Synergy Demo

Data Transfer using MQTT

1. Introduction

This Demo illustrates how to add a clock and a sine signal to the Synergy Starter Kit SK-S7G2 and send and visualize these data in the Renesas IoT Sandbox, by modifying the **SK-S7G2 with LED Toggle Example**[1] and using the Synergy Cloud Driver MQTT (Message Queuing Telemetry Transport).

The MQTT Synergy Cloud Driver library will be included into the project, allowing user to read and write to the data through python code in the Renesas IoT Sandbox. In this demo it is also visualized how to design a Dashboard using the Renesas IoT Sandbox to show the data from Starter Kit[2].

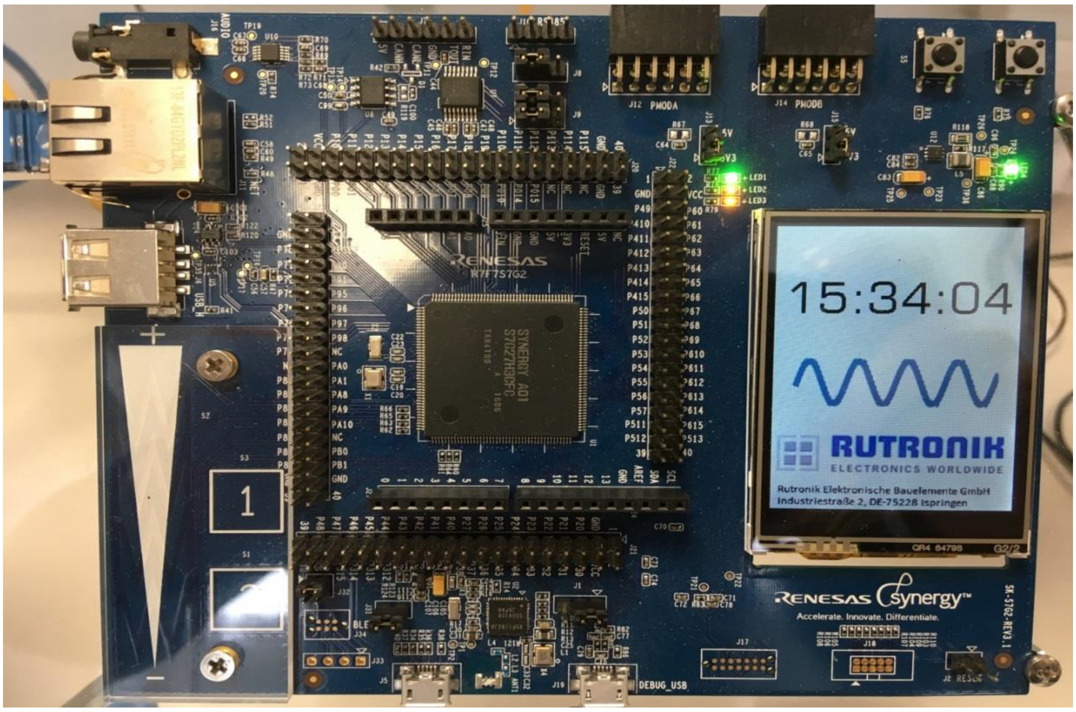
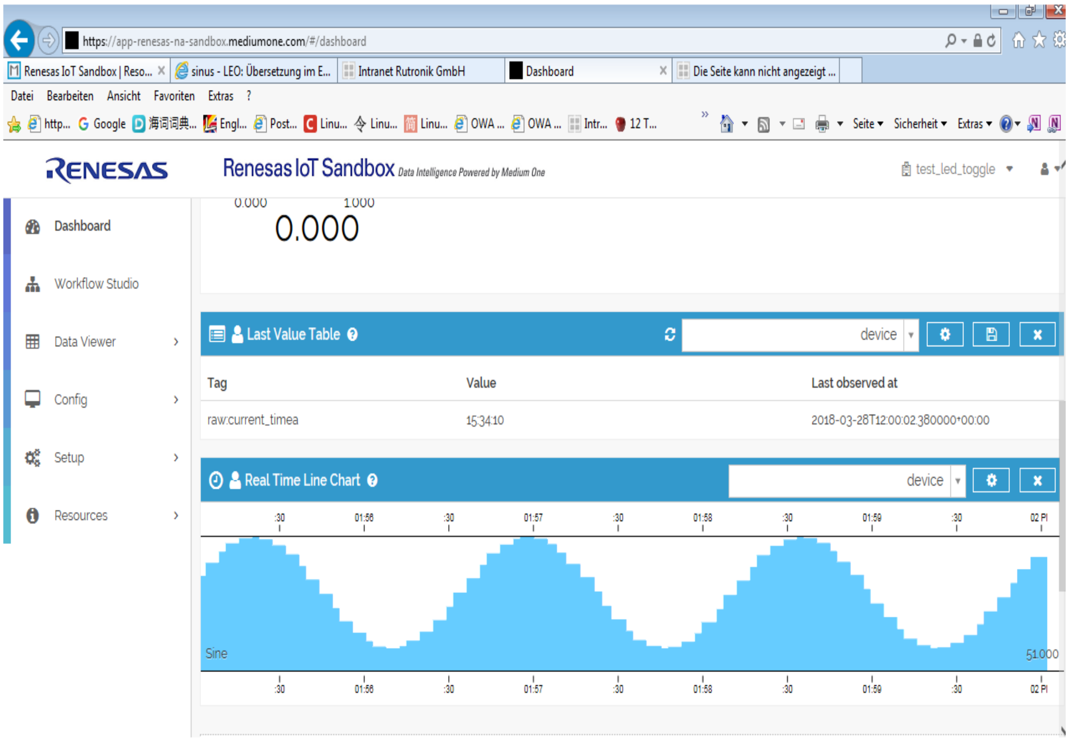


