

# AN14553

## Building a GPS Speedometer using GUI Guider and FRDM-MCXN947

Rev. 1.0 — 17 February 2025

Application note

### Document information

| Information | Content  |
|-------------|--|
| Keywords    | MCX Nx4x/Nx3x, AN14185, DCDC, GPS module, Speedometer, GUI Guider, LVGL, FRDM-MCXN947  |
| Abstract    | This application note provides examples to build a GPS based speedometer with FRDM-MCXN947, LVGL, GUI Guider tool, and a GPS module. |



## 1 Introduction

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This application note provides examples to build a GPS-based speedometer with FRDM-MCXN947, LVGL, GUI Guider tool, and a GPS module. The document describes how to deploy LVGL on the MCX Nx4x platform with GUI Guider and SDK.

### 1.1 MCX Nx4x MCUs

The MCX Nx4x MCU has up to 2 MB flash, up to 512 kB SRAM, 150 MHz system clock, SmartDMA FlexIO, QSPI interface, and I2C interface. The SmartDMA can be used to transfer data from the camera interface to the internal RAM. The FlexIO transfers the data in RAM to an LCD interface. The QSPI extends the memory to store the frame data. The internal SRAM stores the temporary frame data.

The application note example code uses the FlexIO implemented LCD interface. For more information, refer to *Using FlexIO to Drive 8080 Bus Interface LCD Module* (document [AN5313](#)).

### 1.2 GUI Guider

GUI Guider is a user-friendly graphical user interface development tool from NXP that enables the rapid development of high-quality displays with the open source LVGL graphics library. The drag-and-drop editor of GUI Guider makes it easy to use the many features of LVGL, such as, widgets, animations, and styles to create a GUI with minimal or no coding at all.

GUI Guider is free to use with general purpose and crossover MCUs of NXP. It includes built-in project templates for several supported platforms. For more details, visit [GUI Guider](#). The GUI Guider version used in this application note is 1.8.0.

### 1.3 GPS module

The GPS module receives a timestamp from each of the visible satellites, along with data on where in the sky each one is located (among other pieces of data).

## 2 Function and software description

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This demo uses LVGL and GUI Guider to create and deploy the UI interface on FRDM-MCXN947. GUI Guider provides a "DigitalCluster" application demo. Link the speed number to the UI's middle area and adjust the speed pointer position with the speed information of GPS.

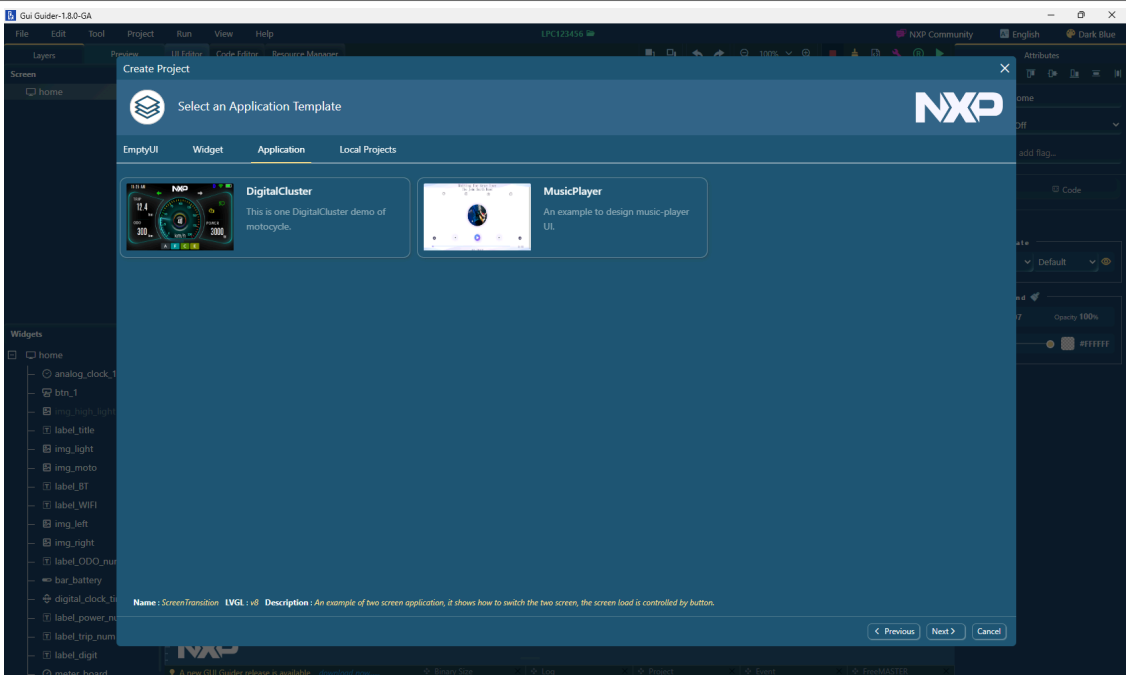


Figure 1. GUI Guider

GPS data usually uses NMEA format. For more information on GPS NMEA data format, refer to [GPS NMEA data](#).

In this demo code, we are using an open source project [lwgps](#) to decode GPS NMEA data to get GPS speed, time, directions, and other parameters.

The [lwgps](#) is a lightweight GPS NMEA parser for embedded systems, created by Tilen Majerle, under MIT license.

About

Lightweight and versatile AT parser library for ESP8266 and ESP32 devices.

[majerle.eu/projects/lwesp-lightweight-es...](#)

esp8266

parser

embedded

esp32

commands

embedded-systems

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Figure 2. About lwgps license

To build up this demo project based on FRDM-MCXN947, user must first download and install the following software.

