STM32CubeU5 B-U585I-IOT02A web server demonstration firmware

Introduction

STM32Cube is an STMicroelectronics original initiative to significantly improve designer's productivity by reducing development effort, time, and cost. STM32Cube covers the whole STM32 portfolio.

STM32Cube includes:

- A set of user-friendly software development tools to cover project development from conception to realization, among which are:
  - STM32CubeMX, a graphical software configuration tool that allows the automatic generation of C initialization code using graphical wizards
  - STM32CubeIDE, an all-in-one development tool with peripheral configuration, code generation, code compilation, and debug features
  - STM32CubeProgrammer (STM32CubeProg), a programming tool available in graphical and command-line versions
  - STM32CubeMonitor (STM32CubeMonitor, STM32CubeMonPwr, STM32CubeMonRF, STM32CubeMonUCPD) powerful monitoring tools to fine-tune the behavior and performance of STM32 applications in real-time
- STM32Cube MCU and MPU Packages, comprehensive embedded-software platforms specific to each microcontroller and microprocessor series (such as STM32CubeU5 for the STM32U5 Series), which include:
  - STM32Cube hardware abstraction layer (HAL), ensuring maximized portability across the STM32 portfolio
  - STM32Cube low-layer APIs, ensuring the best performance and footprints with a high degree of user control over hardware
  - A consistent set of middleware components such as FAT file system, RTOS, OpenBootloader, USB Host, USB Device, and USB Power Delivery
  - All embedded software utilities with full sets of peripheral and applicative examples
- STM32Cube Expansion Packages, which contain embedded software components that complement the functionalities of the STM32Cube MCU and MPU Packages with:
  - Middleware extensions and applicative layers
  - Examples running on some specific STMicroelectronics development boards

The STM32CubeU5 demonstration firmware running on the B-U585I-IOT02A Evaluation board is built around the STM32Cube hardware abstraction layer (HAL) and low-layer (LL) APIs, and board support package (BSP) components.

This demonstration firmware is part of the STM32CubeU5 MCU Package. It shows how to use the MXCHIP module to perform HTTP requests using STM32Cube HAL. The MXCHIP module and a web browser (Google Chrome™ browser in this case) are used to create a web server. This web page supports PC and phone usage. The B-U585I-IOT02A board is the HTTP server in this demonstration. It contains the web page resources sent after each client request. The B-U585I-IOT02A board can decode, treat, and respond according to any client requests:

- Web page resource requests, such as HTML page, CSS files, and JS files
- Sensor values requests (Temperature, pressure, and humidity values)

The STM32U5 Series offers advanced power-saving microcontrollers, based on Arm® Cortex®-M33 to meet the most demanding power and performance requirements for smart applications, including wearables, personal medical devices, home automation, and industrial sensors.

1 General information

The STM32CubeU5 demonstration firmware runs on the B-U585I-IOT02A Discovery kit featuring the STM32U585AI microcontroller based on the Arm® Cortex®-M33 core with Arm® TrustZone®.

Table 1 lists the acronyms and abbreviations used in this document.

Table 1. Definition of terms

Term	Definition
API	Application programming interface
BSP	Board support package
CSS	Cascading style sheets
HAL	Hardware abstraction layer
HTML	Hypertext markup language
HTTP	Hypertext transfer protocol
JS	JavaScript

Note: Arm and TrustZone are registered trademarks of Arm Limited (or its subsidiaries) in the US and/or elsewhere.

2 STM32CubeU5 main features

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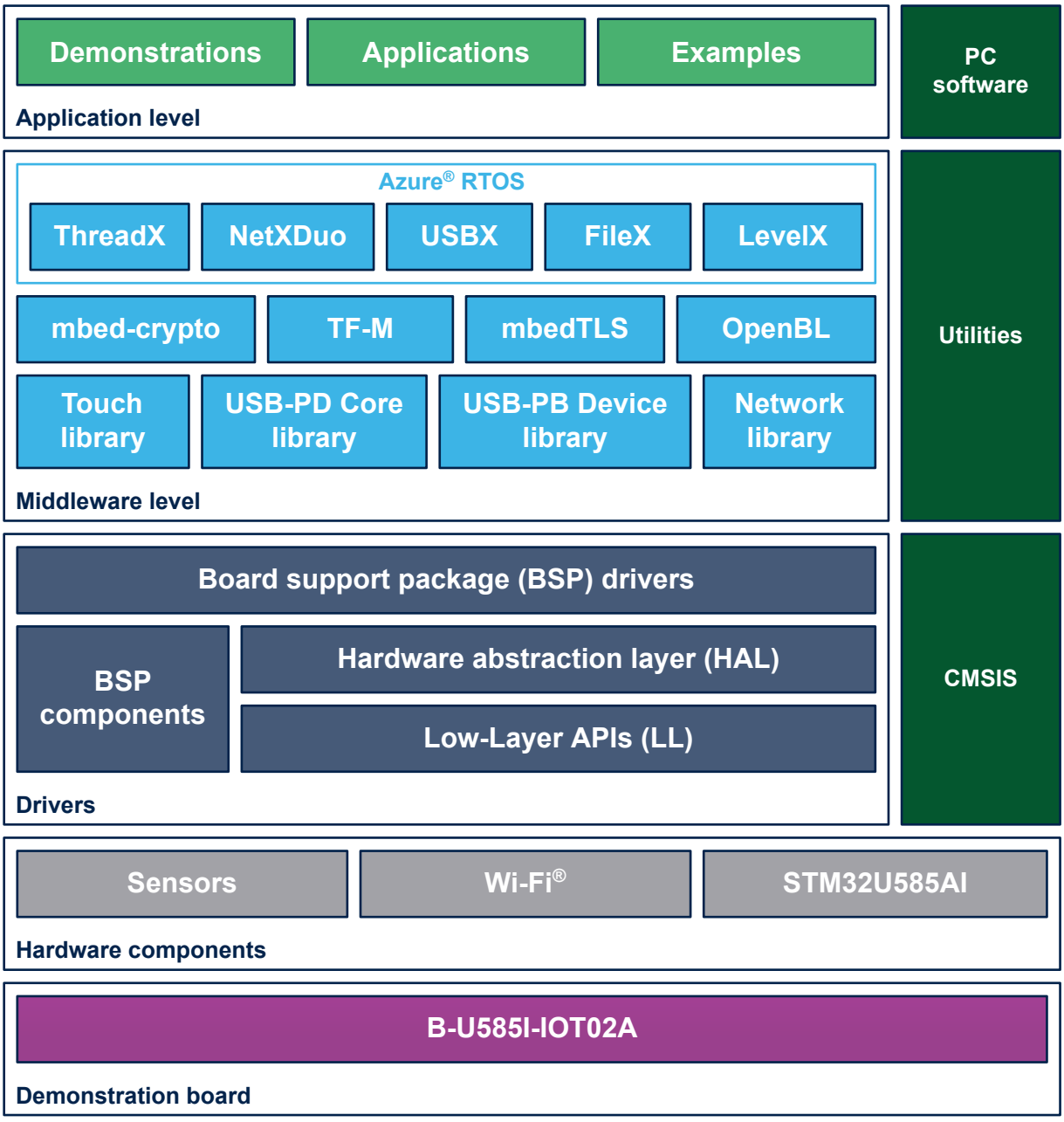
  - STM32Cube low-layer APIs, ensuring the best performance and footprints with a high degree of user control over hardware
  - A consistent set of middleware components such as ThreadX, FileX / LevelX, USBX, NetX Duo, USB power delivery, TF-M, mbed-crypto, Touch library, Network library, OpenBootloader
  - All embedded software utilities with full sets of peripheral and applicative examples
- STM32Cube Expansion Packages, which contain embedded software components that complement the functionalities of the STM32Cube MCU and MPU Packages with:
  - Middleware extensions and applicative layers
  - Examples running on some specific STMicroelectronics development boards

