

HomeKit32 is a personal hobby project turning the Keyestudio KS5009 smart-home kit into a clean, modular automation platform using **ESP32, BLE, MQTT and B4X**.

The ESP32 runs **B4R firmware** acting as a BLE GATT server and optional MQTT gateway. Clients exist for **B4J, B4A, Python**, and a **Blockly visual programming interface** integrated into B4J.

All 13 KS5009 devices are supported (LEDs, relays, servos, sensors, LCD, RFID, etc.). Communication uses structured BLE packets and JSON/MQTT payloads. Focus has been mostly on BLE development.

Why B4R + BLE?

- B4R gives native-speed embedded code with clean structure
- BLE provides low-latency, cable-free control without Wi-Fi dependency
- Perfect for education, experimentation, and protocol design

Why B4J + B4A?

- Same language across firmware, desktop, and Android
- Rapid UI development with minimal glue code

This is a **non-commercial learning project** shared for inspiration.

Keyestudio Smart Home Kit ESP32



ESP32 Firmware: B4R

Kit fully assembled: device 13 sensors and actuators.

Project modular structure with dedicated component libraries (C++ wrapped or b4xlib).

Communication modes with clients BLE or WiFi + MQTT.

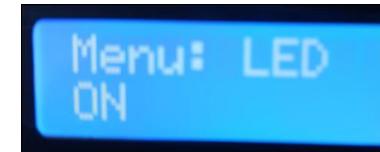
Integrated Menu

Button left select menu item displayed on the LCD1602 (top row).

Button right select menu item state (bottom row).

Example:

Menu: LED, state ON or OFF

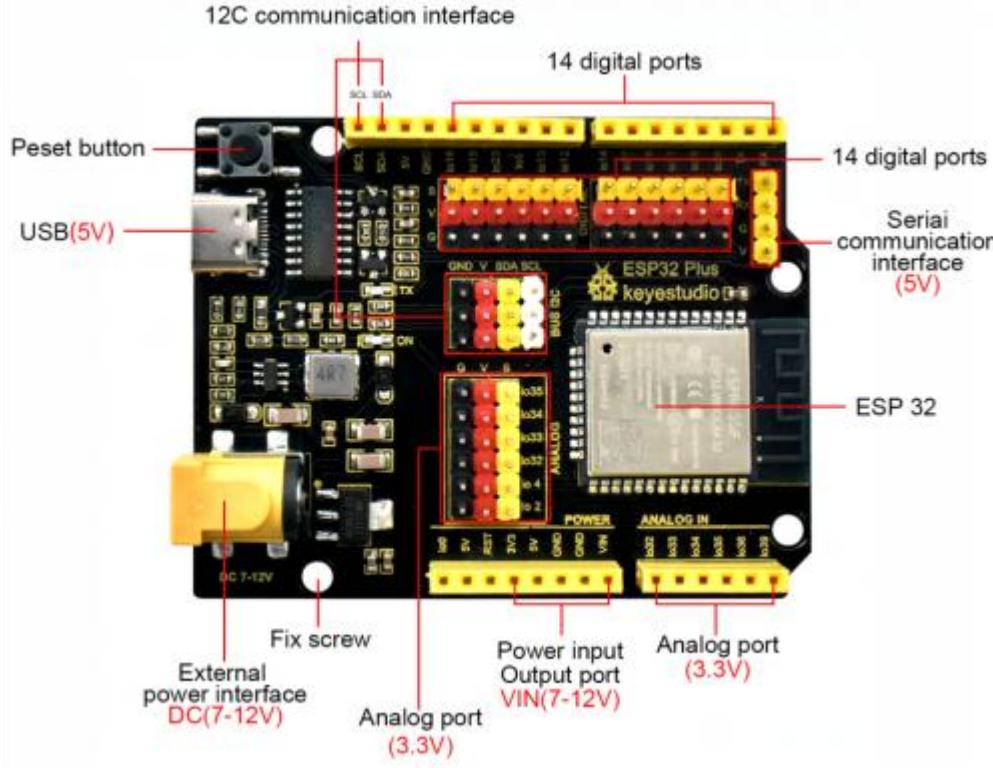


RFID

Open or closed door when touched with tag holding group 2 and command 4.



Keyestudio ESP32 Plus Pinout



Communication

WiFi, MQTT
BLE (UART)
Serial (Arduino, B4R upload)

Pin mapping

===== LEDs =====

Public ONBOARDLED_PIN As Byte = 2

Public YELLOW_LED_PIN As Int = 12

Public RGB_LED_PIN As Int = 26

===== Buttons =====

Public BTN_LEFT_PIN As Int = 16

Public BTN_RIGHT_PIN As Int = 27

===== PIR Sensor (Motion) =====

Public PIR_SENSOR_PIN As Int = 14

===== DHT11 Temp + Hum =====

Public DHT11_PIN As Int = 17

===== Moisture Sensor (Analog) =====

Public MOISTURE_SENSOR_PIN As Int = 34

===== Gas Sensor (Analog) =====

Public GAS_SENSOR_PIN As Int = 23

===== Audio =====

Public BUZZER_PIN As Int = 25

===== Fan =====

Public FAN_DIRECTION_PIN As Int = 19

Public FAN_SPEED_PIN As Int = 18

===== Servos =====

Public SERVO_WINDOW_PIN As Int = 5

Public SERVO_DOOR_PIN As Int = 13

===== I2C Devices =====

Public RFID_I2C_ADDRESS As Byte = 0x28 ' RFID Mifare

Public LCD_I2C_ADDRESS As Byte = 0x27 ' LCD1602

[Source Keyestudio](#)

B4J BLE Client HK32HMI



Human Machine Interface (HMI) to control the HomeKit32 devices over BLE (UART).