- [MCUXpresso IDE](#)
- [FRDM-MCXN947](#) SDK package
- [GUI Guider](#)
- [lwgps](#) source code

### 3 Demo hardware setup

[Figure 3](#) shows the connection overview for this reference design.

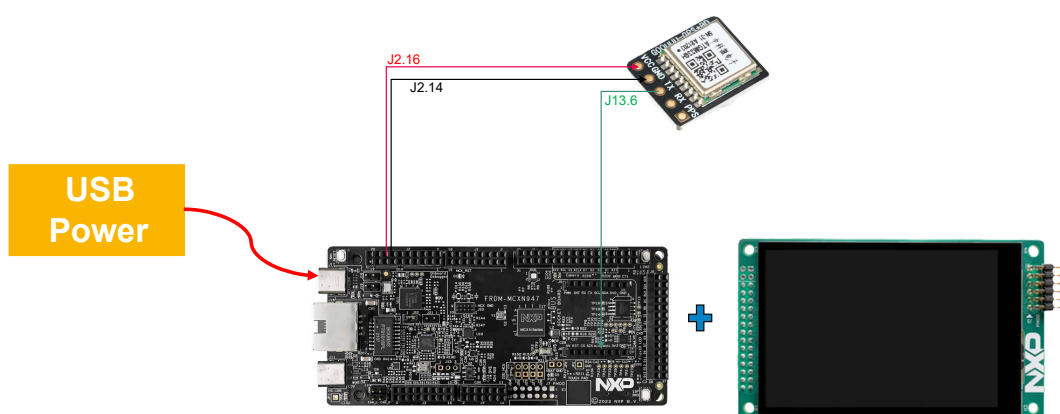


Figure 3. Hardware connection

User should prepare the [FRDM-MCXN947](#) board, a 3.5 inch LCD panel module [LCD-PAR-S035](#) from NXP, and a GPS module.



We used a GT-U8 GPS module. The user can use any GPS module and connect TX with the correct pin. Here, connect the TXD pin of the GPS module with the J13.6 pin of FRDM-MCXXN947. The VCC and GND of the GPS module must be connected with the VCC and GND of FRDM-MCXXN947, as shown in [Figure 3](#).

LCD-PAR-S035 must be connected with connector J12 of FRDM-MCXXN947.

The whole system power is supplied by an external power source through USB port J17 or J6.

## 4 Demo software setup

This chapter introduces how to create a UI interface with GUI Guider, merge the GUI Guider generated source code to an SDK project, and run the UI interface application code on FRDM-MCXXN947.

### 4.1 GUI Guider create UI project

For GUI Guider UI creation, the user must download and install the GUI Guider. The GUI Guider usage details can read the GUIGuider\_User\_Manual.pdf in the "resources" folder under GUI Guider installed path.

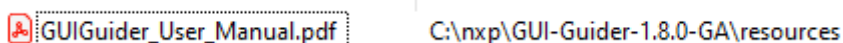


Figure 4. GUI Guider user manual location

To create a project based on an application template, perform the following steps:

1. Open GUI Guider and select **Create a new project**. Then, select the LVGL version and click the **Next** button.

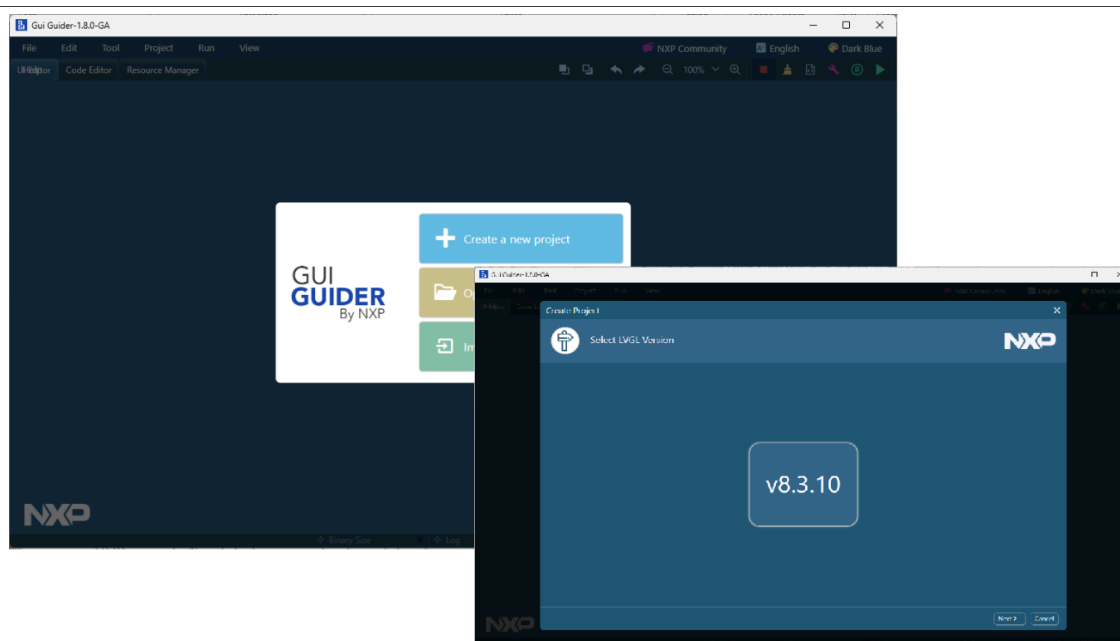


Figure 5. Create a project in GUI Guider

2. Select the FRDM-MCXXN947 board and click the **Next** button.
3. Then, select **Application > DigitalCluster** and click the **Next** button.
4. Finally, input the project name "AN\_GPSSpeedometer" in the Project Name and click the **Create** button.