Within STM32CubeU5, both the HAL and LL APIs are production-ready, checked with CodeSonar® static analysis tool, and developed in compliance with MISRA C® guidelines, following a process certified according to IEC 61508 systematic capability 2 level (SC2). Reports are available on demand.

Figure 1. **STM32CubeU5 MCU Package architecture**



3 Demonstration requirements

3.1 Hardware requirements

The hardware requirements to start the demonstration application are:

- board as shown in Section
- USB Type-A to Mini-B cable to power up the STM32 Discovery board from the CN2 USB ST-LINK connector

3.2 Software requirements

3.2.1 Web browser

This element retrieves content from the web server and displays the page on the user's device.

Figure 2. Google Chrome™ browser icon

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3.2.2 Serial terminal

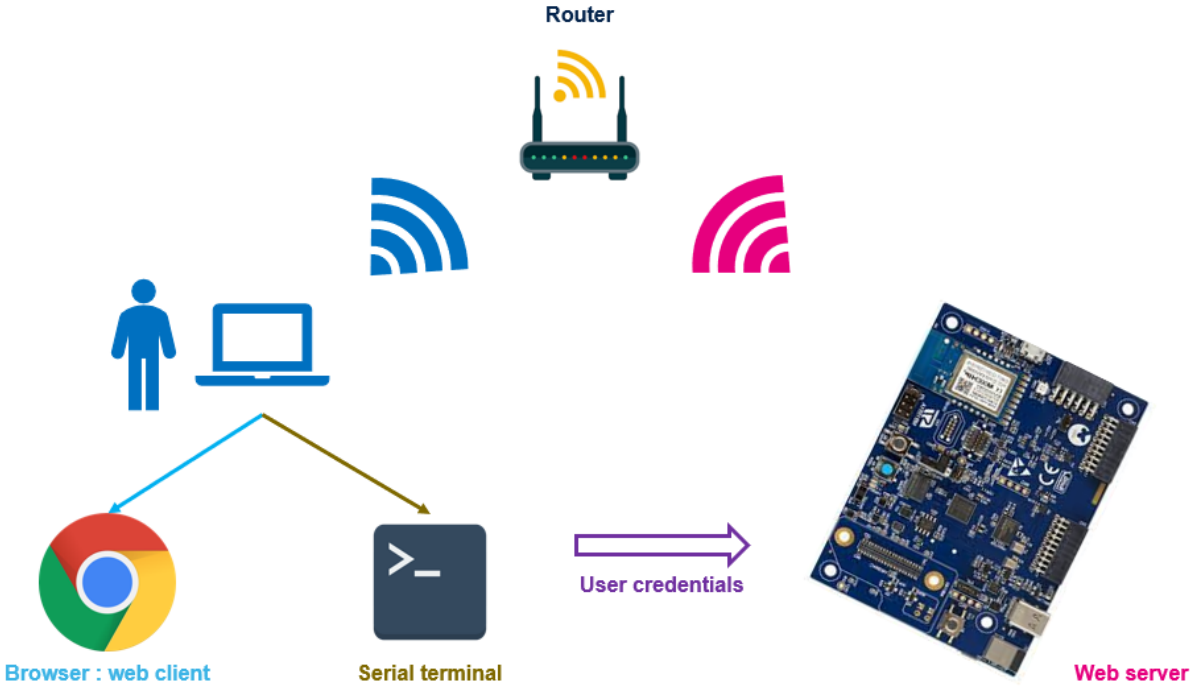
This element allows seeing data sent to and from the microcontroller. The data can be used for several reasons including troubleshooting or debugging, communication testing, calibrating sensors, configuring modules, and data monitoring.