Fig.1 Start Kit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Real Time Line Chart
device
:30
01:56
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02 PI
Sine
51.000

Last Value Table

Tag	Value	Last observed at
raw:current_timea	15:34:10	2018-03-28T12:00:02.380000+00:00

Fig.2 Dashboard

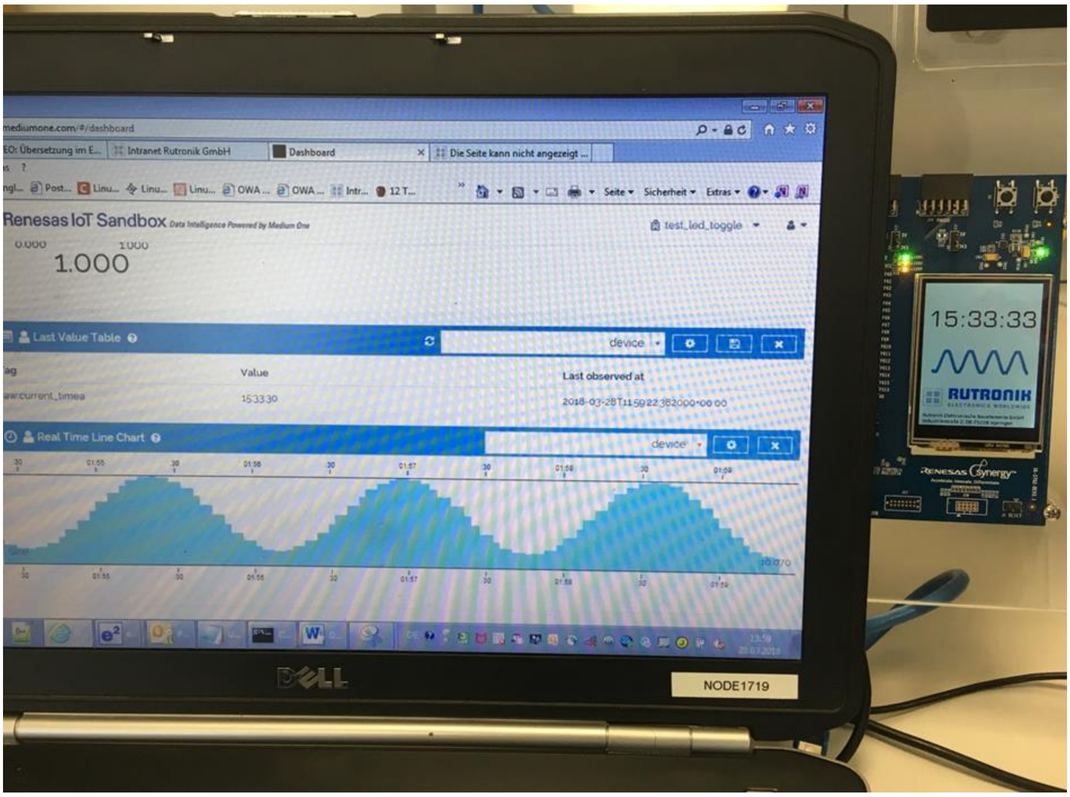


Fig.3 Dashboard and Start Kit

2. Connect to the Board

This section describes how to connect the board to power, the J-Link debugger to the PC.

- Refer to the Quick Start Guide for PE-HMI1, DK-S7G2, DK-S3A7, or SK-S7G2 for setting