## Building a GPS Speedometer using GUI Guider and FRDM-MCXN947

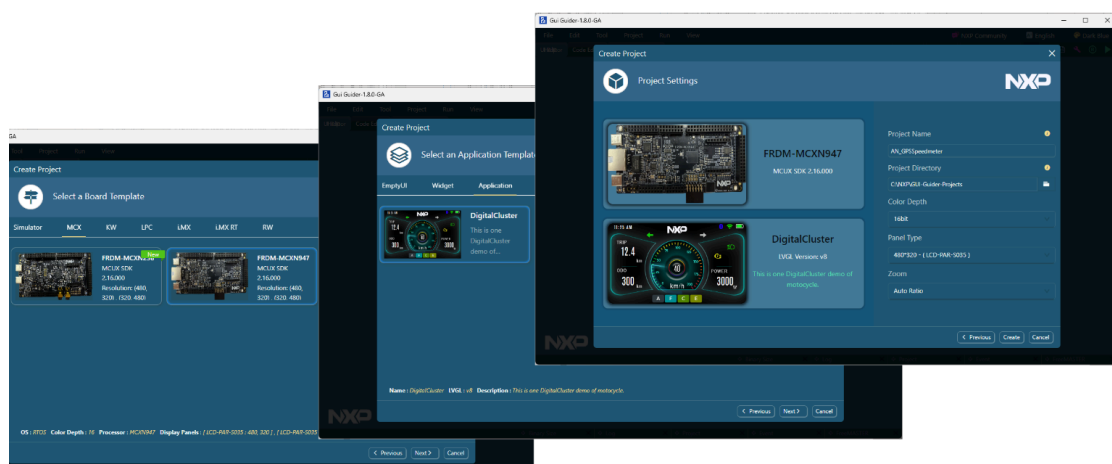


Figure 6. Create DigitalCluster UI for FRDM-MCXN947

5. [Figure 7](#) shows the digital cluster UI. Link GPS speed data with widgets "label\_digit" and "meter\_board". User can delete some widgets from the displayer, such as "img\_left", "img\_right", "label\_ODO\_num", "label\_power\_num", and so on.
- If everything configures OK, the user can select **RUN > Build & Run C** to get LVGL project source code.

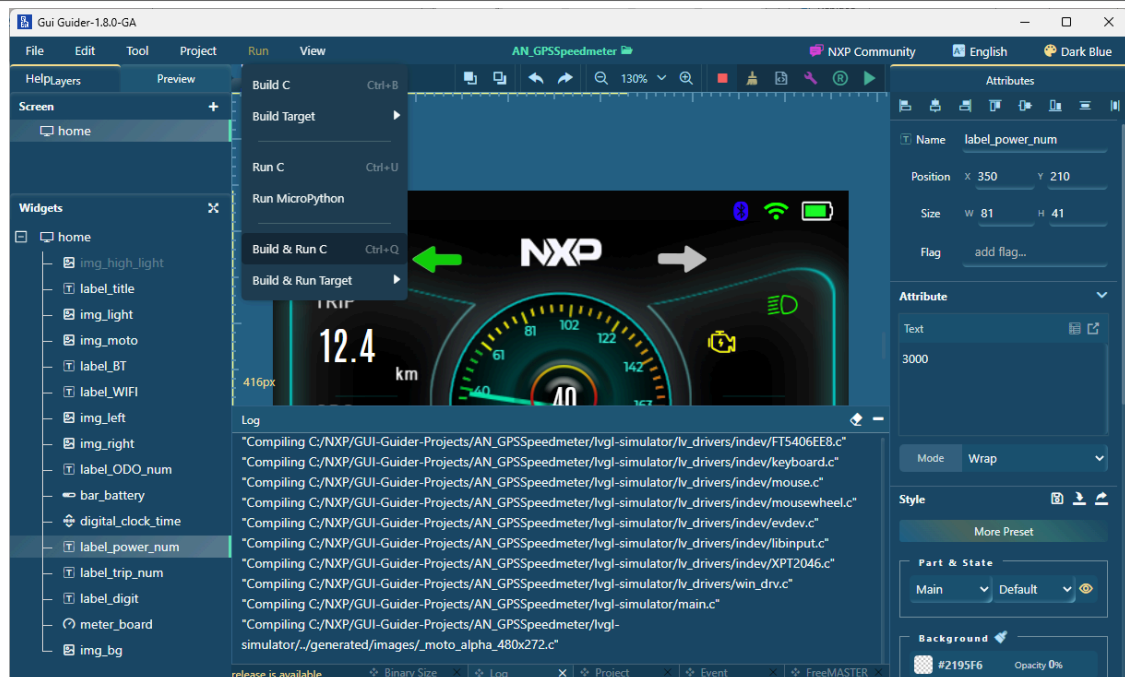


Figure 7. DigitalCluster UI "build C"

Here, we have created the DigitalCluster LVGL UI project source code. User can visit the source code folder from **Project > Open Project Folder**.