Figure 3. Tera terminal icon

4 Demonstration architecture

4.1 Architecture overview

Figure 4. **Demonstration architecture overview**



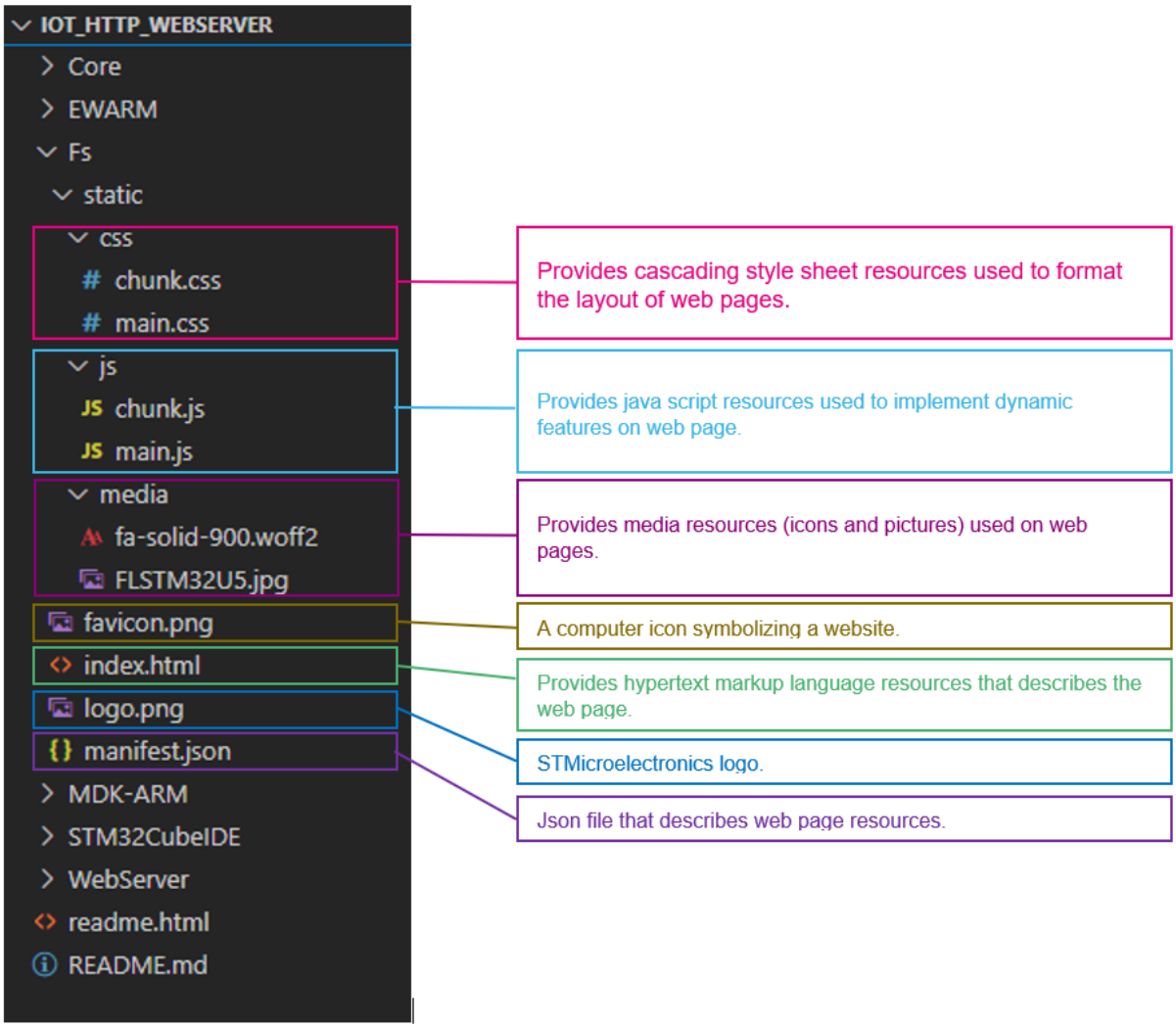
This demonstration has two user interfaces:

- Serial terminal allows the users to follow demonstration run-time steps and to provide their Wi-Fi® credentials (Login and password).
- Web browser is the web client that communicates with the web server via the HTTP protocol.