up the power connection and the J-link debugger connection from your PC to the JTAG connector on the target board[3].
- The connection to Ethernet: it should be same as SK-S7G2 with LED Toggle Example[1]

3. Import the Project into e2 studio

These zipped demo project files can be copied from: XXX

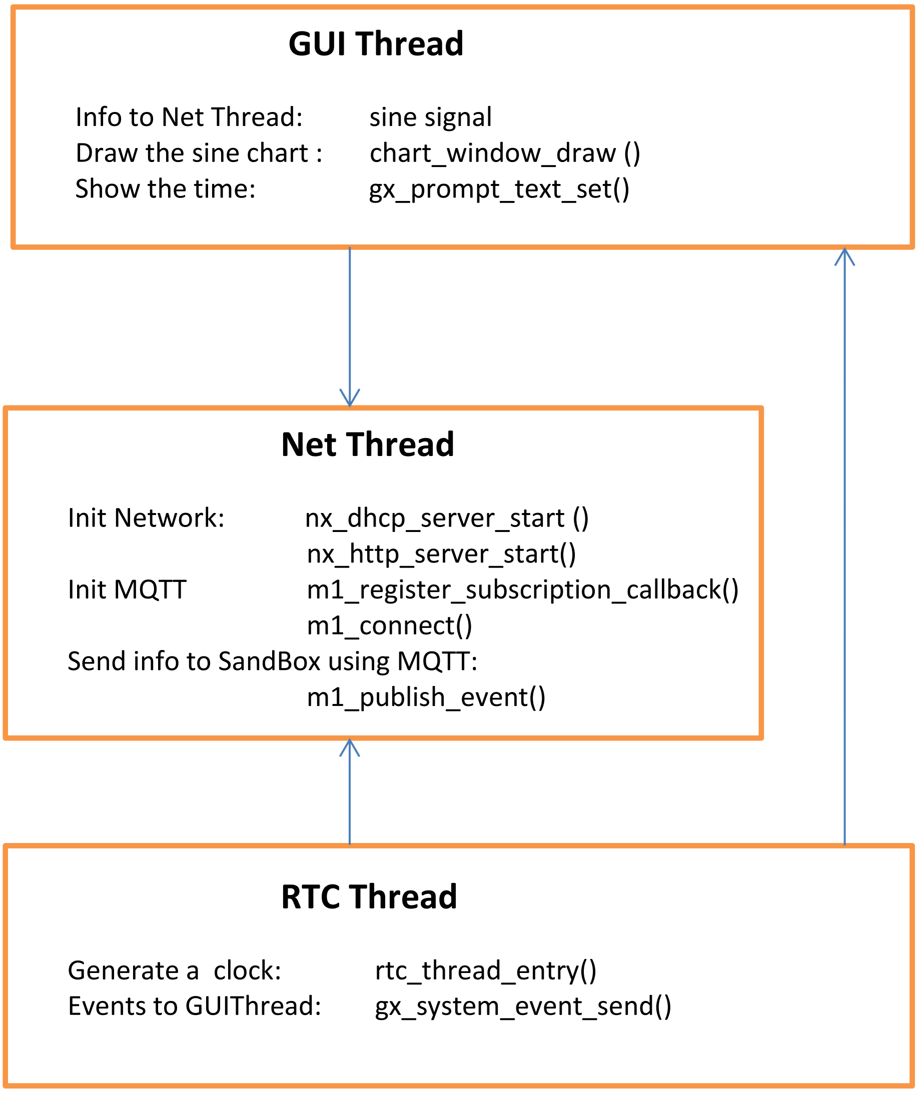
Refer to the "Synergy Project Import Guide" [3] (r11an0023eu0100_synergy_ssp.pdf) for instructions on importing the project into e2 Studio and building/running the project. When debugging, use the “SK_S7_LED_Toggle Debug” configuration.