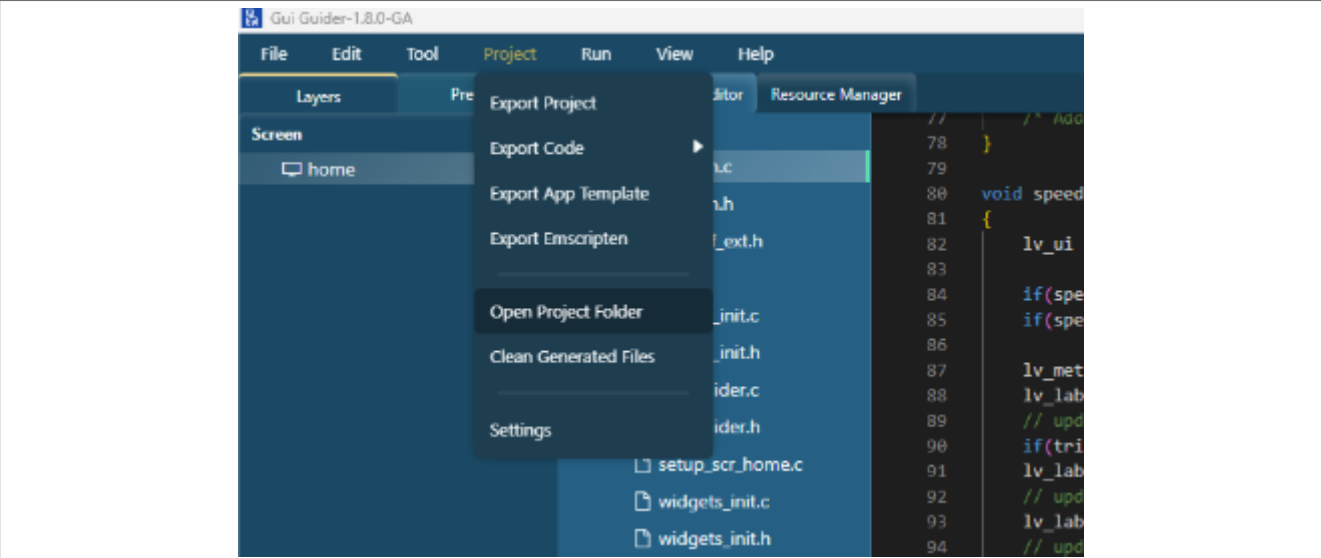


Figure 8. Open Project Folder in GUI Guider

4.2 Example code based on FRDM-MCXXN947

An example code lvgl\_guider\_bm under lvgl\_examples is used here.

To setup the GPS speedometer demo with FRDM-MCXXN947 and LCD-PAR-S035, perform the following steps:

- 1. First, install the SDK\_2\_16\_000\_FRDM-MCXXN947 or the latest version package into MCUXpresso IDE.

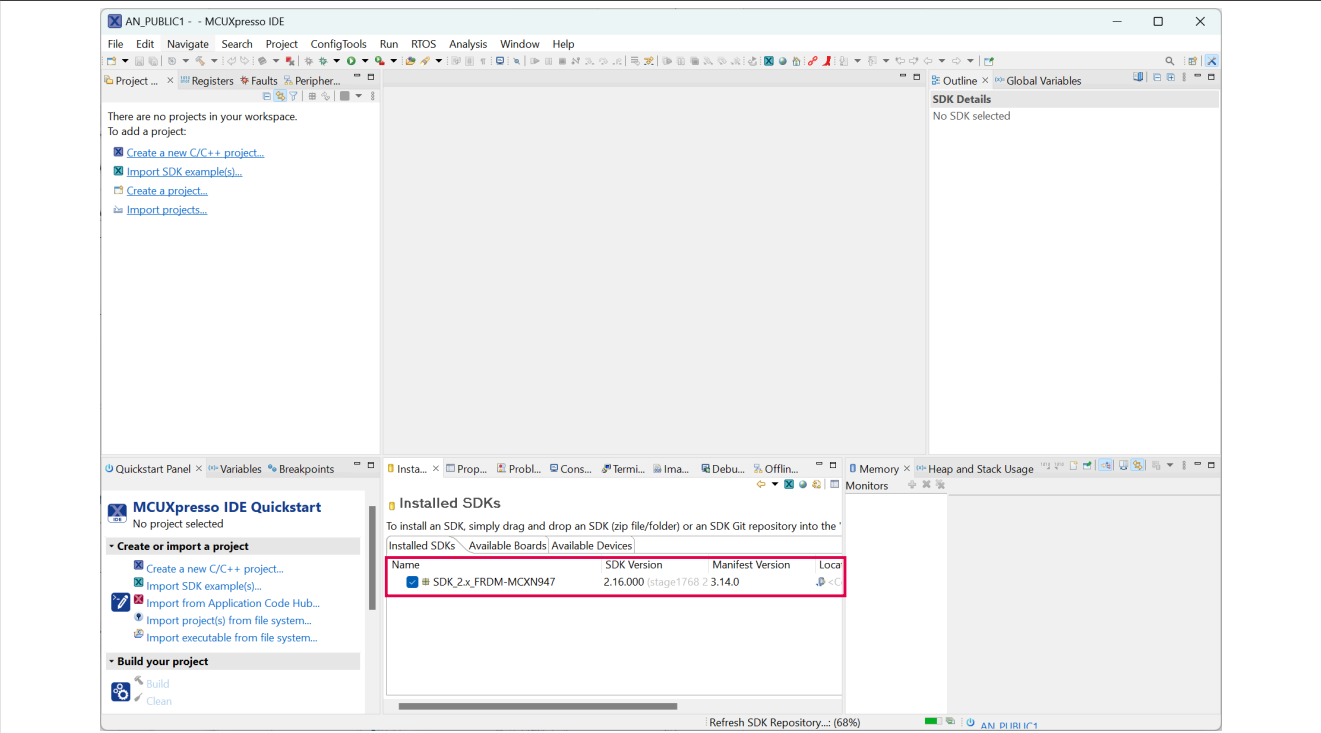


Figure 9. FRDM-MCXXN947 SDK pack installed in MCUXpresso

- 2. Import lvgl\_guider\_bm example code into MCUXpresso.
- 3. Click **Import SDK example(s)...** and select **frdmmcxn947** board. Click the **Next** button.