4.2 Architecture components

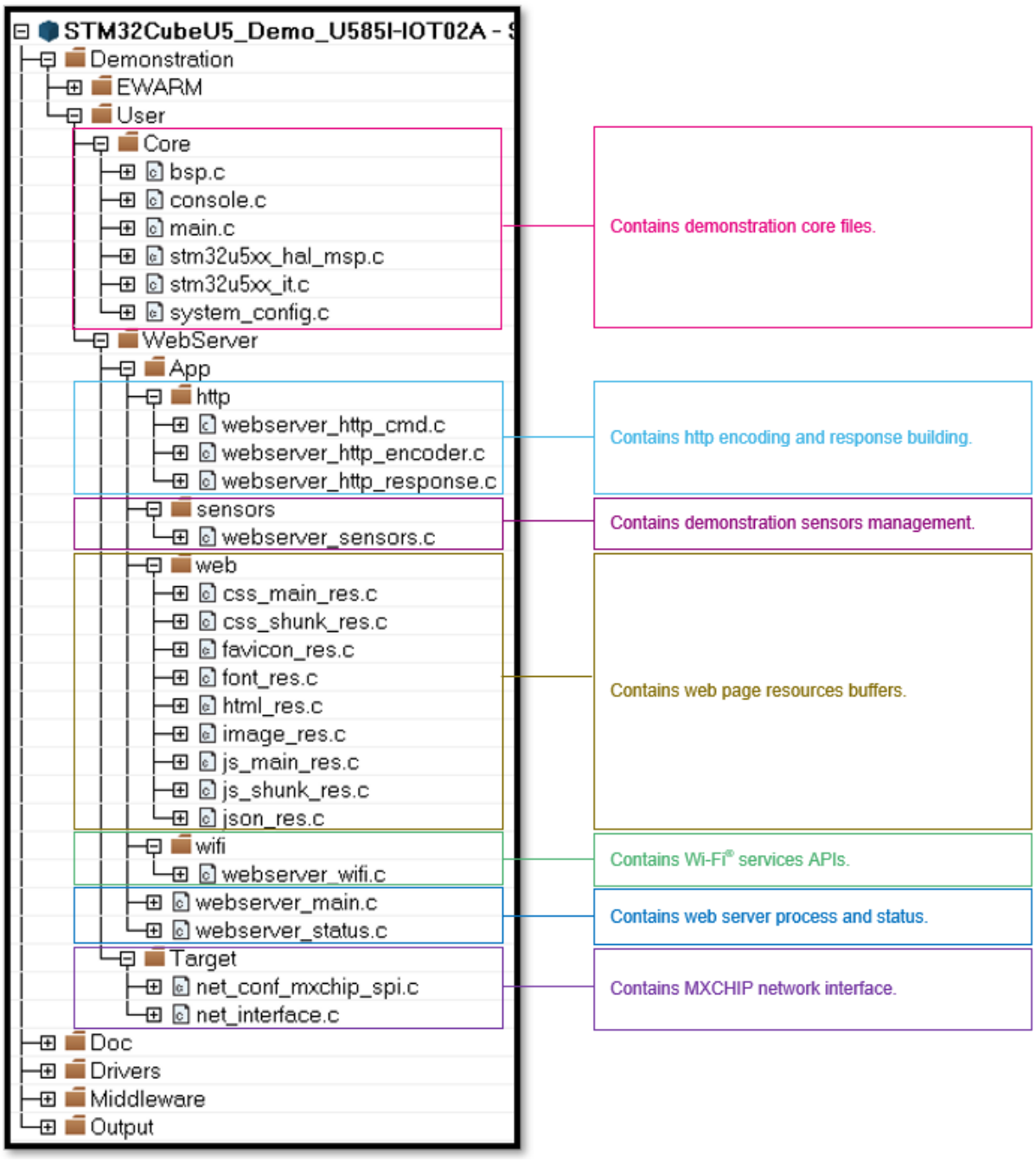
4.2.1 Web page architecture

Figure 5. **Web page resources**



4.2.2 Project architecture

Figure 6. **Demonstration project architecture**

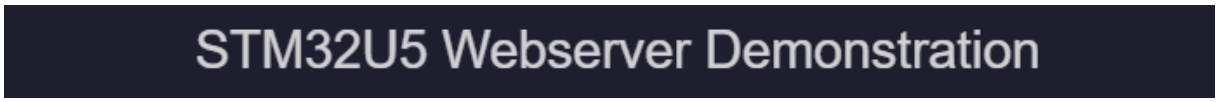


5 Demonstration features

5.1 Title bar

The title bar is a static bar that shows the demonstration title.

Figure 7. Title bar

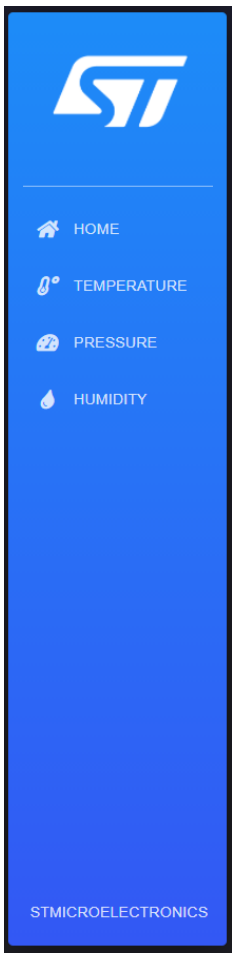


5.2 Sidebar

The sidebar is the only navigation bar to dynamically switch between web page views.
It counts four different menus:

- Home view
- Temperature acquisition view
- Pressure acquisition view
- Humidity acquisition view

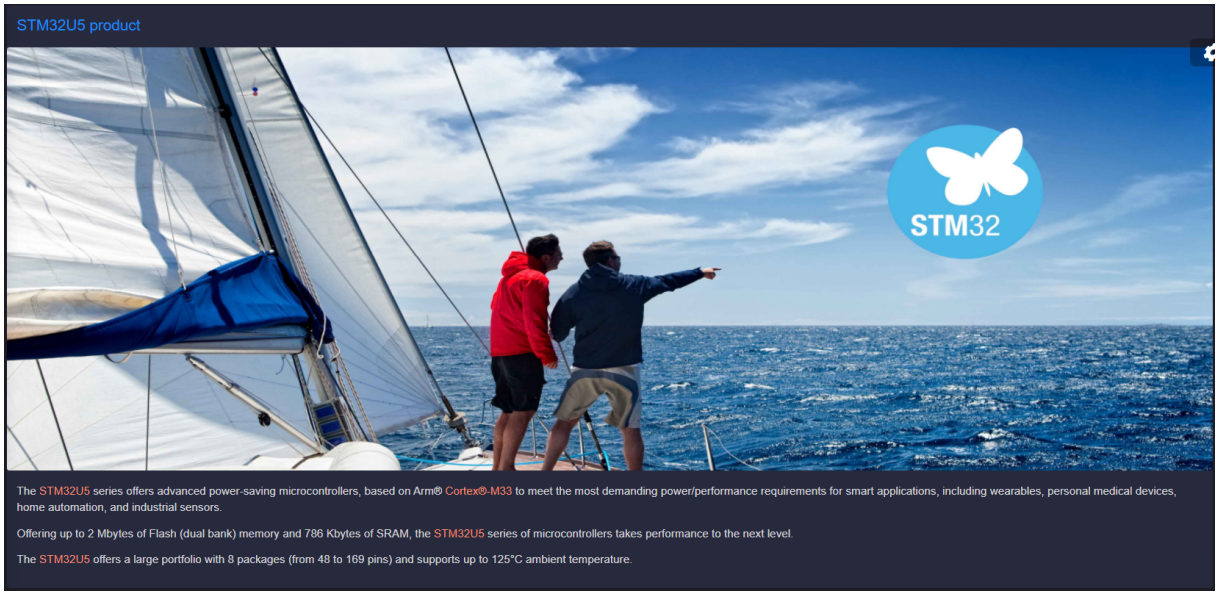
Figure 8. Sidebar



5.3 Home view

This is the default view. It contains the STM32CubeU5 product information and web page views description.

Figure 9. Home view



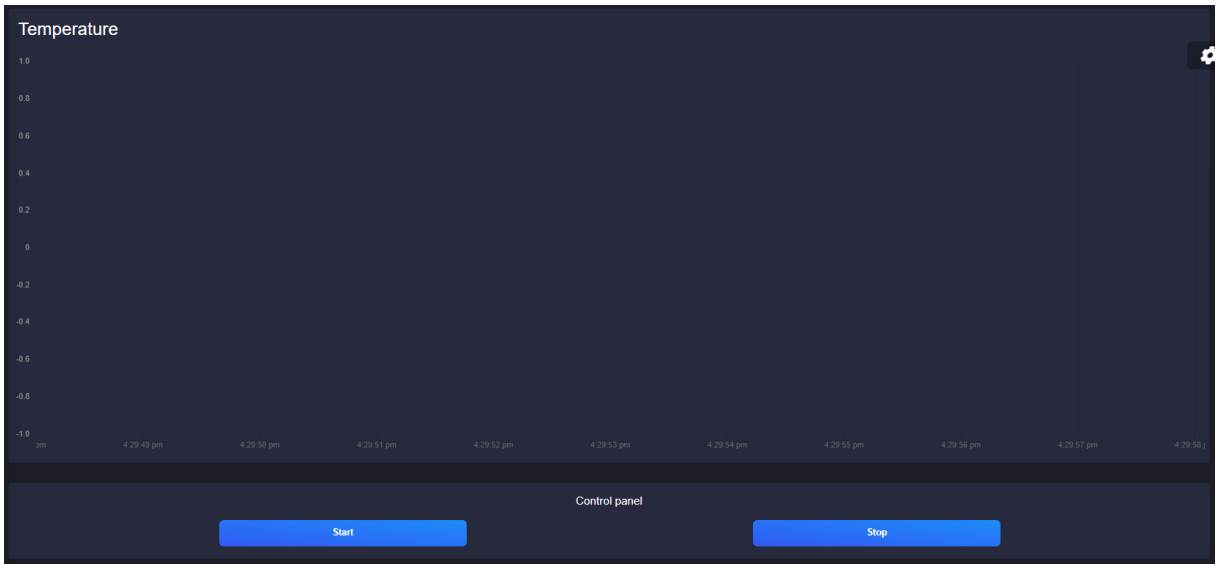
5.4 Sensor acquisition view

A dedicated view for each used sensor. Each view contains a draw area where curves are presented and a control panel that allows to start and stop the sensor acquisition.