B4J Project

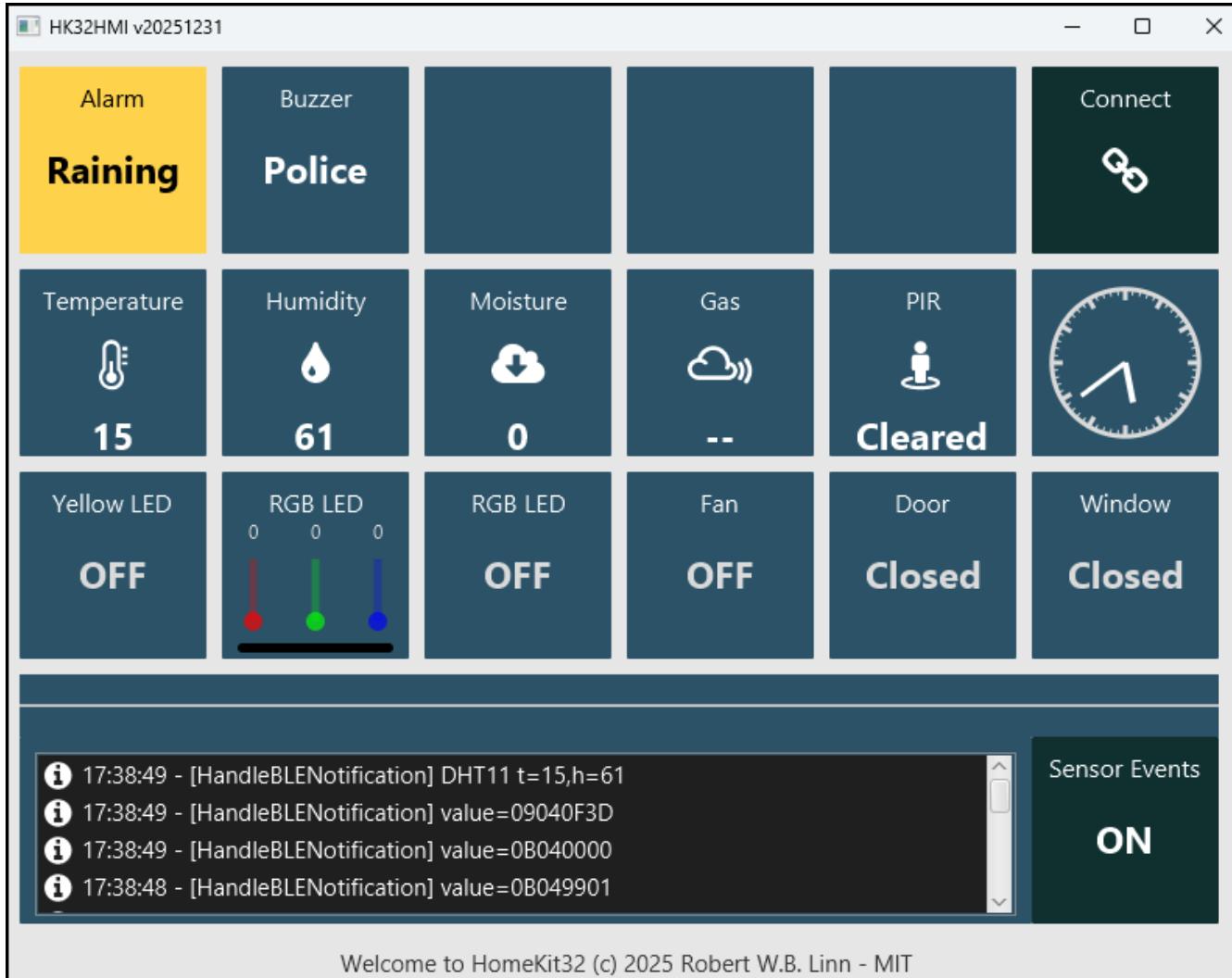
- B4X Pages Project
- B4J Layout Single Page
- HMI Tiles (Custom Views)
(Human-Machine Interface)
Default 120px x 120px
- Event log (CustomListView)
- ISA-101 Guidelines aligned
(Human-Machine Interface Design)

Communication Mode

- BLE
- BLE Frame:
[DeviceID][Command][Payload...]
Optional response
(GET/request commands):
[DeviceID][Command][Response...]
- Example Payload switch YellowLED ON:
Byte Array with 3 bytes:
0x01 0x01 0x01
Device-ID Command-ID Payload

B4J BLE Client HK32HMI with HMITiles

Human Machine Interface (HMI) using the [HMITiles B4X library](#) - control the HomeKit32 devices over BLE (UART).



