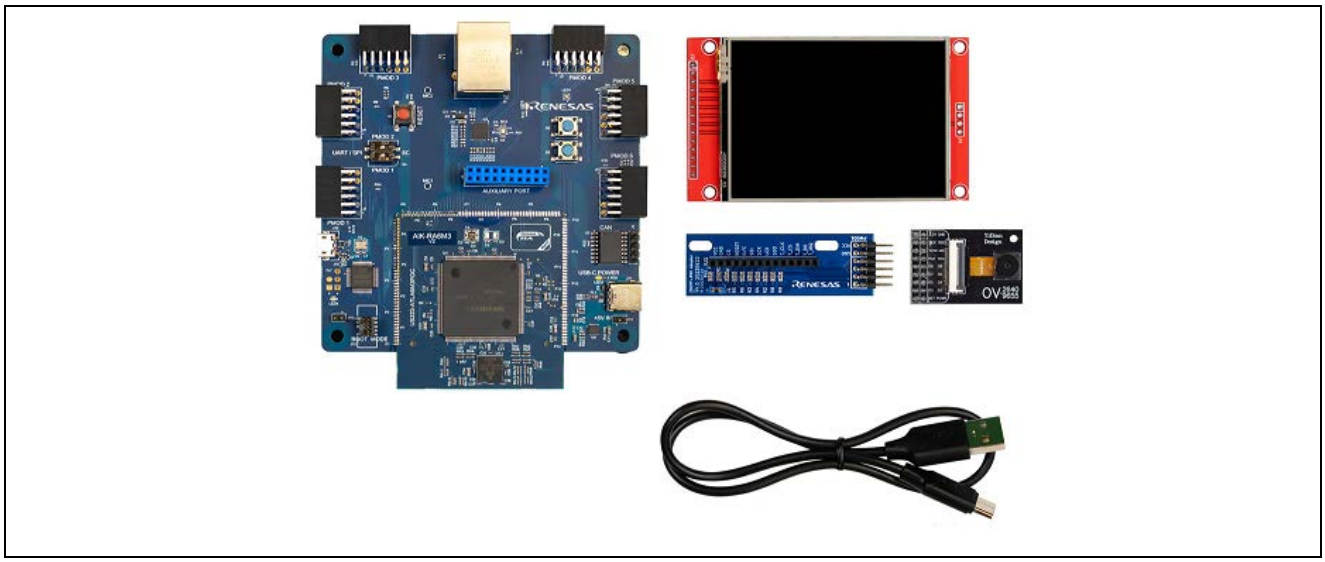

Figure 3. AIK RA6M3 Board & USB Debug cable

3.2 Programming the application example

Flash the device with the binary that has been provided with this document.

In the folder Flasher you will find the following files:

- Flash Device.bat
- Flash Device.jlink
- JLink.exe
- JLink_x64.dll
- AIK_RA6M3_VAS.srec

Verify that the AIK RA6M3 board is connected to the PC and run the Flash Device.bat file, the project will be automatically downloaded to the DUT.

3.3 Launching the application example with e2studio

Launch e² studio. e² studio can be launched from the Windows start menu or directly from the installation folder.

In the Eclipse Launcher window, specify the destination for the new workspace. It is recommended to keep the path simple and avoid using spaces.

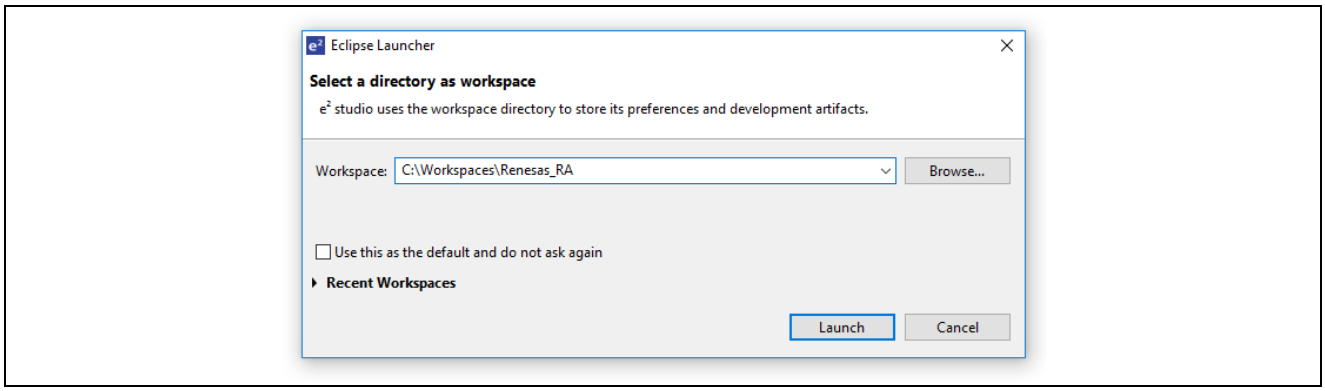

Figure 4. e² studio launcher

Click Launch to start e² studio in the specified path. If prompted, press Apply to dismiss pop up window asking for permission to log and report usage (it will remain disabled).