Three sensor acquisition views can be selected:

- Temperature acquisition view
- Pressure acquisition view
- Humidity acquisition view

Figure 10. Sensor acquisition view



5.5 Background mode

5.5.1 Background mode panel

The background panel allows the user to switch dynamically between the light mode and the dark mode views.

Figure 11. Background mode panel

5.5.2 Background mode views

Figure 12. **Dark mode view**

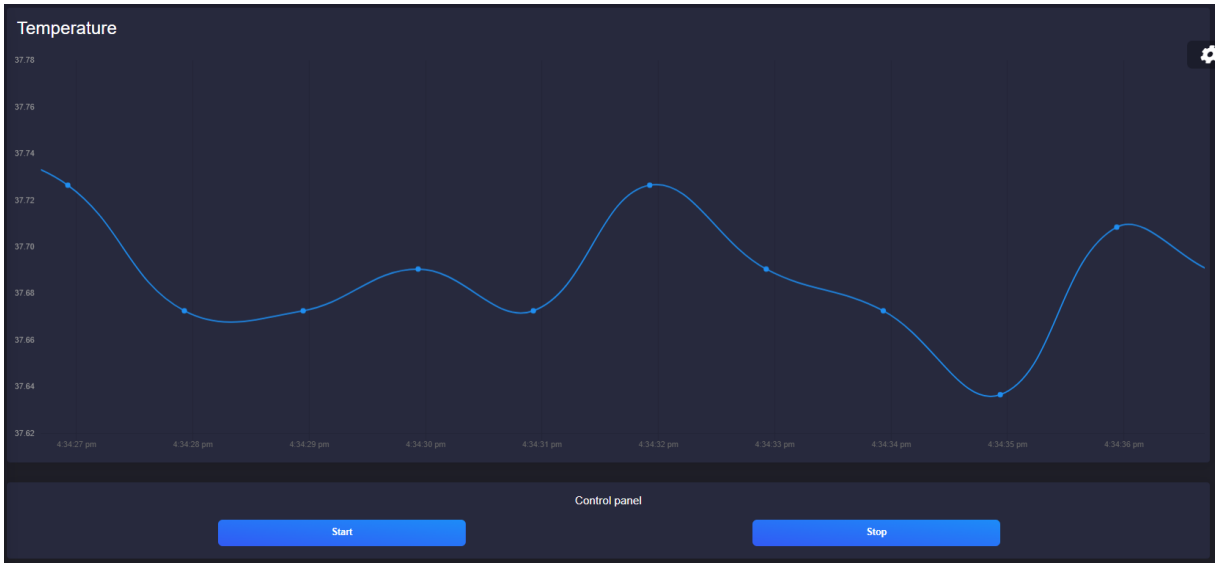
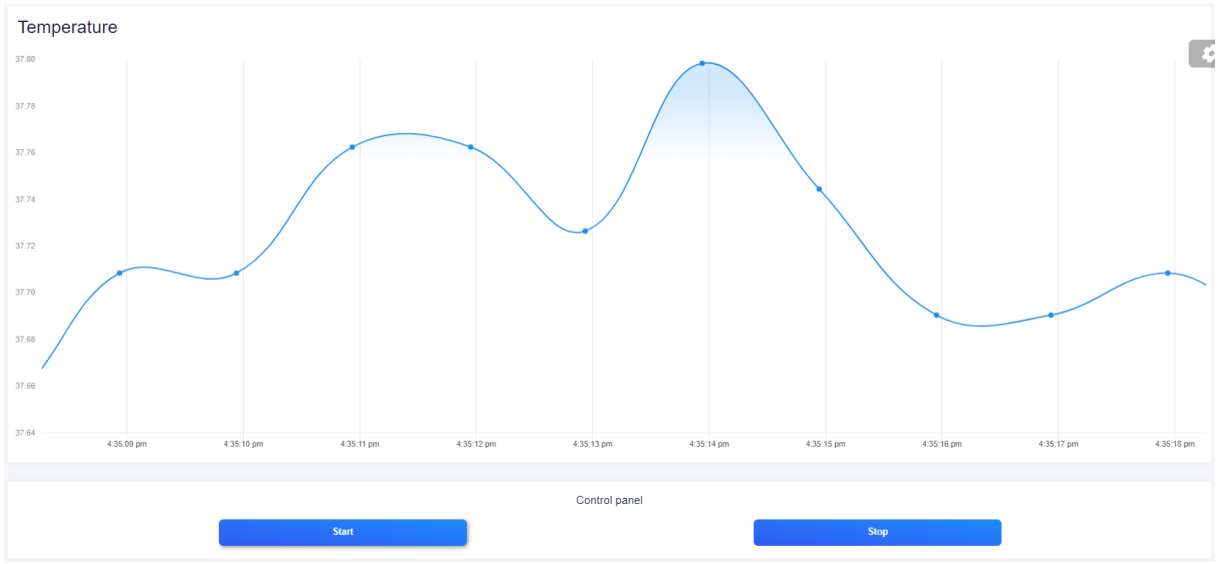


Figure 13. **Light mode view**



5.6 Serial terminal

At run time, the demonstration returns a detailed status according to each demonstration step via a Virtual COM port. The serial terminal allows also to provide Wi-Fi® credentials to creating an access point and stating a socket communication between the web server and the web client.