## Building a GPS Speedometer using GUI Guider and FRDM-MCXN947

4. Then, select the `lvgl_guider_bm` under `lvgl_examples`, and click the **Finish** button to create the project.

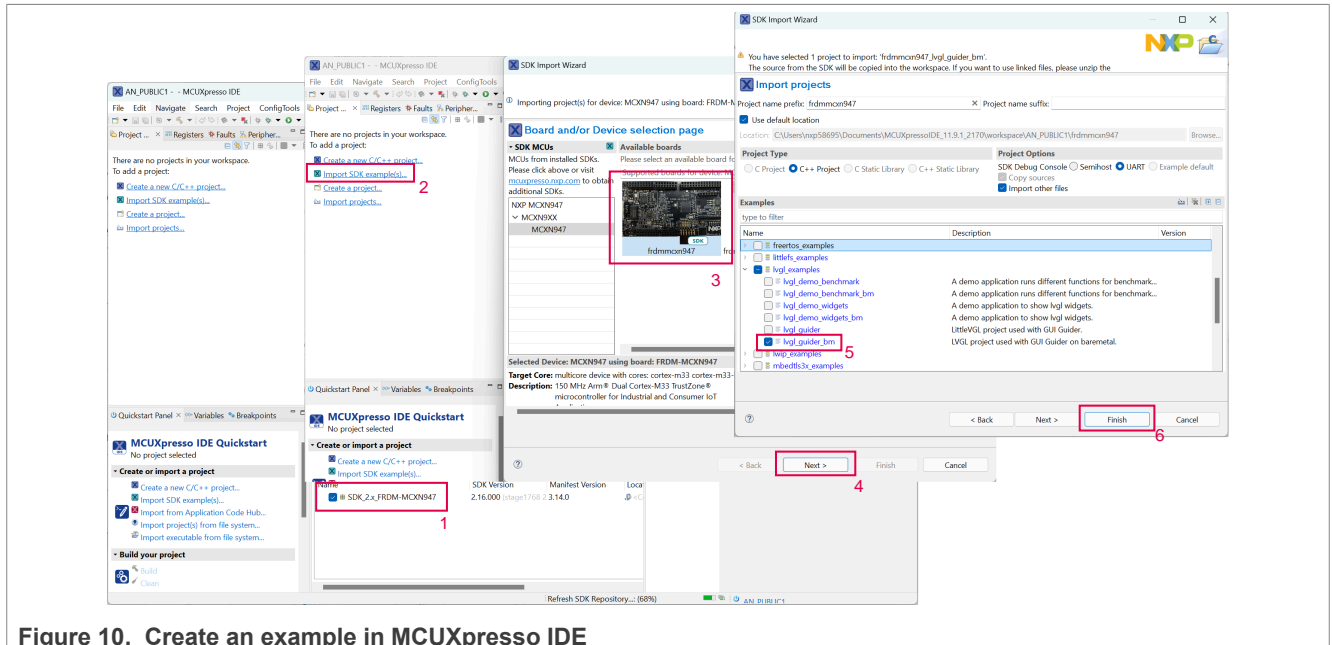


Figure 10. Create an example in MCUXpresso IDE

5. After successfully importing the project, update the `BOARD_LCD_S035` from 0 to 1 in `lvgl_support.h`.

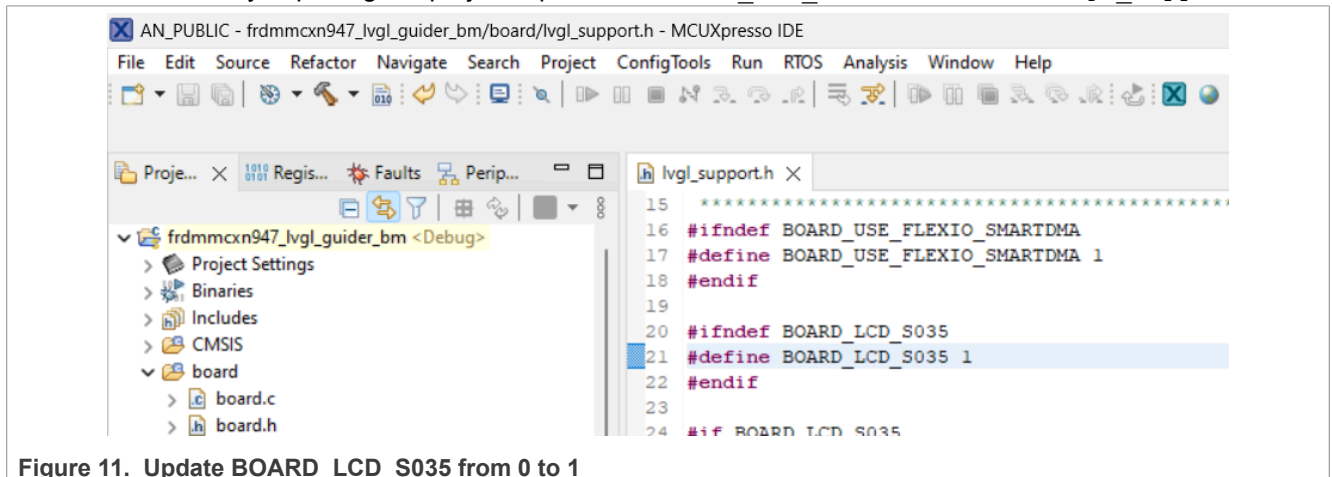


Figure 11. Update `BOARD_LCD_S035` from 0 to 1

### 4.3 Deploy GUI Guider project on FRDM-MCXN947

User can find the "custom" and "generated" folder in both the GUI Guider project and MCUXpresso project folder. Copy these two folders and the files from the GUI Guider project path to the MCUXpresso project and merge them.