HMITiles Used

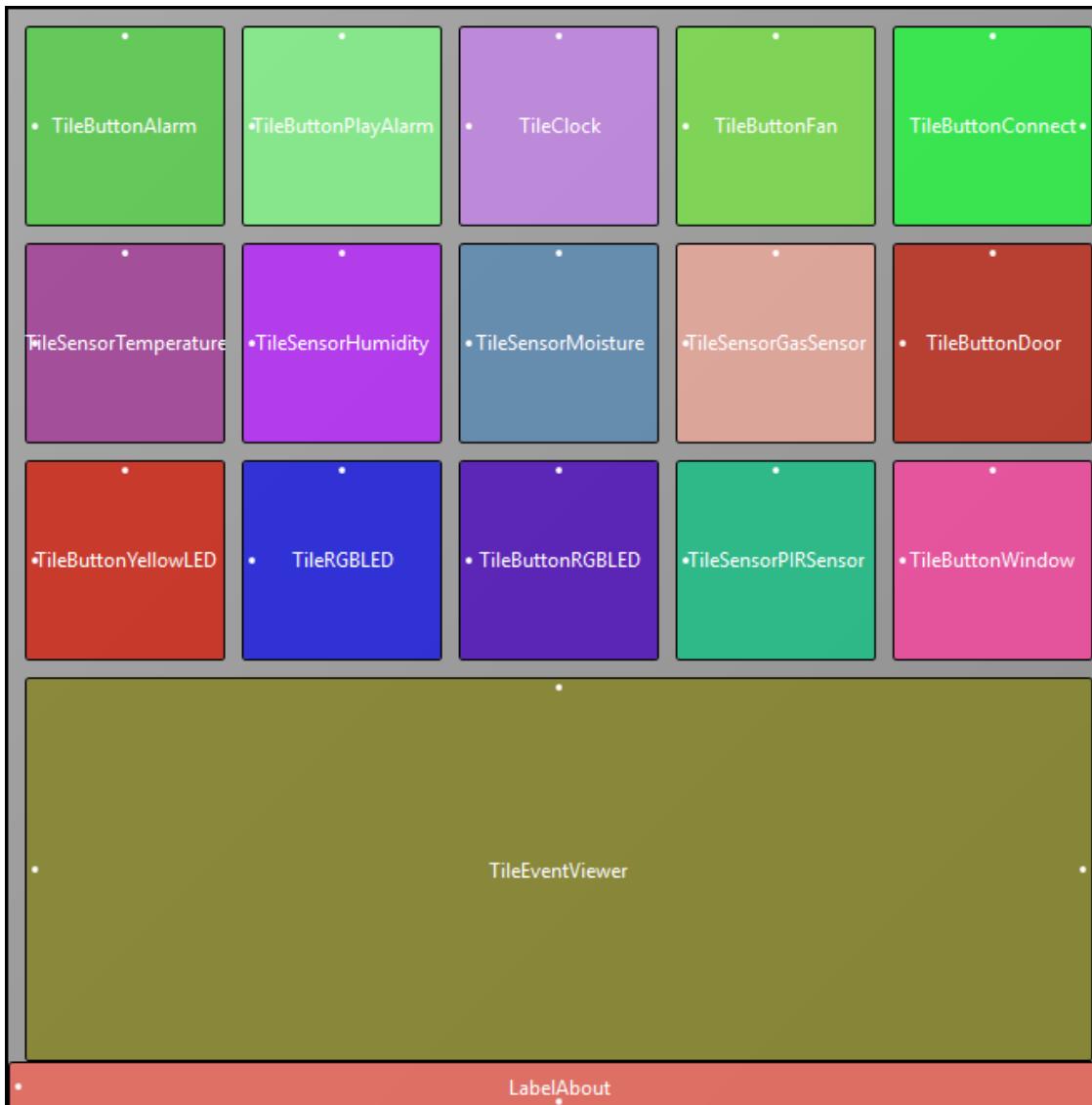
HMITileLabel (2)
HMITileButton

HMITileSensor (4)
HMITileDigitalClock
HMITileClock

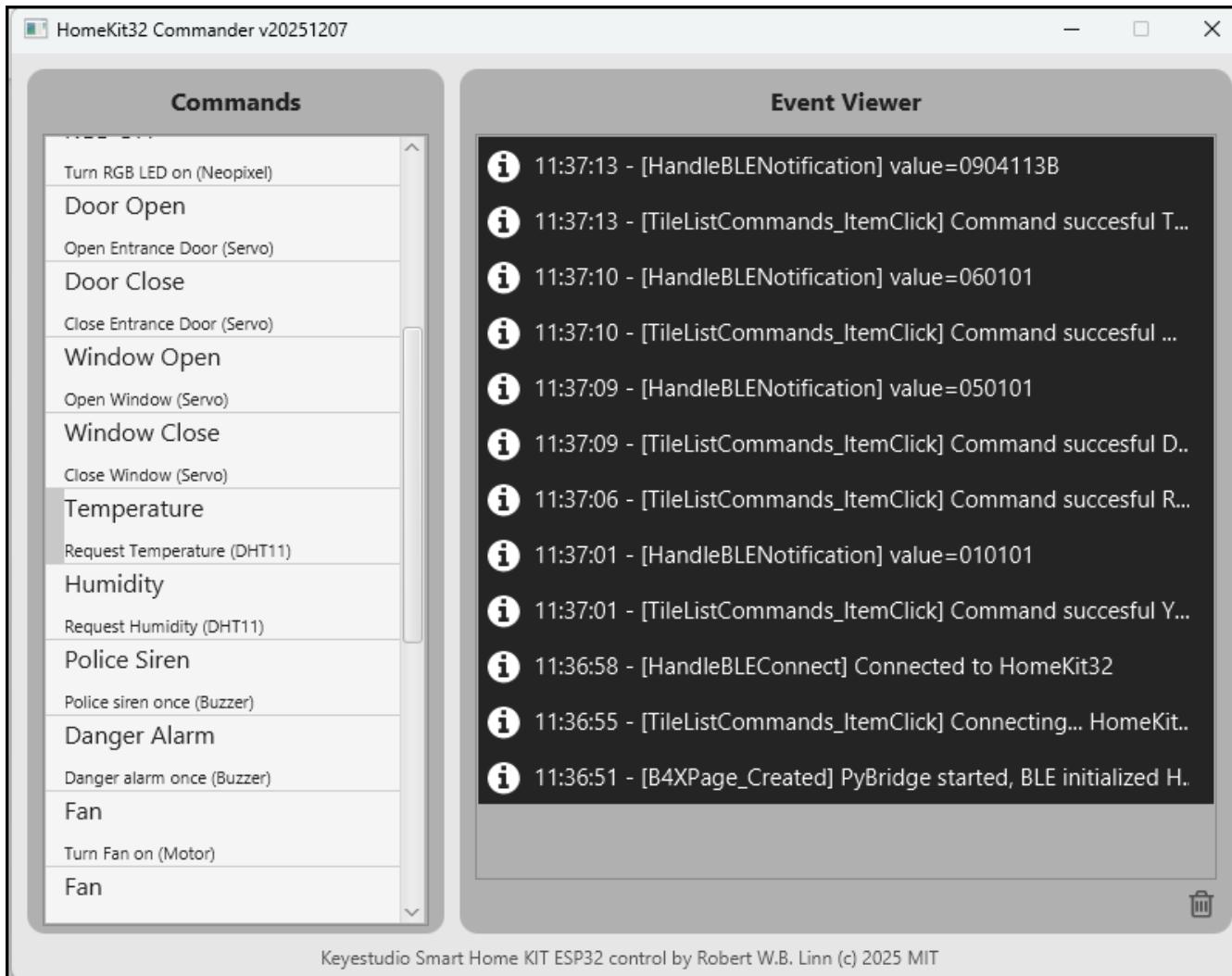
HMITileButton (5)
HMITileRGB

HMITileEventViewer
HMITileButton

B4J BLE Client HK32HMI Layout Single Page



B4J BLE Client HK32Commander