Figure 14. Serial terminal view

```
================================================================================================
============================       STM32U5 Webserver Demonstration       ============================
================================================================================================

*** Start wifi scan

       0                              Android ch  6 rss -49 Security   WPA2-AES country  .CN bssid f2.4c.83.64.69.1d
       1                            Orange-59A7 ch 11 rss -57 Security   WPA2-AES country  .CN bssid 5c.03.39.be.59.a7
       2                           guest network ch 11 rss -57 Security   WPA2-AES country  .CN bssid 5c.03.39.be.59.a8
       3                           ooredoo41E1E9 ch 13 rss -71 Security   WPA2-AES country  .CN bssid d8.d8.66.41.e1.e9
       4                             TOPNET_8630 ch  7 rss -72 Security   WPA2-AES country  .CN bssid d8.47.32.35.86.30
       5                           TTBOX-PHU869 ch  1 rss -75 Security   WPA2-AES country  .CN bssid 72.3d.ff.54.28.90
       6                                Raoudha ch  2 rss -76 Security  WPA2-TKIP country  .CN bssid d4.6e.0e.f1.a4.69
       7                             TOPNET_8DD8 ch  9 rss -76 Security   WPA2-AES country  .CN bssid 34.e8.94.e3.8d.d8
       8                                    amir ch 11 rss -76 Security   WPA2-AES country  .CN bssid 84.9f.b5.2b.c9.90
       9                           Ooredoo-8315 ch 10 rss -78 Security   WPA2-AES country  .CN bssid 84.9f.b5.c6.83.15

*** End of wifi scan


*** Please enter your wifi ssid : ==============================================================

*** Please enter your wifi password : ==========================================================


Selected Access Point                          Android ch  6 rss -52 Security   WPA2-AES country  .CN bssid f2.4c.83.64.69.1d
- Network Interface starting:
- Network Interface ready:
   - Device Name : MXCHIP-WIFI.
   - Device ID   : EMW3080B.
   - Device Version : V2.1.11.
   - MAC address: 4.78.63.39.4b.32
- Network Interface connecting:
- Network Interface connected:
   - IP address :  192.168.153.149.

*** Create TCP socket
*** TCP socket created
*** Set port and bind socket
*** Port and socket binded
*** Listen for incoming connections
*** Listening started
```

6 Functional description

6.1 Demonstration flow

Figure 15 explains the demonstration flow diagram, while Figure 16 to Figure 20 detail the five different steps following the software launch.