The welcome screen will show inside the new workspace. It can be dismissed by clicking on the Hide button in the top-right corner.

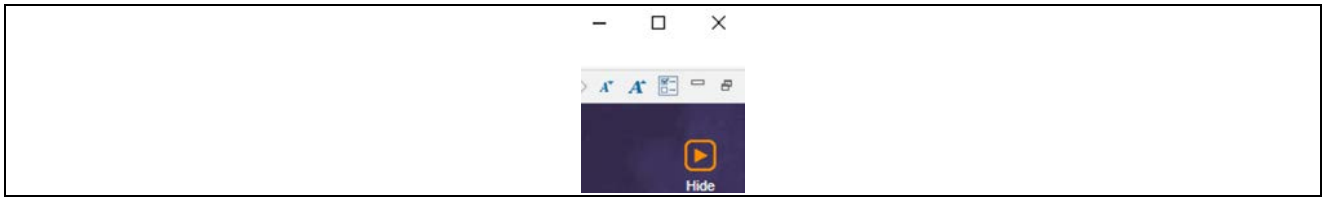

Figure 5. Hide button

If you already have installed the BSP for AIK-RA6M3 kit, proceed. Otherwise, go to File -> Import and Select General -> CMSIS Pack.

In the Import CMSIS Pack window, click … to browse for the .pack file containing BSP for AIK-RA6M3 kit (Renesas.RA_board_RA6M3.<version>.pack). Select Renesas RA from the drop-down box under Specify device family and click Finish.

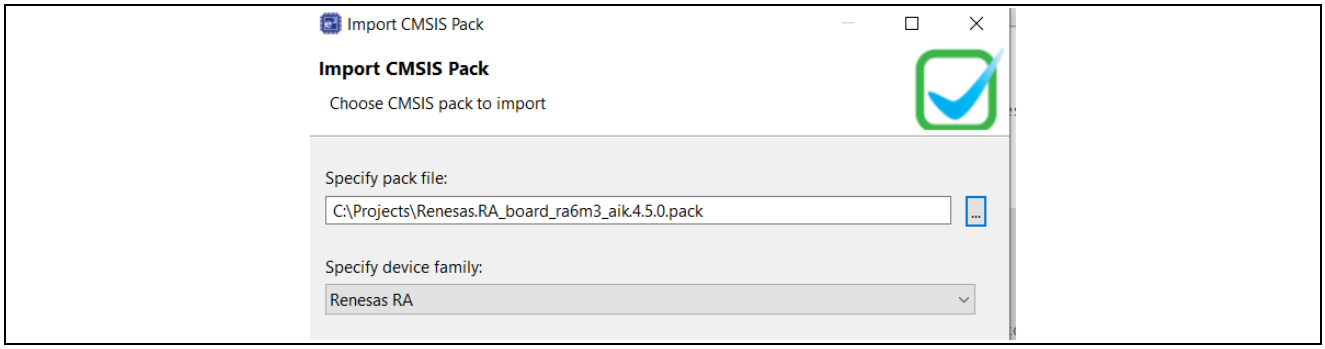

Figure 6. Import CMSIS Pack

Click OK in the pop-up window confirming successful pack file import.

Go to **File** -> **Import** -> **Existing Projects into Workspace** -> **Select archive file**

And select AIK_RA6M3_PAS.zip from the download location.

Click on the project file and then press **Finish.**

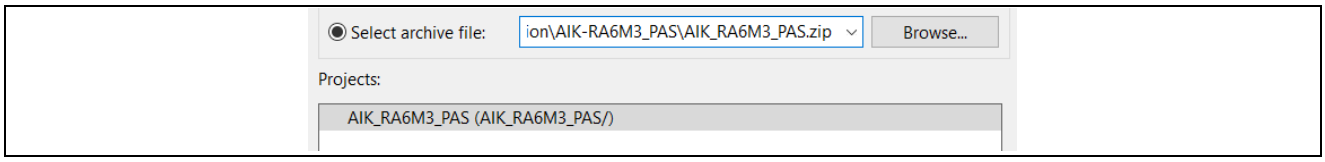

Figure 7. Select archive file

Double click to “configuration.xml” file and hit the “Generate Project Content” in the top-right corner of the Configurator window. When prompted to Proceed with save and generate, tick the box next to Always save and generate without asking and click Proceed.