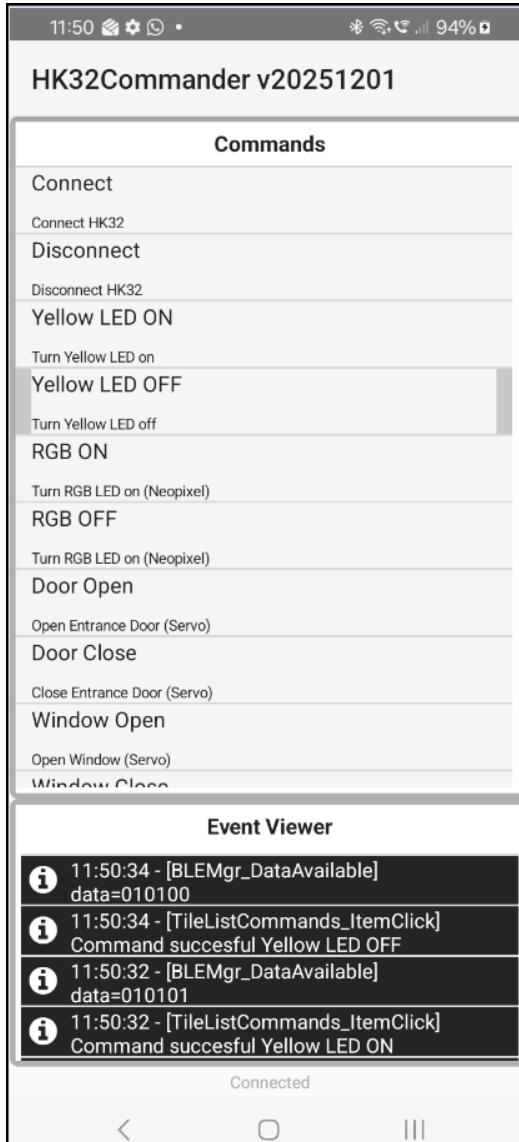


Test Commands to control devices over BLE.

B4J Project

- B4X Pages Project
- B4J Layout Single Page
- Commands List (CustomListView)
- Event Viewer (CustomListView)

B4A BLE Client HK32Commander



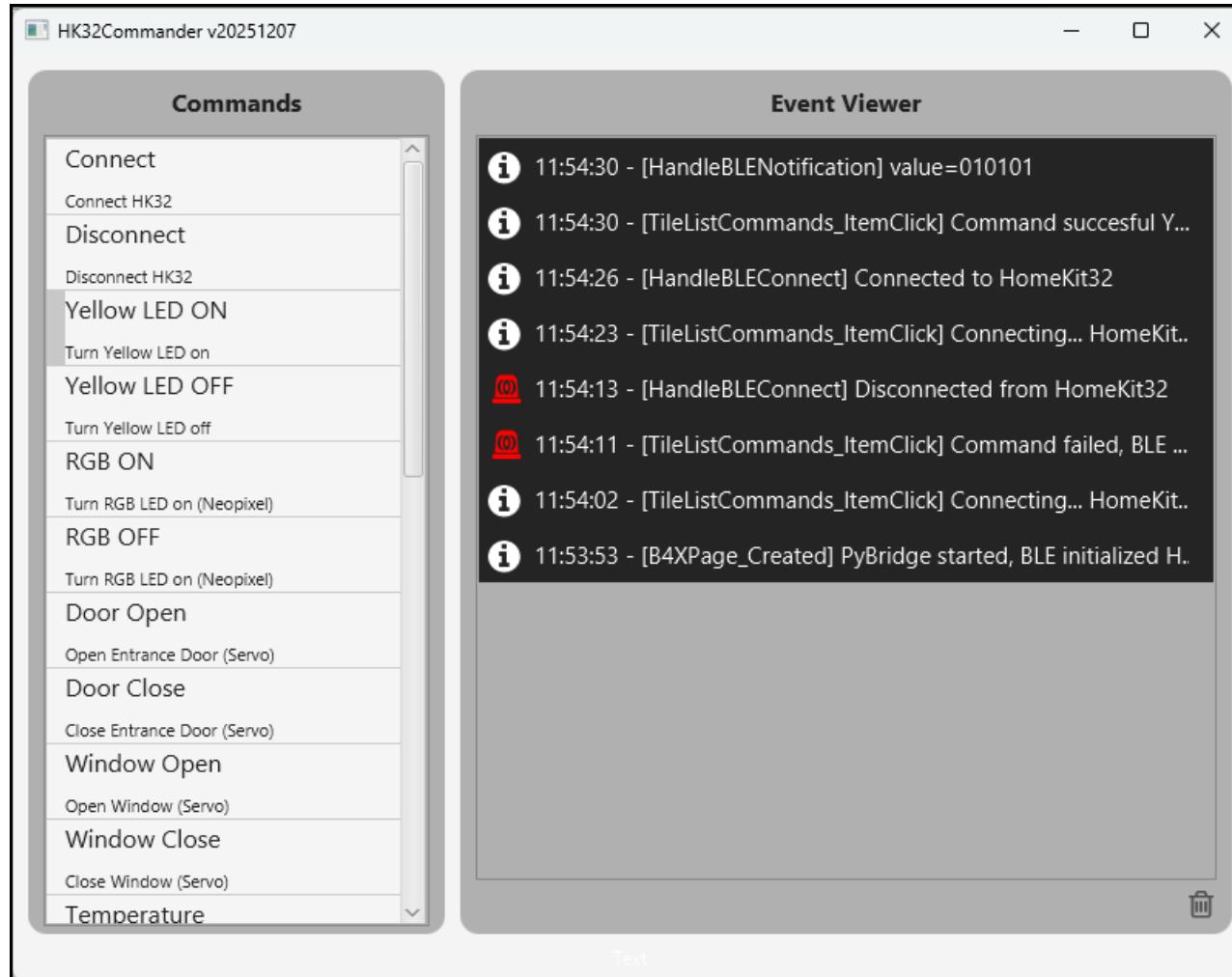
Test Commands to control devices over BLE.