## Building a GPS Speedometer using GUI Guider and FRDM-MCXX947

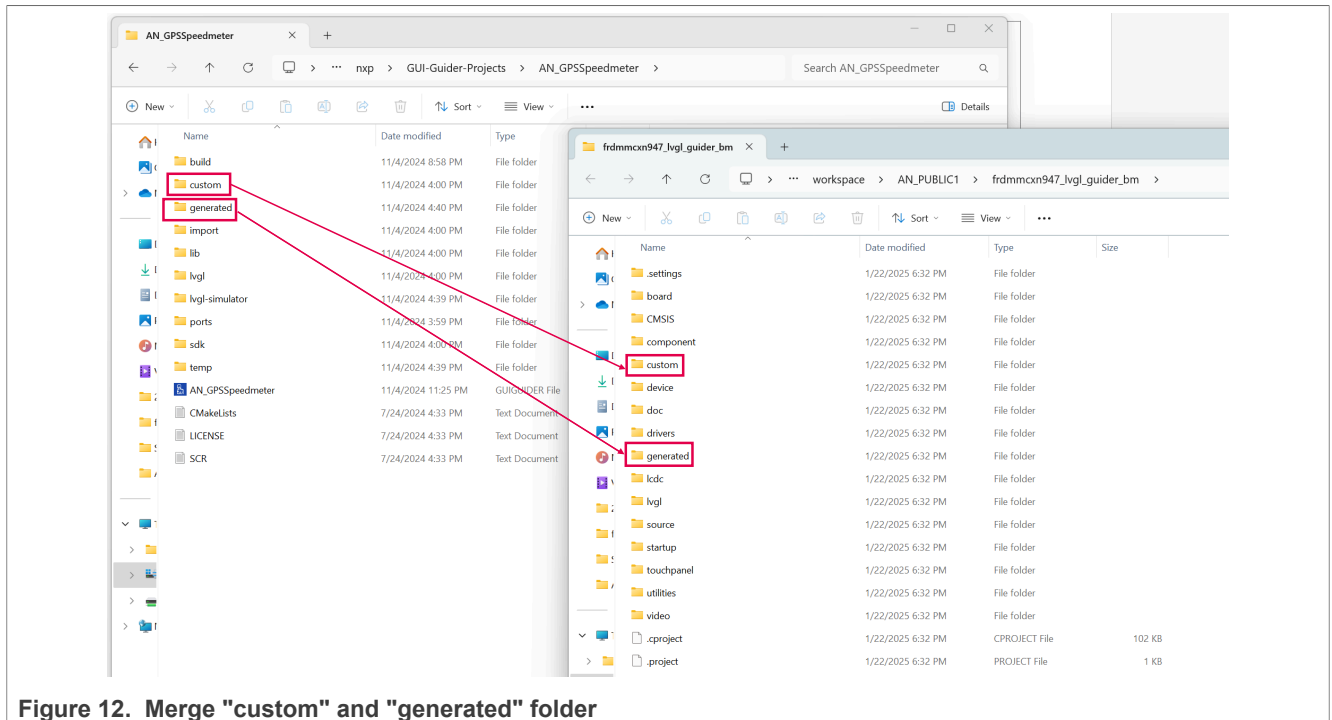


Figure 12. Merge "custom" and "generated" folder

While compiling the project, the user might face some issues. To resolve those issues, perform the following steps:

1. Update `LV_USE_USER_DATA` in `lv_conf.h` from 0 to 1.
2. Copy the `dclock` folder under the GUI Guider project `lvgl\src\extra\widgets` to MCUXpresso project `lvgl\lvgl\extra\widgets`. Then, add `#define LV_USE_DCLOCK 1` in the `lv_conf_internal.h` file.