Figure 15. Demonstration flow diagram

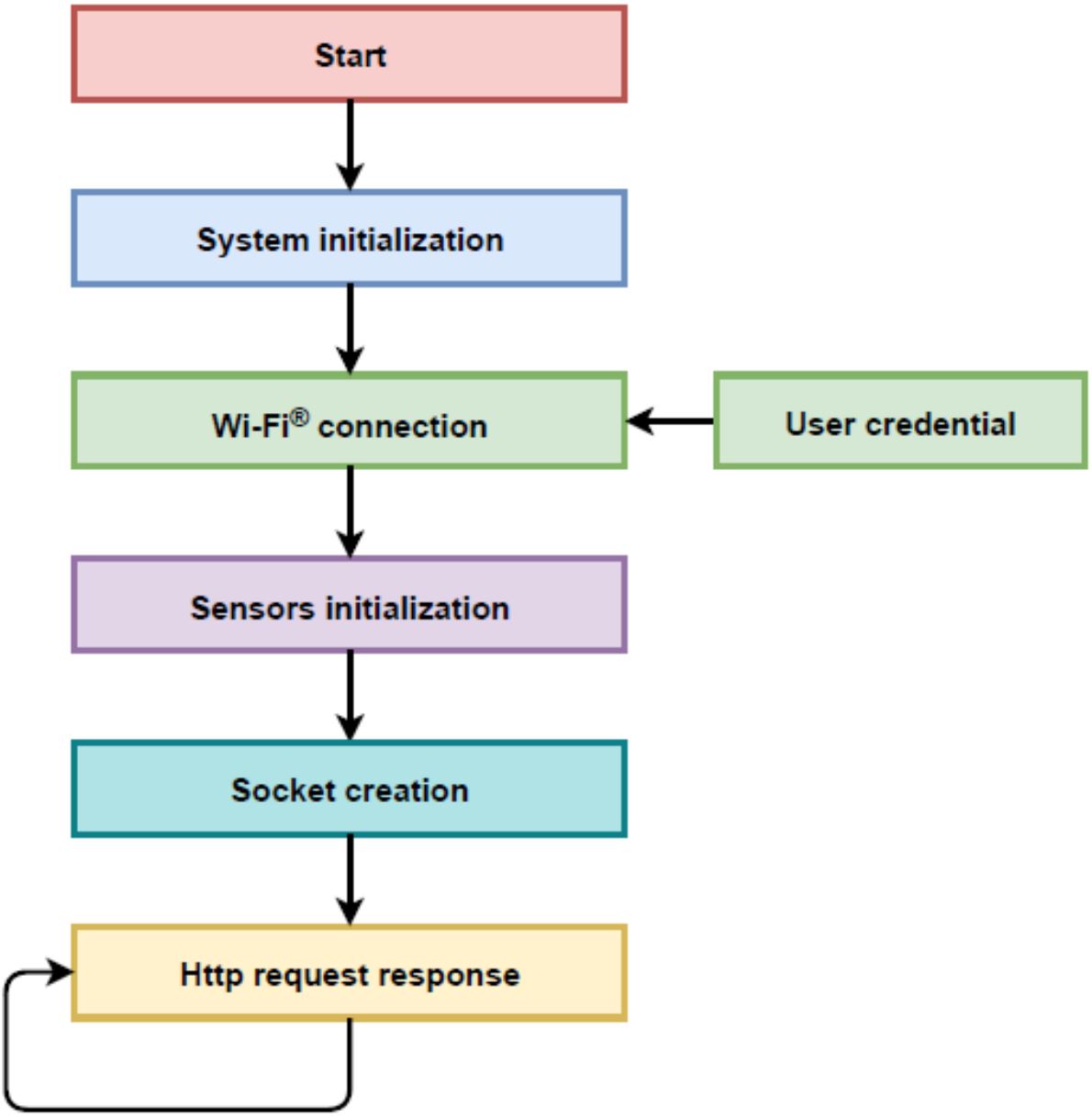


Figure 16. System initialization flow diagram

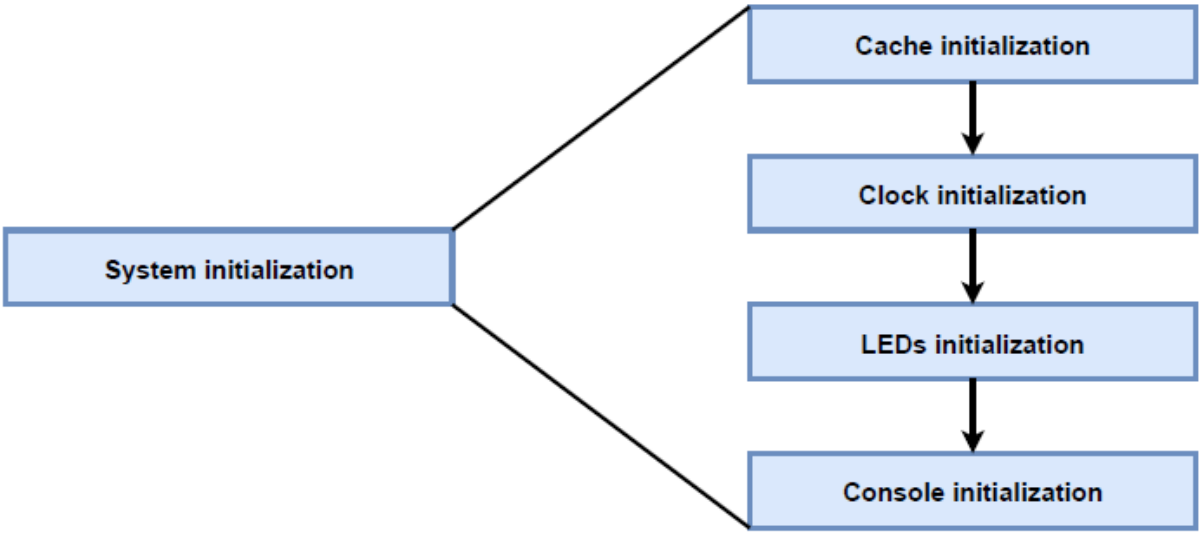


Figure 17. Wi-Fi® connection flow diagram

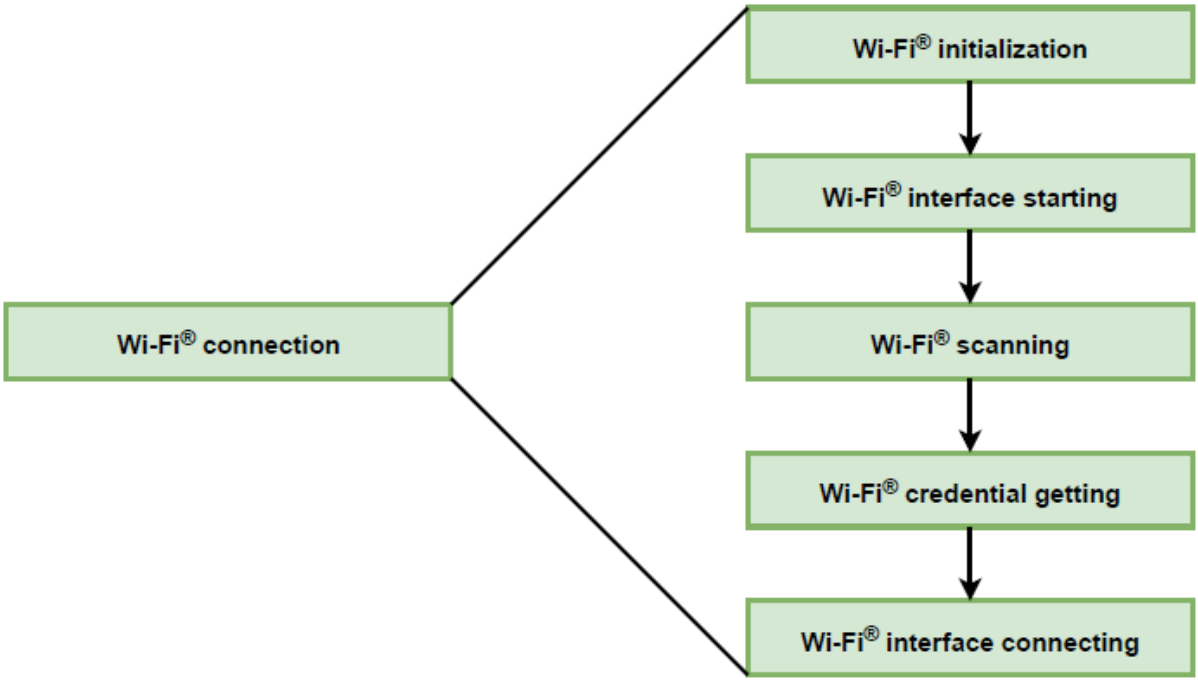


Figure 18. **Sensor initialization flow diagram**

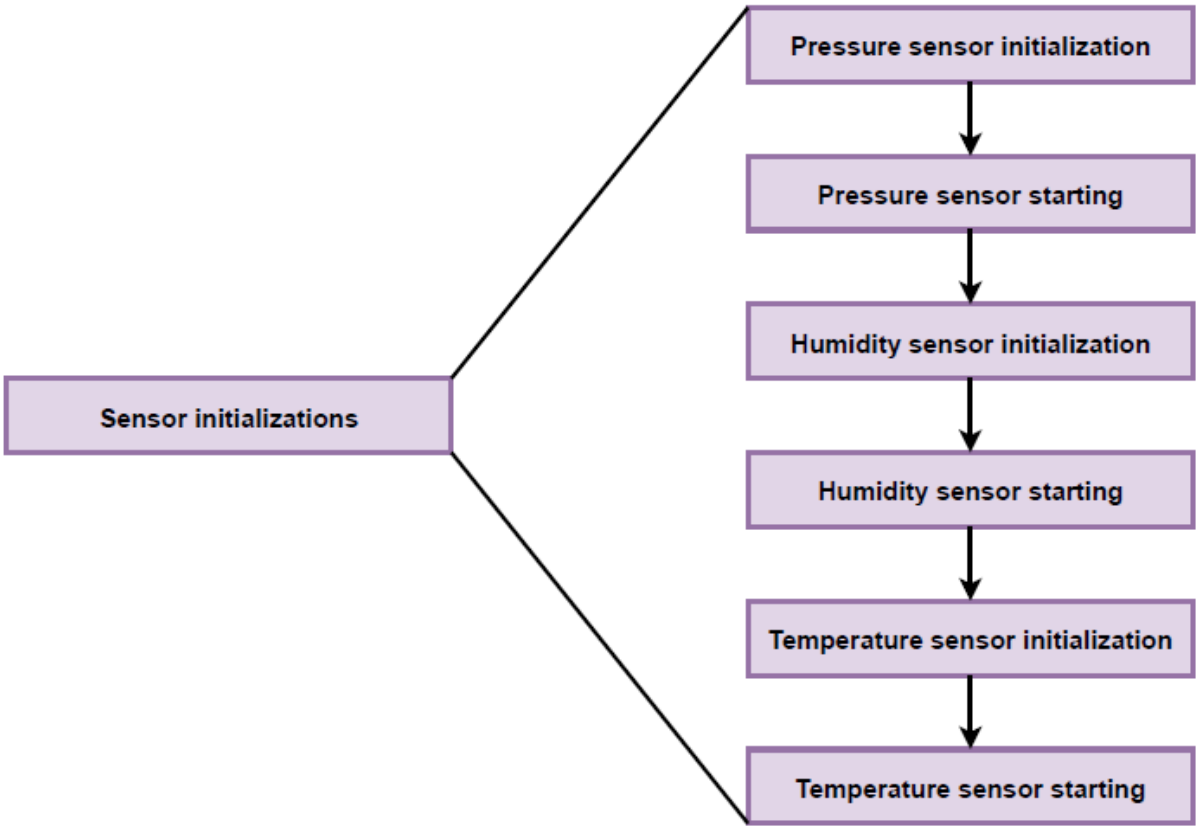