B4A Project

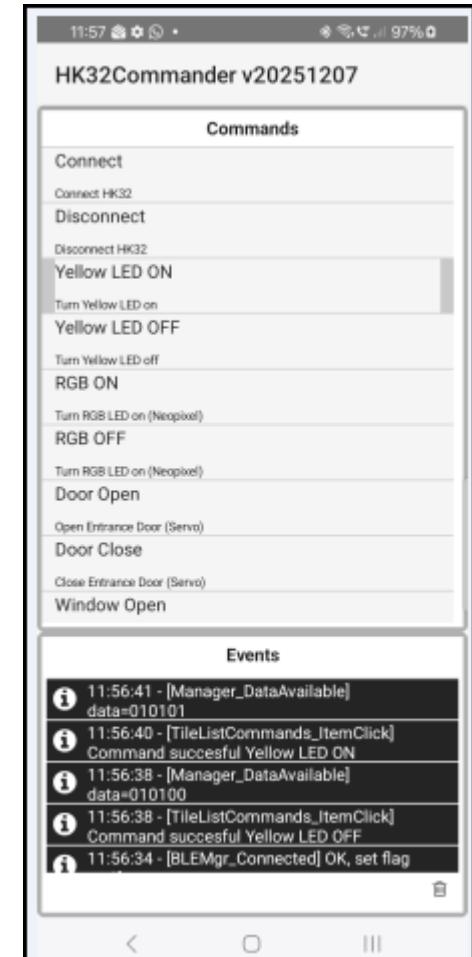
- B4X Pages Project
- B4A Layout Single Page
- Commands List
(CustomListView)
- Event Viewer
(CustomListView)

B4X BLE Clients HK32Commander

B4A & B4J BLE clients. B4X pages project with HMI Tiles to test direct commands to control devices.