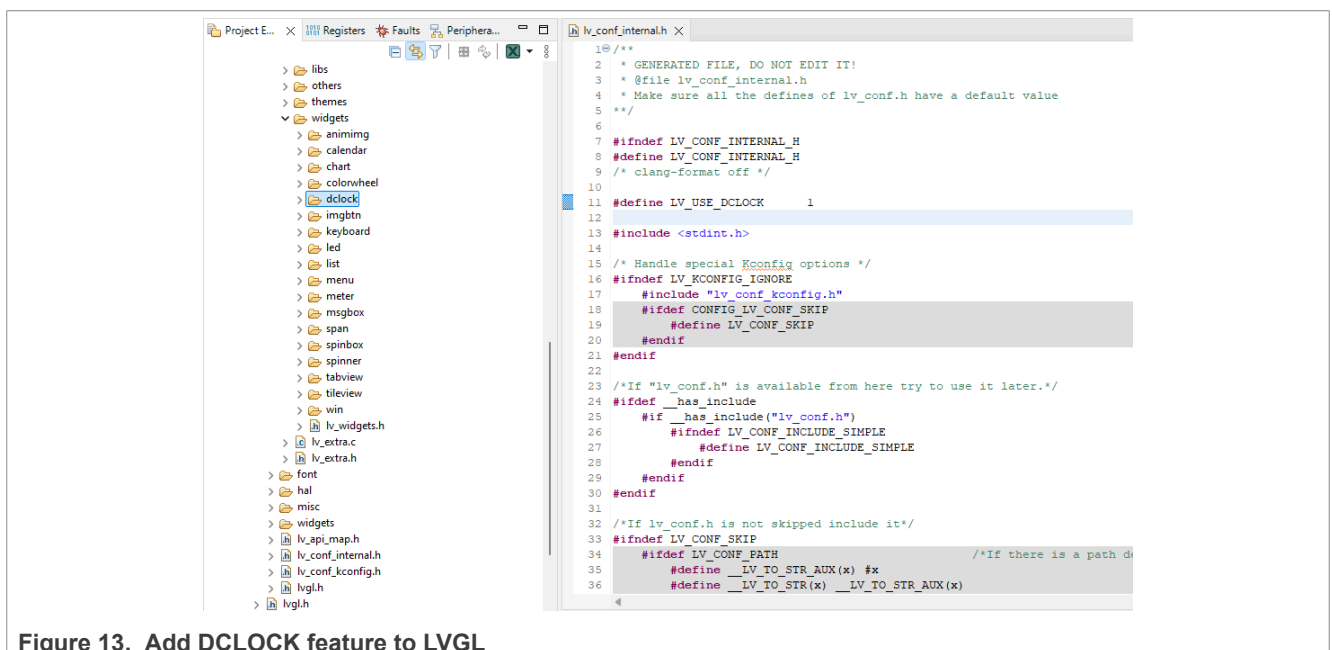


Figure 13. Add DCLOCK feature to LVGL

Once done, download the code to your FRDM-MCXX947 with LCD-PAR-035S LCD panel connected and click the reset button. The DigitalCluster example code should run fine.

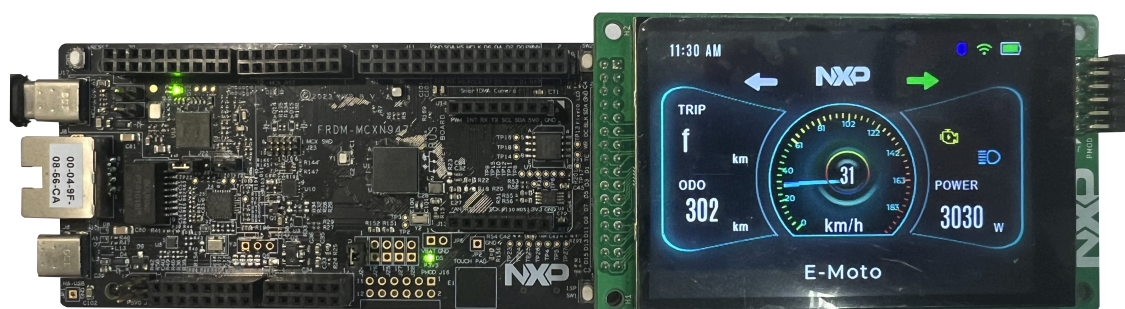


Figure 14. Running DigitalCluster on FRDM-MCXX947

#### 4.4 Enable GPS function

To decode the GPS module's data, perform the following steps:

1. Download the `lwgps` source code from GitHub and copy the "lwgps" folder under "lwgps-develop" to the MCUXpresso project.
2. Right-click the "lwgps" folder in the MCUXpresso project and select **Properties**. Then, unselect the **Exclude resources from build** option.

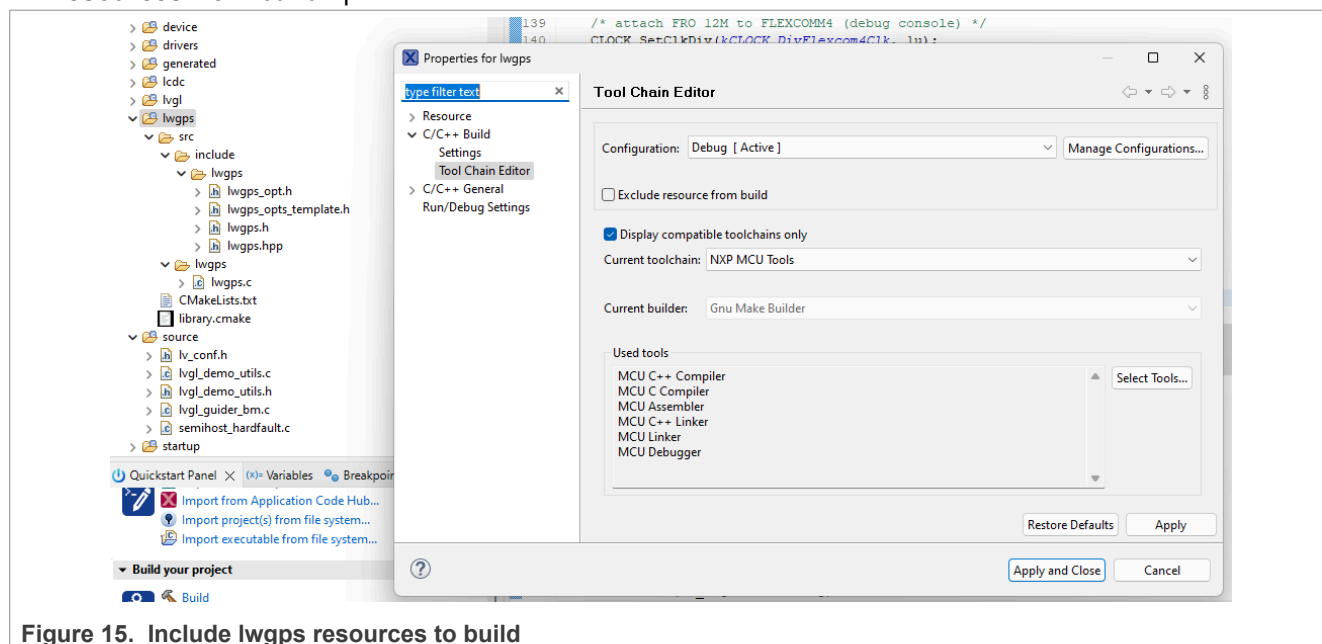


Figure 15. Include lwgps resources to build

3. Copy `lwgps_opts.h` from `lwgps-develop/dev` to MCUXpresso project folder "source".
4. Add `lwgps/src/include` into MCUXpresso project path Quick Settings > Include paths.

