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1. TECHNICAL SUPPORT

For general contact, technical support, to report documentation errors and to order manuals, contact *BEANAIR® Technical Support Center* (BTSC) at:

tech-support@Beanair.com

For detailed information about where you can buy the Beanair equipment/software or for recommendations on accessories and components visit:

www.Beanair.com

To register for product news and announcements or for product questions contact BEANAIR[®]'s Technical Support Center (BTSC).

Our aim is to make this user manual as helpful as possible. Please keep us informed of your comments and suggestions for improvements. Beanair appreciates feedback from the users.

2. VISUAL SYMBOLS DEFINITION

| Visual | Definition |
|--------|--|
| | <u>Caution or Warning</u> – Alerts the user with important information about Beanair wireless sensor networks (WSN), if this information is not followed, the equipment /software may fail or malfunction. |
| | <u>Danger</u> – This information MUST be followed if not you may damage the equipment permanently or bodily injury may occur. |
| 1 | <u>Tip or Information</u> – Provides advice and suggestions that may be useful when installing Beanair Wireless Sensor Networks. |

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3. AIM OF THE DOCUMENT

The aim of this document is to demonstrate a simple integration of the BeanDevice[®] Wilow in the Internet of things ecosystem using cutting-edge technology, this will be very important for a countless possibilities of measurements, collecting, analyzing and processing the data.

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1. OVERVIEW



The idea is to introduce the BeanDevice to the internet of things using the MQTT protocol

Figure 1: System diagram

We can install and use local MQTT broker or use a free of cost online broker (limited). The BeanDevice will publish data to all subscribed devices on its topic, and we can publish configuration (change acquisition mode, restart BeanDevice ...set sleep mode) to a subscribed BeanDevice.







Figure 3: BeanDevice Configuration over MQTT

2. INSTALATION AND ENVIRONMENT CONFIGURATION

2.1 SIMPLE SOLUTION

2.1.1 Network

To get started using Our BeanDevice Wilow over MQTT and before starting the configuration we need to install an MQTT broker on any embedded computer or SBC of your choice(Raspberry PI,Beaglebone black,..)Alternatively, even use a windows system (like in this example), also we can simply use an online broker (free with limits), next we build our WiFi network and make sure we have the network architecture as shown in the figure below.



2.1.2 Configuration

In order to start the MQTT communication we have to setup the MQTT configuration using BeanScape, after connecting the BeanDevice to the network (<u>find more details in our YouTube video:</u> <u>getting started with BeanDevice Wilow</u>).Select your BeanDevice and scroll down to MQTT in the BeanDevice tab.

| File Server Tools Data Analysis | BeanDevice Help |
|---------------------------------|--|
| 🛃 🔝 🔟 👳 | Enable measure log |
| MAC ID : 0 x F4B85E00A5BF0000 | Disable measure log |
| INC_X | Reset measure memory cache for all the sensors |
| | Display Wireless Network Information |
| | Sensor Conf |
| | MQTT |

A new window will pop up and it is where we will configure the BeanDevice MQTT module.

| MQTT Module : MAC_ID : 0 x C4BE84747DF60000 | - |
|---|---|
| Broker Port: 1883 DNS Status: 0 | MQTT Status Connected Start Validate MQTT Status: Connected Restart MQTT Ack: Client Accepted Restart |
| IP Broker: 192.168.1.243 DNS: Validate | Topic for static measurement Publish Status: Enabled ID Channel: 0 Ch_Z |
| Authentication Usemame: | Topic Name: C4BE84747DF60000/SENSOR/0 Default Validate Validate |
| Password: Validate | MQTT Status: Enabled Default Streaming Topic: C4BE84747DF60000/STREAMING Default |
| Interval : 60 Version: V3R1R1 Auto ded ID Client: 1 | Subscription Subscription status: Enabled |
| ID Client: WILO4169641567171258948 Validate | Topic Name: C4BE84747/DE60000/OTAC Default Validate |

2.1.2.1 <u>Broker</u>

Using IP broker:

| Broker | | |
|-------------|---------------|---------------|
| Port: | 1883 | 1883 |
| DNS Status: | 0 | |
| IP Broker: | 192.168.1.243 | 192.168.1.243 |
| DNS: | | |
| | import | Validate |
| | | |

| Bean Device [®] Wilow [®] IoT starter Guidelines using MQTT protocol | | | | |
|--|---|--|--|--|
| Using DNS broker :public MQTT bro | ker ("iot.eclipse.org": free with limits) | | | |
| Broker Port: 1883 | 1883 | | | |
| DNS Status: 1 | | | | |
| IP Broker: 192.168.1.243 | | | | |
| DNS: iot.eclipse.org | iot.eclipse.org Validate | | | |
| Port: TCP/IP port to use with MQTT .1883 and 8883 are the reserved ports for use with MQTT | | | | |
| DNS Status : check if you want to enter your broker DNS.DNSStaus is 1 | | | | |
| Brokerlp: enter your broker Ip address after unchecking DNSStatus .DNSStatus is 0 | | | | |