The following tools should be used for compile and debug:

•	e2 studio	V5.4.0.023
•	SSP	V1.2.0
•	GNU	V4.9.3.20150529
•	GUIX	V5.3.0.1

4. Architecture

A high-level view of the architecture of this application is shown below.



GUI Thread

Info to Net Thread: sine signal
Draw the sine chart : chart_window_draw ()
Show the time: gx_prompt_text_set()

Net Thread

Init Network: nx_dhcp_server_start ()
nx_http_server_start()
Init MQTT m1_register_subscription_callback()
m1_connect()
Send info to SandBox using MQTT:
m1_publish_event()

RTC Thread

Generate a clock: rtc_thread_entry()
Events to GUIThread: gx_system_event_send()

Function description of this demo

In this demo, the RTC Thread, Net Thread and GUI thread are added.

In the RTC thread, the function rtc_thread_entry() provides a system clock from RTOS that the function TimeUpdate() uses to generate the new clock information, it sends also an event with the clock information to the GUI thread every second through using system function gx_system_event_send().

In Net Thread, at first it initiates the ethernet with the function nx_ip_creat(), nx_tcp_enable(), nx_dhcp_create(),nx_dhcp_start(), nx_dhcp_server_create(), nx_dhcp_server_start(),nx_dns_create(),nx_http_server_create(), etc.; the function nx_http_server_start() is used for provision, and the function m1_connect() of MQTT is used to builds the connection with Sandbox; after then, it can send information to Sandbox using MQTT through calling m1_publish_event ().

In GUI Thread, the function options1() receives the events that come from RTC Thread, and from them it gets the clock information and shows them on TFT in time; at the same time, through calling the function chart_window_draw() it updates the sine chart which moves left about PI/6 at every update.

5. Cloud application

5.1 Sandbox introduction

Renesas IoT Sandbox allows user to rapidly create IoT applications using cloud services and real-time workflows. All functions needed for development are included, from connecting to the cloud and processing device data, to IoT-centric libraries with analytics functions for predicting trends and detecting anomalies.

Renesas IoT Sandbox aggregates all event data from any source, whether it's sensors, mobile apps, or an existing cloud, and performs real-time processing to extract intelligence or implement automation. With Renesas IoT Sandbox, user can focus on the application's logic while the Sandbox quickly extracts intelligent insights to power their applications.

Renesas IoT Sandbox accepts data as events in JSON format, and uses the integrated Python to process the data, transfers data using MQTT.