Figure 19. **Socket creation flow diagram**

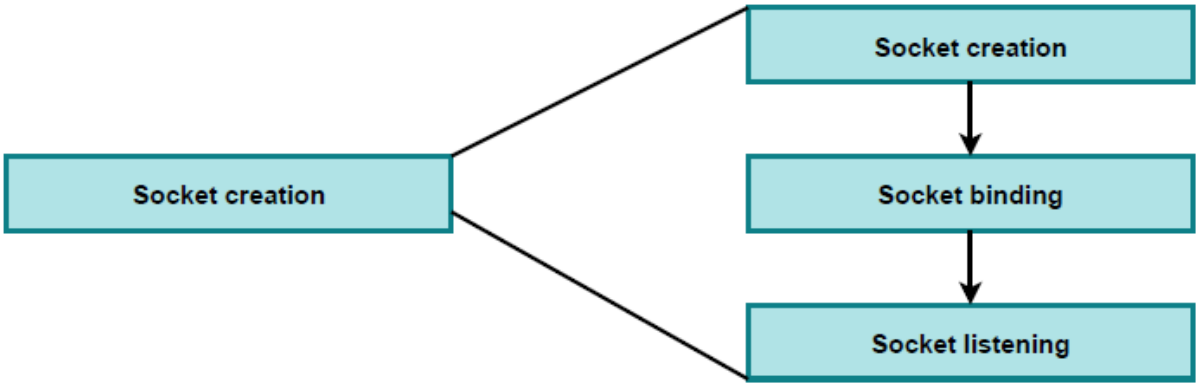
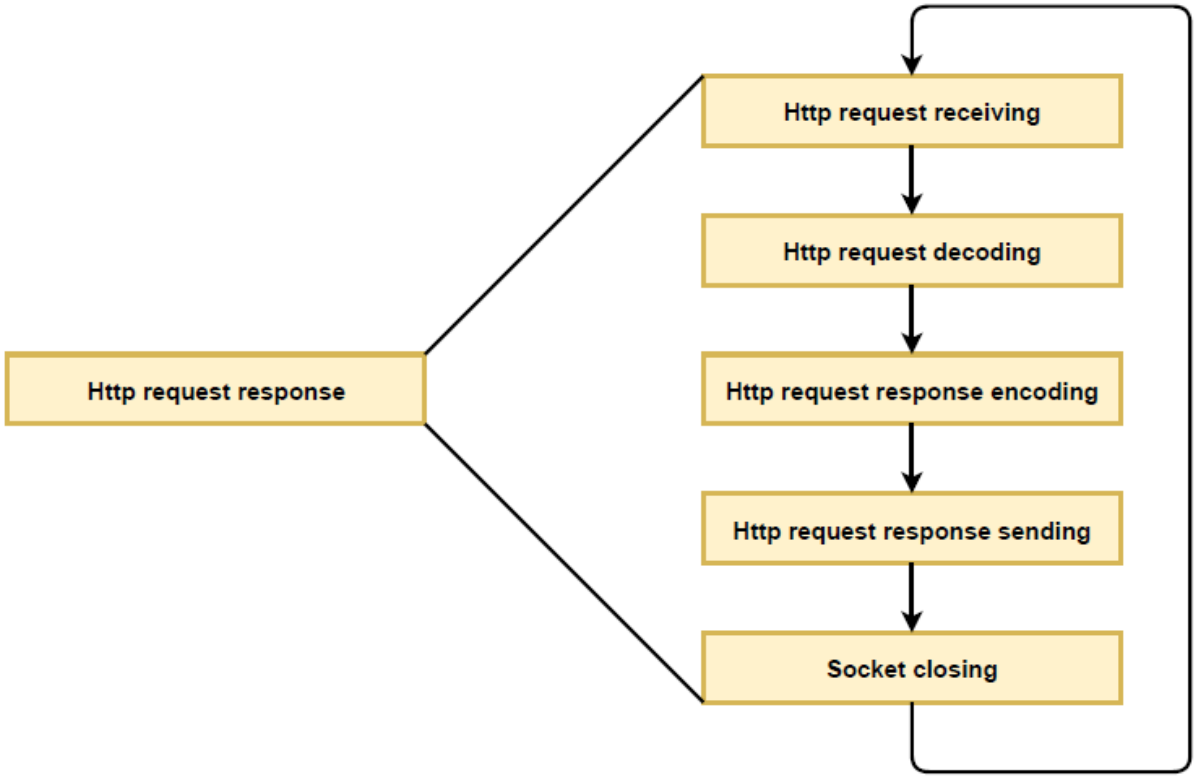


Figure 20. HTTP response flow diagram



Revision history

Table 2. **Document revision history**

Date	Revision	Changes
1-Oct-2021	1	Initial release.

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