DNS:domain name server of your Broker

2.1.2.2 Keep alive

The keep alive functionality assures that the connection is still open and both broker and client are connected to one another

| KeepAlive | | |
|---------------------|-------------------------|----------|
| Interval: | 55 | 55 |
| Version: | V3R1R1 | V3R1R1 - |
| Auto_gen_client_id_ | 1 | |
| Client ID: | WILO8702641497263000210 | Validate |

- Interval: The interval is the longest possible period of time, which broker and client can endure without sending a message.
- Version: MQTT Protocol version
- Auto_gen_client_ID: check for auto generate a Client ID
- **Client ID**: Enter your client ID

2.1.2.3 Authentication

MQTT broker can be configured to require client authentication using a valid username and password before a connection is permitted.

| | Authentification User Name: Password: | | Validate | | |
|--------------|---|----|--------------------|-------------|----|
| Beanair Gmbł | 4 | "F | Rethinking sensing | technology" | 12 |
| | | | | | |

- **User Name:** specify your user name
- **Password:** enter your password

2.1.2.4 <u>MQTT STATUS</u>

Here you can check your MQTT different status, connected, stopped, connecting or disconnecting and can start your connection from here.

| MQTTSTATUS | | | |
|--------------|------------|---------|----------|
| MQTT Status: | Connecting | Start 🔻 | Validate |
| MQTT Ack: | NA | | Restart |

MQTT Status: shows the current status of the MQTT module:

- Connecting: trying to establish a connection
- Connected: connection established
- Disconnecting: disconnecting the Client
- Stopped: the connection is stopped
- Password: enter your password
- **Start/Stop:** select and **Validate** to start or stop your MQTT Client connection
- Restart: restart your connection

2.1.2.5 Topic for static measurement

The topic is a string used by the broker to filter messages for each connected client and in our case; it is the Topic that will help receive measurements from the sensors (LowDutyCycle and Alarm modes) .for a better organization keep your Topic as follow:

BeanDevice_MAC-ID/Channel

For Example: C4BE84747DF60000 CHX for the channel x on that BeanDevice with that MAC ID

| Topic for static measurer | nent | | |
|---------------------------|--------------------------|--------|----------|
| Publish Status: | Enabled | | |
| ID Channel: | 0 | Ch_Z ~ | |
| Topic Name: | C4BE84747DF60000/SENSOR/ | /0 | Default |
| | | | Validate |

- Publish_status:check and validate to enable publishing
- **Channel ID** : Channel identification
- **Topic Name:** Field to enter your topic's name

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2.1.2.6 Streaming topic

Here it is the Topic for streaming measurements, for a better use and follow the labeling standard:

BeanDevice_MAC-ID

For Example: C4BE84747DF60000

| - Topic for dynamic me | asurement | |
|------------------------|----------------------------|----------|
| MQTT Status: | Enabled | |
| Streaming Topic: | C4BE84747DF60000/STREAMING | Default |
| | | Validate |

- Publish_status:check and validate to enable publishing
- Retain Flag: Check and validate to enable retain flag
- Streaming Topic: Text field to enter your streaming topic's name

2.1.2.7 Subscribe

The BeanDevice will subscribe to a another MQTT client who will publish configuration messages,

| Subscription Subscription status: | Enabled | | |
|--------------------------------------|-----------------------|--|----------|
| Topic Name: | C4BE84747DF60000/OTAC | | Default |
| | | | Validate |

- Subscribe status: check and validate to enable subscribing
- **Topic Name:** Field to enter your topic's name to subscribe to

2.1.3 Tests

After configuring the BeanDevice MQTT module and setting the BeanDevice to Streaming, SET or shoc detection acquisition mode we can check the configuration by subscribing to its topic using a desktop MQTT test client and an ip address of local broker or public MQTT broker (iot.eclipse.org)

MQTT toolkit only works when setting the BeanDevice to **STREAMING**, **SET** or **shock Detection** acquisition mode.