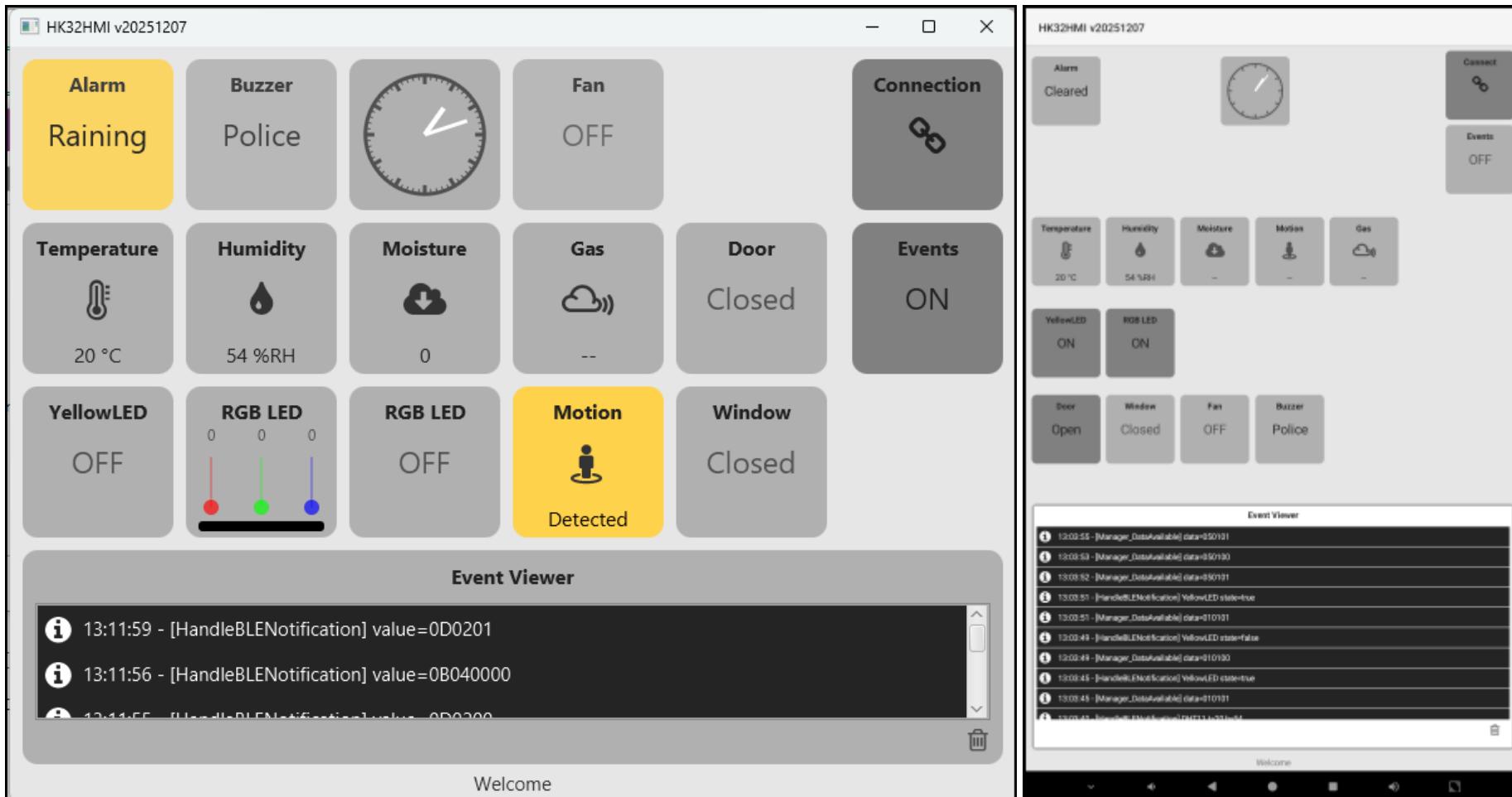
B4J Windows 11 Desktop



B4A Smart Phone

B4X BLE Clients HK32HMI

B4A & B4J BLE clients. B4X pages with HMI Tiles project HMI.



B4J Windows 11 Desktop

12/31/2025

Project make-homekit32

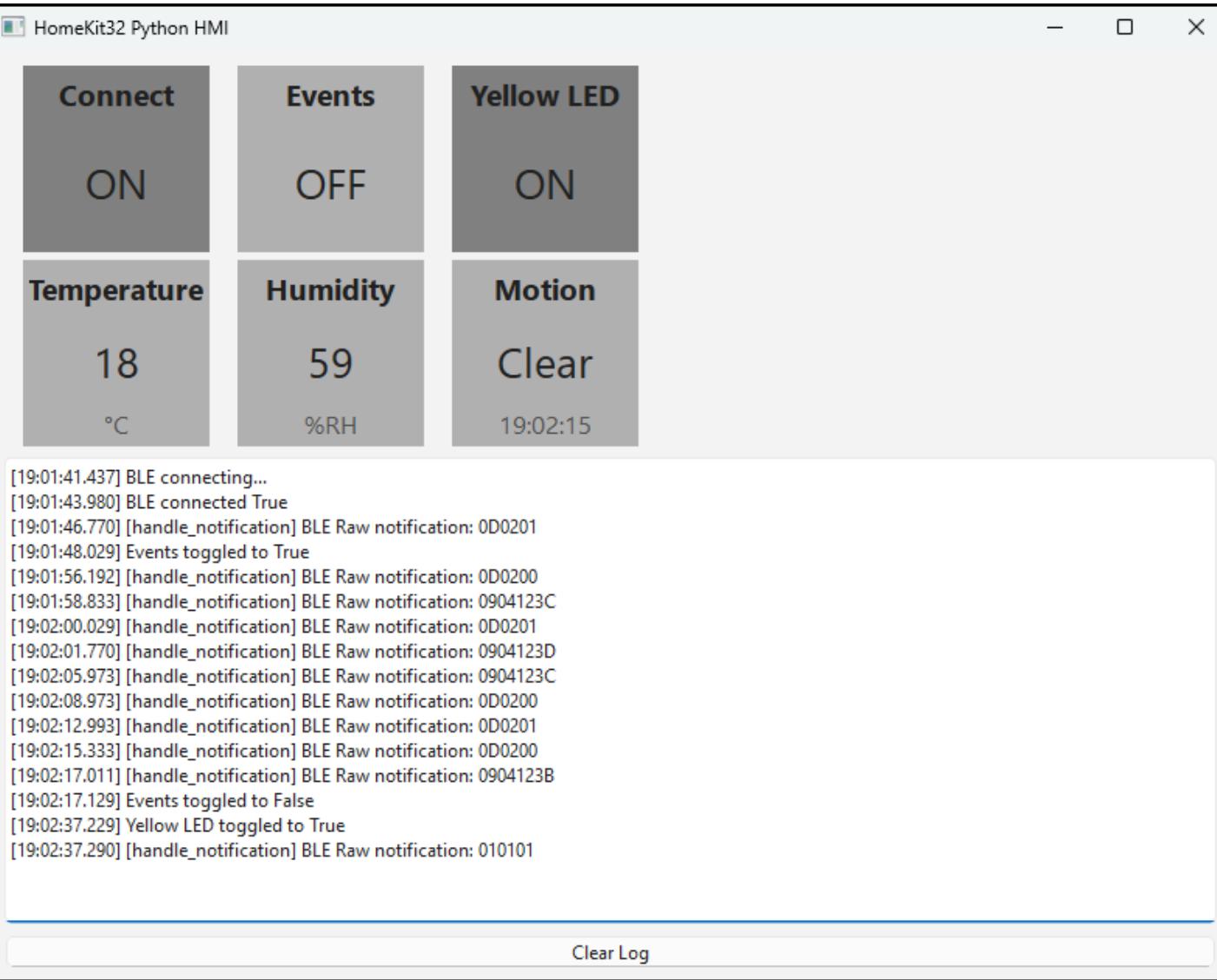
B4A Tablet

10

Python BLE Client HK32HMI

Python with PySide6 framework example using same HMITile concept as B4X – selective TileButton & TileReadout.