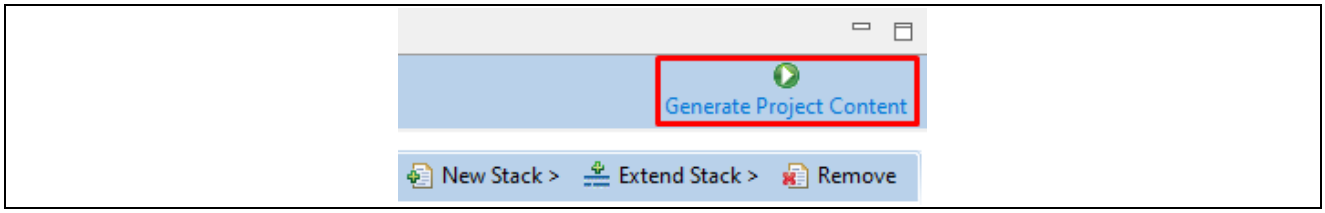

Figure 8. Generate Project Content

The FSP Configurator will extract all the necessary drivers and generate the code based on the configuration provided in the Properties tab.

The project is now ready to compile. Press the “hammer” icon  to start building the project.

Once the build has finished, the Console pane in the lower-right corner of e^2 studio will report zero errors:

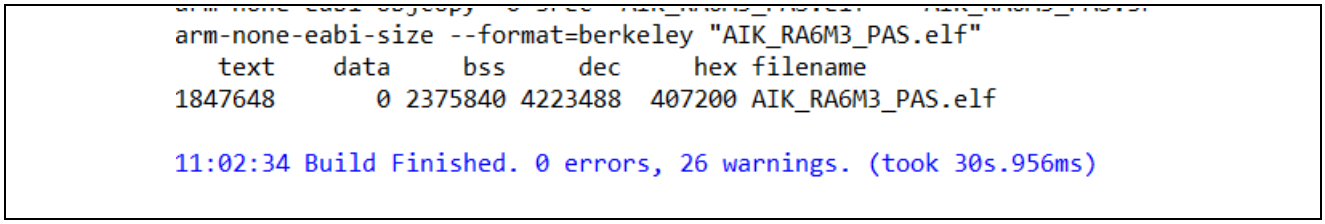

Figure 9. Build project

Verify again that the Display is connected to PMOD3 as seen below.

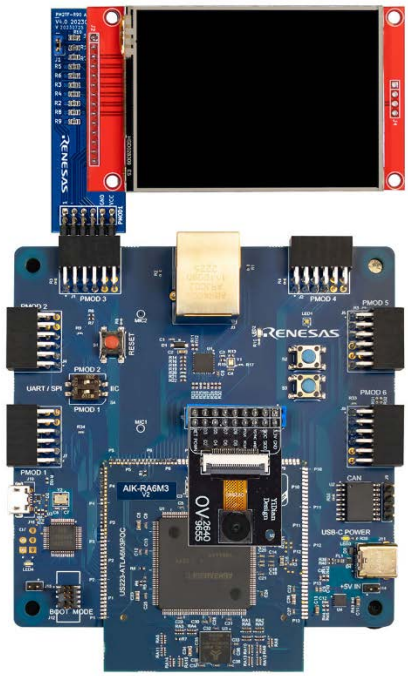

Figure 10. Connect display to PMOD3

The application is now ready to be programmed and run on the AIK kit. Press the “bug” icon  to begin the debug session.

You may be prompted to update the J-Link debugger firmware. You can click Yes to update. It will take a few moments to complete.

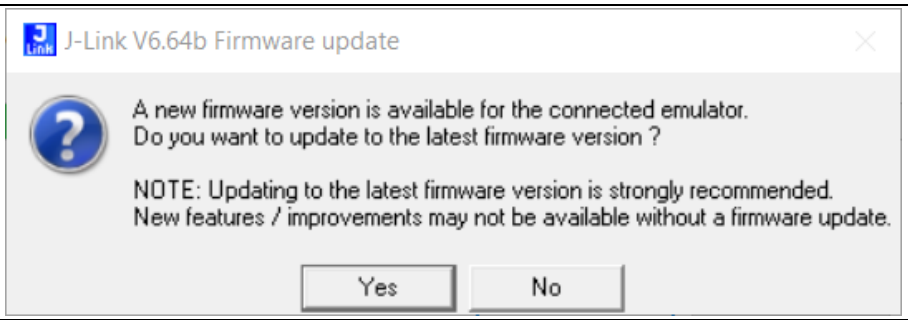

Figure 11. Update J-Link debugger firmware

Windows could also prompt you to allow the GDB server through your firewall. Click the checkbox to allow it through private networks, then Allow access.

e^2 studio will perform flash programming routines and prompt to switch to Debug perspective. Select the check box by Remember my decision and click Switch.