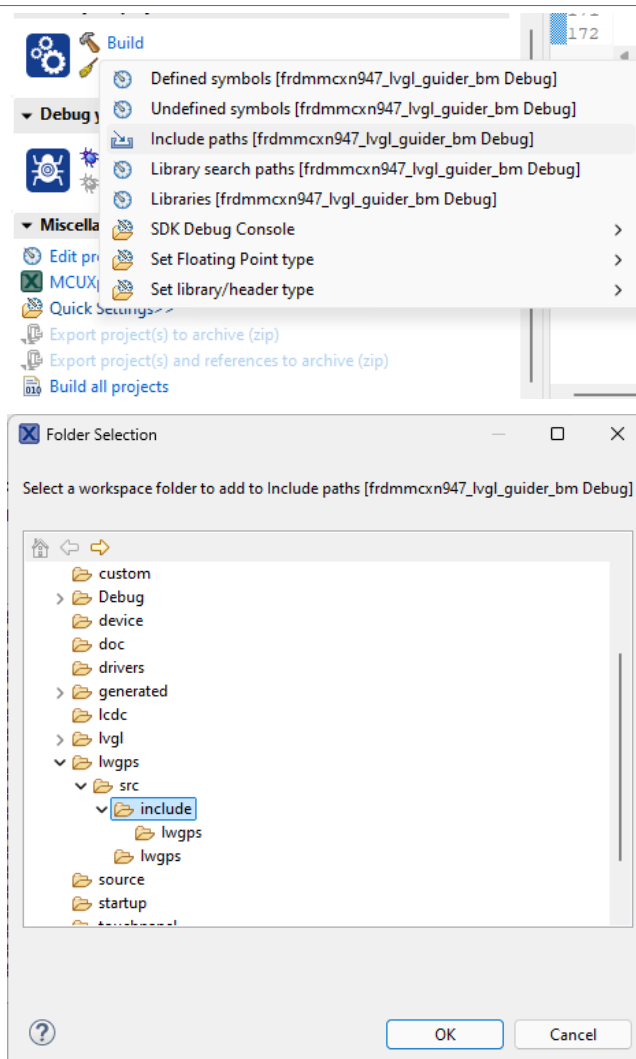


Figure 16. lwgps include file

5. Compile the project.
6. Create or add `app_gps.c` and `app_gps.h` in MCUXpresso project. Enable the LPUART with receive feature in `app_gps.c`. In this example code, we use LPUART6 and 9600, 8n1. Also, initialize `lwgps` with this API code `lwgps_init(&hgps)`.
7. Add `gps_task((uint8_t *) &g_GPSTaskRet); into speed_meter_timer_cb()` in `custom.c`. The global variable `hgps` includes all the GPS information translated from GPS module NMEA data, like speed and direction.
8. Disable the UI icons animation in `home_label_digit_animation()`.

## 4.5 Demo

Compile the project and download to FRDM-MCXN947. Make sure the GPS module and LCD module connect with the FRDM board. Click the reset button and walk to an open space. Make sure that the GPS can get the signal. Walk with a slow speed. The speed information is displayed on the screen.



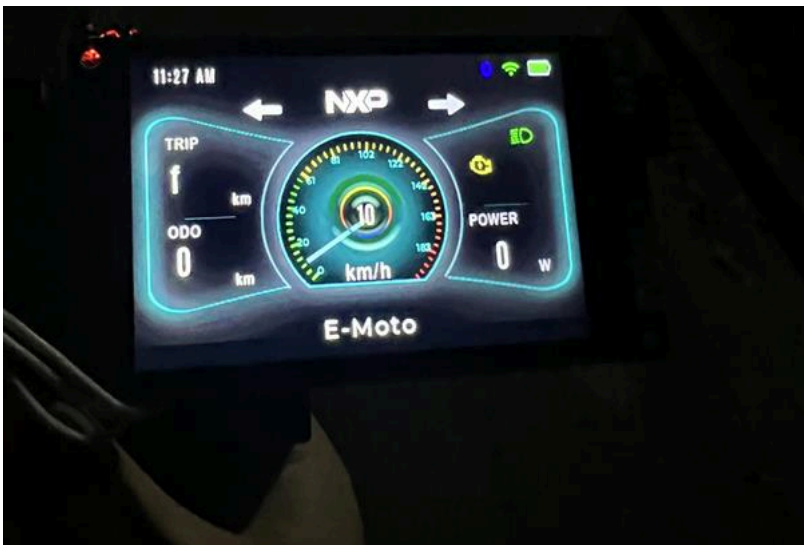


Figure 17. DigitalCluster demo with GPS on FRDM-MCXN947

## 5 Note about the source code in the document

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## 6 Revision history

[Table 1](#) summarizes the revisions to this document.

Table 1. Revision history

| Document ID   | Release date     | Description            |
|---------------|------------------|------------------------|
| AN14553 v.1.0 | 17 February 2025 | Initial public release |



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