5.2 Cloud GUI design

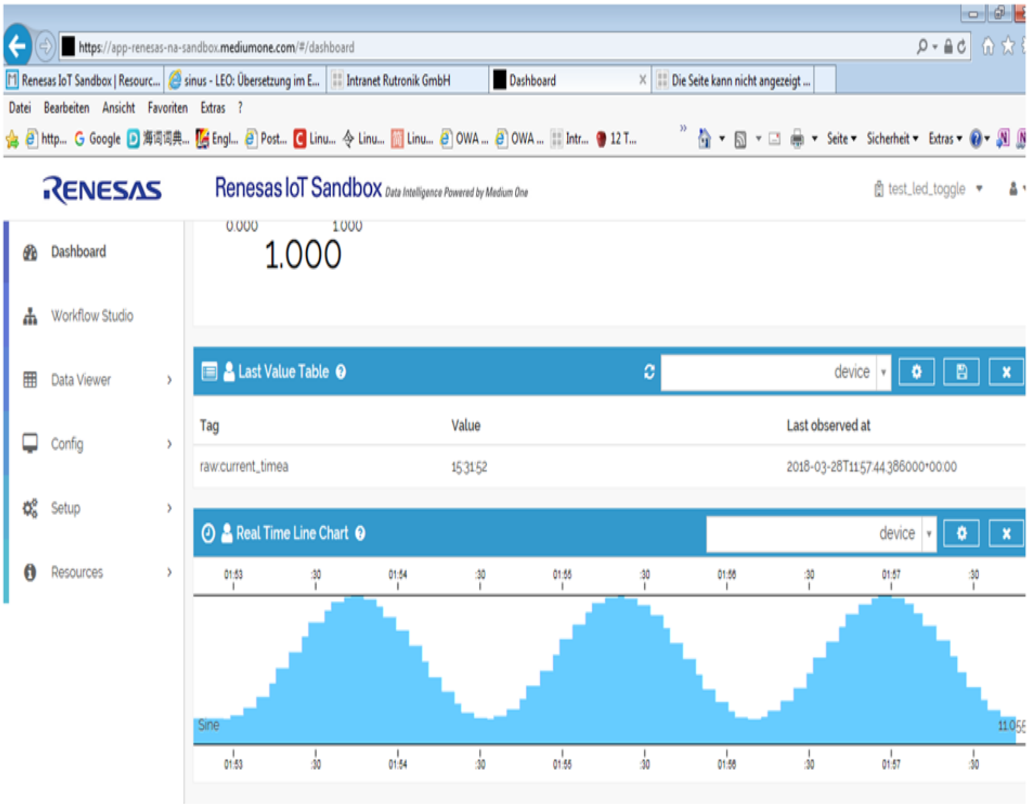
Following explain how to design a dashboard using Renesas SandBox for this project.

1. Login to Renesas IoT Sandbox with user web credentials: https://app-renesas-na-sandbox.mediumone.com/#/dashboard.
2. On the Config →Data Streams page, click Edit for the Raw Data Stream; select the Active checkbox for the two listed Tags (current_time and sine), and then Save Data Stream**.**
3. On Workflow, click the Tags & Triggers pane on the right toolbar, and under the "raw" dropdown, drag and drop the sine tags onto the main canvas; from the Modules pane, click on the "Foundation" dropdown and then drag and drop the Base Python module onto the canvas; from the Outputs panel, drag and drop the Processed Stream - Single module onto the canvas; connect the input and output connectors (click and drag) with Base Python; double click the Base Python module again, and let's replace the default script and enter the following into the script text area:

   ```
   sine1 = IONode.get_input('in1')['event_data']['value'] -140.0
   output = IONode.set_output('out1', {'sine1': sine1})
   ```

   then save the code in the Base Python module; go to the Revisions panel, and activate the Workflow by clicking on the check icon under the most recent revision.

4. Click on Dashboard on the navigation side bar, select Last Value Table widget from the widget selector; from the Select User dropdown, select the username, click the configuration gear icon, and select the current_time tag. Then the time is showed in this table.
5. Click on Dashboard on the navigation side bar, select the Real Time Line Chart widget from the widget selector; from the Select User dropdown, select the username, click the configuration gear icon, and select the sine1 tag. Then the sine signal is showed in this table.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0.000
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Last Value Table
device
Real Time Line Chart
device
01:53
:30
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:30
01:55
:30
01:56
:30
01:57
:30
Sine
11.055

Tag	Value	Last observed at
raw:current_timea	15:31:52	2018-03-28T11:57:44.386000+00:00

6. Application Features

This section describes the key features of this demo application and the steps needed to run the application.

This demonstration application illustrates the remote monitoring of the data from a start kit through using MQTT and the Renesas SandBox through following functions:

- Add the software to display a clock and the sine curve on the TFT of the kit.
- Change the software to integrate the clock and sine data in the project in order to send them to the dashboard using MQTT.
- Design a dashboard to show the data of the time and sine signal from the start kit in real time. Due to the update delay, the showing data have the delay of ca. 3 Seconds.

To run the demonstration application:

- Click Resume twice to run the demo.

- Build the dashboard as 5.2, and then the data should be seen on dashboard. Please refer to the **SK-S7G2 with LED Toggle Example**[1]
- Click Terminate to close the debugger.

1. http://renesas-blog.mediumone.com/sk-s7g2-with-led-toggle-kit-quick-start-guide/
2. If you have any questions or want to get the source code of this demo, please do not hesitate to contact Mr. Weizhong Xu, Weizhong.Xu@rutronik.com.
3. This file / these files can be found under the path XXXX