The debug session is now started, and the application is paused at its entry function (SystemInit() in Reset_Handler). At this point, you can set up additional debug features such as variable and expressions views before the program is executed.

Click the Resume button  or press F8 on the keyboard to start the application.

The Program will stop again, this time at the start of the main function. Low-level initialization routines are now completed. Press Resume or F8 again to resume the application and begin executing user code.

3.4 Running the Quick Start Guide Project

To run the application example, use the following instructions:

1. Program the AIK with the aforementioned steps.
2. On power up or RESET.
3. Stand in front of the camera with the face in the field of view.
4. The display will print: “Person detecting…
   Or hold User Button to register a new user”
5. User Registration process:
   a. Press and hold “S2” user button until “Speaker ID registration for User “batman” appears.

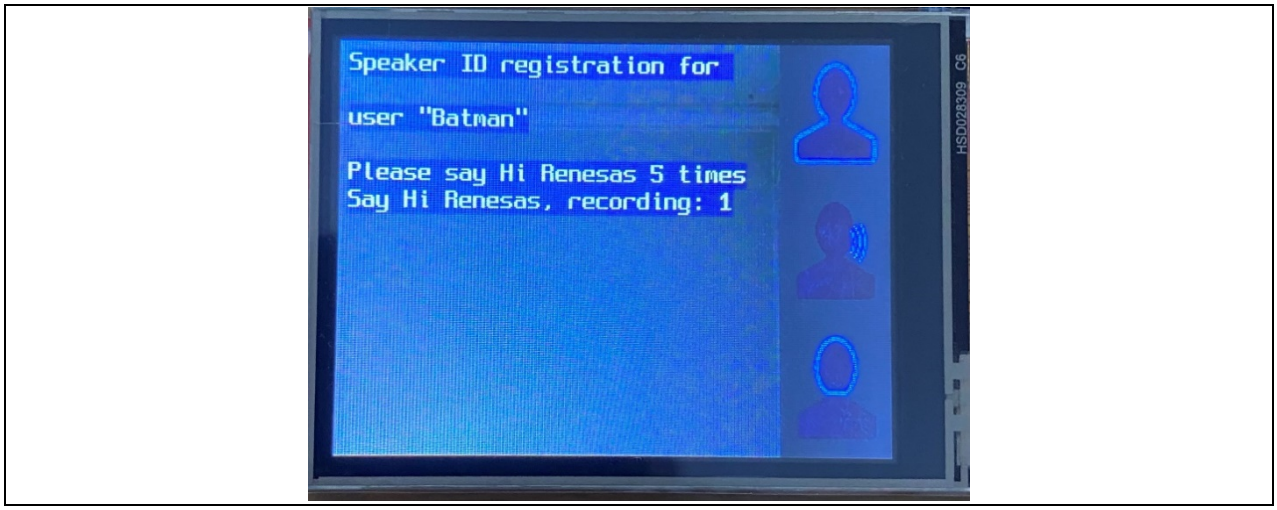

Figure 12. User 1 (Batman) Speaker ID registration

   b. Follow the instructions provided on the screen.
   c. Give the wake-word “Hi Renesas” five (5) times, the wake word might be requested multiple times if not recognized successfully. Once the timeout limit is reached without success, the system will go back to the person detection phase (3).

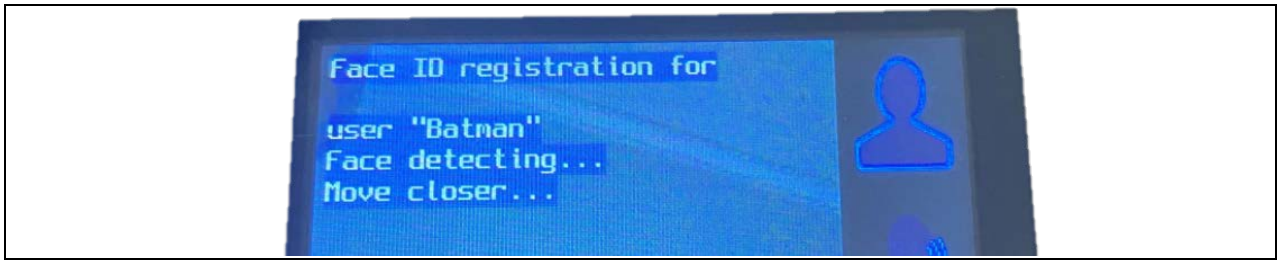

Figure 13. Face registration

   d. After the wake word training is completed, the system will request face data. Similarly, within 15s, the user should follow the on-screen instructions to help the system to acquire the required data. If the timeout limit is reached without their face detected, the system will go back to person detection.