TileButton



MQTT - mosquitto

On Windows 11 device started the **mosquitto broker** and subscribed to topics **homekit32/home1/#**.
Submitted test commands using the mosquitto client **mosquitto_pub**. Example Yellow LED on:
`mosquitto_pub.exe -t homekit32/home1/yellow_led/set -m {"s": "on"}`

Mosquitto Broker

```
C:\WINDOWS\system32\cmd. x + □ ×

1765183477: Received PUBLISH from auto-0B9C9BF3-AEE1-054C-52B0-701E2F9613B6 (d0, q0
, r0, m0, 'homekit32/home1/yellow_led/set', ... (10 bytes))
1765183477: Sending PUBLISH to homekit32 (d0, q0, r0, m0, 'homekit32/home1/yellow_l
ed/set', ... (10 bytes))
1765183477: Sending PUBLISH to auto-1116E697-CB28-CE36-3F15-41507BCAE531 (d0, q0, r
0, m0, 'homekit32/home1/yellow_led/set', ... (10 bytes))
1765183477: Received DISCONNECT from auto-0B9C9BF3-AEE1-054C-52B0-701E2F9613B6
1765183477: Client auto-0B9C9BF3-AEE1-054C-52B0-701E2F9613B6 disconnected.
1765183477: Received PUBLISH from homekit32 (d0, q0, r1, m0, 'homekit32/home1/yello
w_led/status', ... (10 bytes))
1765183477: Sending PUBLISH to auto-1116E697-CB28-CE36-3F15-41507BCAE531 (d0, q0, r
0, m0, 'homekit32/home1/yellow_led/status', ... (10 bytes))
1765183484: New connection from ::1:55980 on port 1883.
1765183484: New client connected from ::1:55980 as auto-CAA9919F-9091-CCED-C24B-FA
FA1606BA1 (p2, c1, k60).
1765183484: No will message specified.
1765183484: Sending CONNACK to auto-CAA9919F-9091-CCED-C24B-FA3FA1606BA1 (0, 0)
1765183484: Received PUBLISH from auto-CAA9919F-9091-CCED-C24B-FA3FA1606BA1 (d0, q0
, r0, m0, 'homekit32/home1/yellow_led/set', ... (11 bytes))
1765183484: Sending PUBLISH to homekit32 (d0, q0, r0, m0, 'homekit32/home1/yellow_l
ed/set', ... (11 bytes))
1765183484: Sending PUBLISH to auto-1116E697-CB28-CE36-3F15-41507BCAE531 (d0, q0, r
0, m0, 'homekit32/home1/yellow_led/set', ... (11 bytes))
1765183484: Received DISCONNECT from auto-CAA9919F-9091-CCED-C24B-FA3FA1606BA1
1765183484: Client auto-CAA9919F-9091-CCED-C24B-FA3FA1606BA1 disconnected.
1765183484: Received PUBLISH from homekit32 (d0, q0, r1, m0, 'homekit32/home1/yello
w_led/status', ... (11 bytes))
1765183484: Sending PUBLISH to auto-1116E697-CB28-CE36-3F15-41507BCAE531 (d0, q0, r
0, m0, 'homekit32/home1/yellow_led/status', ... (11 bytes))
|
```

Subscribe Topics

```
C:\WINDOWS\system32\cmd. x + □ ×

c:\Daten\projects\make\make-homekit32\servers\mosquitto>REM Subscribe to mosquitto payload homekit
32/home1/#

c:\Daten\projects\make\make-homekit32\servers\mosquitto>c:\Prog\mosquitto\mosquitto_sub.exe -v -t
homekit32/home1/#

homekit32/home1/yellow_led/set {"s": "on"}
homekit32/home1/yellow_led/status {"s": "on"}
homekit32/home1/yellow_led/set {"s": "off"}
homekit32/home1/yellow_led/status {"s": "off"}|
```

Publish Topics

```
C:\WINDOWS\system32\cmd. x + □ ×

Microsoft Windows [Version 10.0.26200.7309]
(c) Microsoft Corporation. Alle Rechte vorbehalten.

c:\Daten\projects\make\make-homekit32\servers\mosquitto>c:\Prog\mosquitto\mosquitto_pub.exe -t homekit32/home1/yellow_led/set -m {"s": "on"}
c:\Daten\projects\make\make-homekit32\servers\mosquitto>c:\Prog\mosquitto\mosquitto_pub.exe -t homekit32/home1/yellow_led/set -m {"s": "off"}|
```

B4R IDE Log

```
GlobalStoreHandler.Put][I] slot=0, bufferlength=31, Max=200, data size=10, hex=7B2273223A226F6E227D
[CommMQTT.MQTT_MessageArrived][I] topic=homekit32/home1/yellow_led/set, index=1, payload={"s": "on"}, storeindex=0
[DevYellowLed.ProcessMQTT] storeindex=0, payload={"s": "on"}
```

B4J MQTT Broker (console app)

B4J console application acting as an MQTT broker.

Running on Windows 11 the MQTT broker us started, the MQTT internal client is connected and **subscribed** to topics **homekit32/#**.

Submitted test commands using the mosquitto client **mosquitto_pub**.