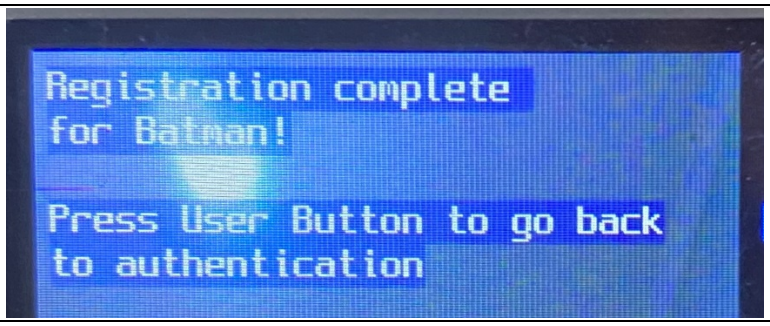

Figure 14. Registration completed

6. After the registration is completed Successfully the user will press the “S2” user button to go to user identification screen described in step 3.

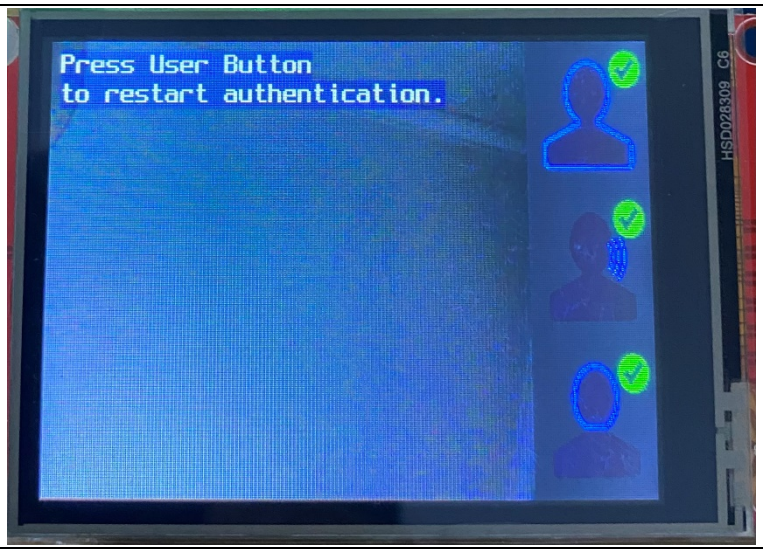

Figure 15. User Authentication pass

7. Follow the screen displayed instructions to operate in normal mode. If the user is the user registered, then all the three icons in the right side of the screen will turn green for the Visual Wake Word detection, the Voice identification and the Face identification.
8. A second user can be added to the system by following steps 3 and onwards again.

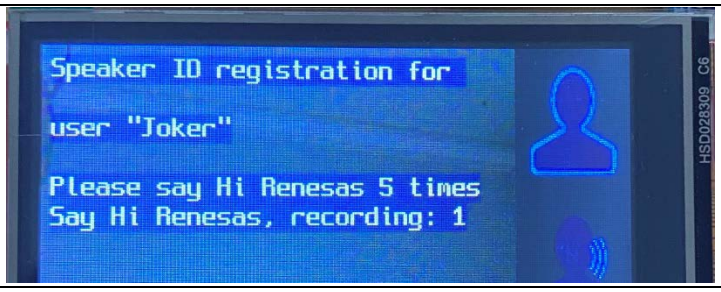

Figure 16. User 2 (Joker) registration

4. Website and Support

Visit the following URLs to learn about the kit and the RA family of microcontrollers, download tools and documentation, and get support.

AIK-RA6M3 Resources	www.renesas.com/aik-ra6m3
RA Product Information	www.renesas.com/ra
RA Product Support Forum	www.renesas.com/ra/forum
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Rev.	Date	Description	
		Page	Summary
1.00	Jun.03.24	—	Initial release

AIK-RA6M3 – Quick Start Guide

Publication Date: Jun.03.2024

Published by: Renesas Electronics Corporation

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Renesas Electronics Corporation

R30QS0016EE0100