Example Yellow LED on / off:

```
mosquitto_pub.exe -i hk32client -t homekit32/home1/yellow_led/set -m {"s":"on"}
```

```
mosquitto_pub.exe -i hk32client -t homekit32/home1/yellow_led/set -m {"s":"off"}
```

Notes

Mandatory to set the MQTT client ID, like hk32client (or any other name)

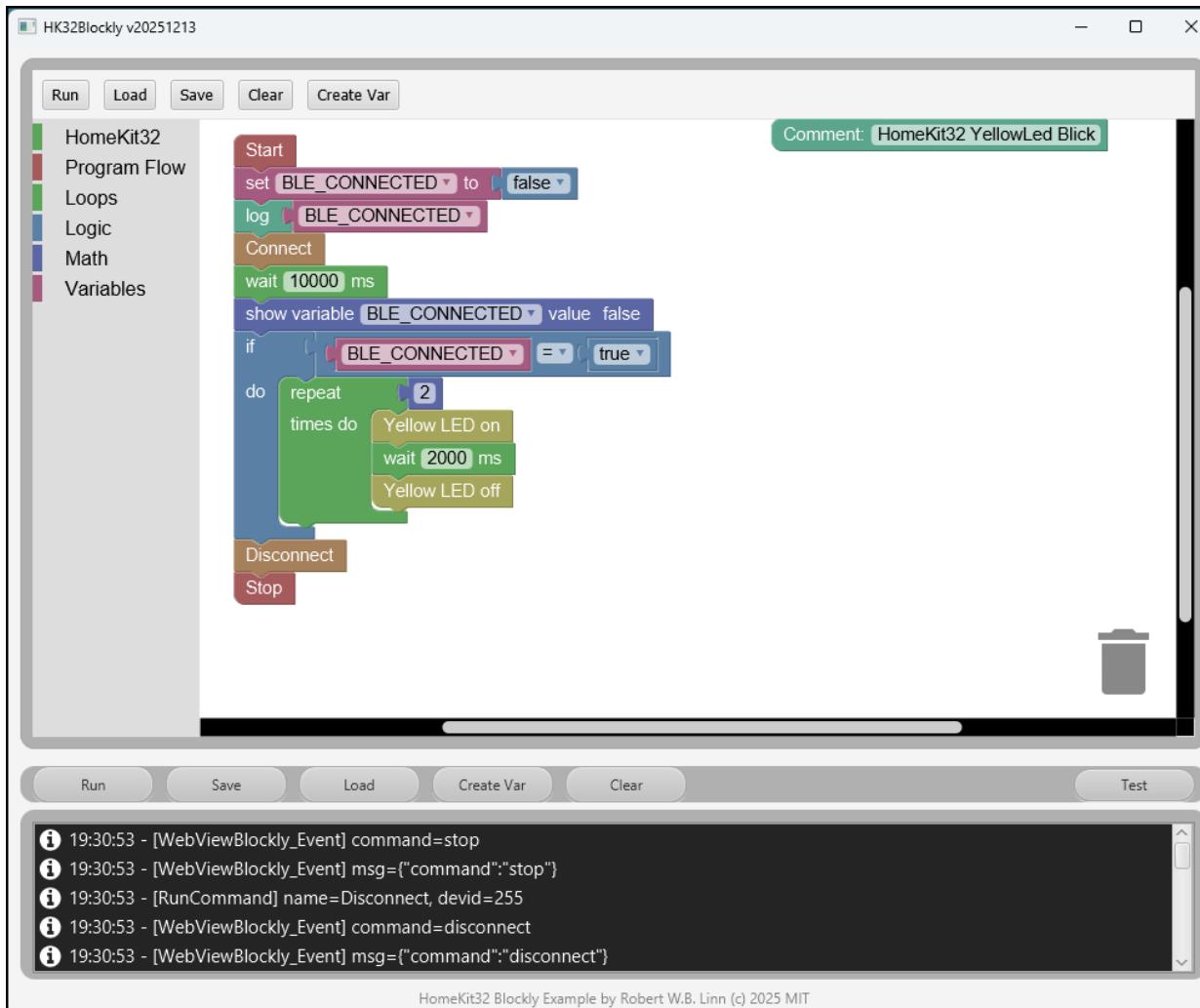
On Windows 11 the “ characters must be escaped \”

MQTT Broker B4J IDE Log

```
[Main.AppStart][I] HomeKit32 Broker Starting
[Main.AppStart][I] Broker IP 192.168.1.94
[Main.AppStart][I] Broker initialize on port 1883
[Main.AppStart][I] Broker started
[Main.AppStart][I] MQTT internal client connected
[Main.MQTT_Connected][I] OK. Subscribed to homekit32/# 
[MQTT_MessageArrived][I] Topic=homekit32/home1/yellow_led/set, Payload={"s":"off"}
[MQTT_MessageArrived][I] Topic=homekit32/home1/yellow_led/set, Payload={"s":"on"}
[MQTT_MessageArrived][I] Topic=homekit32/home1/yellow_led/set, Payload={"s":"on"}
[MQTT_MessageArrived][I] Topic=homekit32/home1/yellow_led/status, Payload={"s":"on"}
[MQTT_MessageArrived][I] Topic=homekit32/home1/yellow_led/set, Payload={"s":"off"}
[MQTT_MessageArrived][I] Topic=homekit32/home1/yellow_led/status, Payload={"s":"off"}
```

B4J BLE Client Blockly (Experimental)

Example custom **Blockly** integration inside a **B4J WebView**, enabling visual programming of **HomeKit32** devices.
Blockly programs are executed in **JavaScript** and communicate back to **B4J** via `executeScript` / **WebView** callbacks
The project is experimental and optimized for Blockly v12.x.



Example Blockly Workspace
Let the Yellow LED blink 2 times.

- For testing 2 button panels:
- **Webview panel** to test the Javascript modules in a web browser without B4J connection, because the debug & console windows are required.
 - **B4X page panel** has been initially used to test within B4J – but can be removed, because the Webview buttons work also under B4J.

To Do

- Add B4X pages menu toolbar
- Add more Blockly Custom Blocks.
- Make this application generic without dedicated HomeKit32 features.