| 0 BEANAIR MQTT TOO | DLKIT | | | | | _ | | × |
|--|---------------------|-------------|-----------------|------|-------------------|----------------|-------------|---|
| MQTT Config | | Use DNS | 6 | | MQTT Connection | | Disconnect | |
| Broker DNS: | | | | | Connect | | Disconnect | |
| Broker IP | 92.168.1.243 | 192.168.1.2 | 43 | | C4BE84747DF60 | 000/STREAMIN | IG | |
| Port: | 883 | 1883 | | | Subscribe | | Unsubscribe | |
| | | | Validate | | MQTT Status : Sto | pped | | |
| Data Reading Config. | | | | | NO TOPIC | | | |
| | Enable Data Reading | | | | Screen/Log folder | | | |
| Data reading Cycle | 60 | Sec | | | Enable Log Fol | der | | |
| Data reading duration | 50 50 | Sec | Validate | | | | | |
| Index; Measures Ch_Id_(|);Ch_ld_1;Ch_ld_2 | 🗹 En | able Screen Log | ging | Date 2019/10 | /04 11:35:49.0 | 22 | |
| 36615 : -0.007 : 0.802 : 0.0 | 17 | | | ^ | SR | 100 | Hz | |
| 36617; -0.007; 0.801; 0.0 | 18 | | | | Avtive Sensor | 3 | | |
| 36619;-0.006;0.802;0.0 | 16 | | | | segmentNumber | 332 | | |
| 36620 ; -0.008 ; 0.801 ; 0.0 36621 ; -0.007 ; 0.801 ; 0.0 | 15 | | | | Masura number/ch | 110 | | |
| 36622 : -0.007 : 0.801 : 0.0 36623 : -0.008 : 0.802 : 0.0 | 16 16 | | | | Data Aca Cycle | 0 | Sec | |
| 36624 : -0.006 : 0.802 : 0.0 36625 : -0.007 : 0.8 : 0.018 | 17 | | | | Data Acc Duration | 0 | | |
| 36626 ; -0.007 ; 0.802 ; 0.0 | 16 15 | | | | Data Acq Duration | | Sec | |
| 36628 ; -0.006 ; 0.8 ; 0.015 | 17 | | | | Lon | 1/5 | | |
| 30023;-0.003;0.802;0.0 | 17 | | | ~ | | | | |

Figure 5: Beanair MQTT toolkit

2.1.3.1 Beanair MQTT toolkit (MQTT Configurations)

| MQTT Config | | Use DNS |
|-------------|---------------|---------------|
| Broker DNS: | | |
| Broker IP | 192.168.1.243 | 192.168.1.243 |
| Port: | 1883 | 1883 |
| | | Validate |

Figure 6: MQTT configuration

- **Broker DNS**: domain name server of your Broker
- **Broker IP:** enter your broker Ip address.
- *Port*: TCP/IP port to use with MQTT .1883 and 8883 are the reserved ports for use with MQTT.

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Make sure to choose the same Broker ip or Dns used in the MQTT configuration of Beanscape.

2.1.3.2 Data Reading Config

| Data Reading Config. | |
|-----------------------|---------------------|
| | Enable Data Reading |
| Data reading Cycle | 60 🔶 Sec |
| Data reading duration | 50 Sec Validate |

Figure 7: Data Reading Config

- Data Reading Cycle: Cycle of data reading
- Data Reading Duration: duration in which data is displayed in the MQTT toolkit Example: in every 60 Sec data will be displayed for 50 Sec
- Enable/Disable Data Reading: only Data will be displayed continuously when data reading is not enabled.
- 2.1.3.3 MQTT connection





- **SR** : Sampling rate frequency
- Active Sensor: Number of active channels
- Segment number : Number of Segments transmitted
- Measure number/ch= 330 / Number of Active sensors



Data acq cycle and Acq duration will be activated when Burst mode is chosen. Data Acq Duration will be displayed when One shot mode is activayed.

LQI : Signal Quality

2.1.3.4 MQTT toolkit Data acquisition



Figure 10 : Data aquisition

| Bean Device [®] Wilow [®] IoT starter Guidelines using MQTT protocol | | | | | | | |
|---|--|----------------------------|-------------------|---|--|------------------------------------|--------|
| 😗 BEANAIR MQTT TOO | DLKIT | | | | | - 0 | × |
| MQTT Config Broker DNS: Broker IP Port: | 92.168.1.243 883 | Use DNS 192.168.1.243 1883 | Validate | MQTT Connection Connect C4BE84747DF Subscribe | n 60000/STRE | Disconnect AMING Unsubscribe | • |
| Data Reading Config. Data reading Cycle Data reading duration | Enable Data Reading 60 60 50 | Sec | Validate | Subscribe to C48 Screen/Log folde Enable Log | E84747DF60 r Folder | 1000/STREAMIN | IG |
| Index; Measures Ch_Id_C 900995; -0.01; 0.803; -0.0 900996; -0.009; 0.801; -0. 900997; -0.01; 0.799; -0.0 900998; -0.011; 0.801; -0. 901900; -0.011; 0.801; -0. 901000; -0.011; 0.801; -0. 901002; -0.01; 0.801; -0. 901002; -0.01; 0.801; -0. 901004; -0.009; 0.801; -0. 901005; -0.009; 0.801; -0. 901005; -0.009; 0.801; -0. 901005; -0.009; 0.799; -0. 901008; -0.009; 0.799; -0. 901008; -0.009; 0.799; -0. | 0;Ch_ld_1;Ch_ld_2 05 001 02 001 001 001 001 003 003 003 003 | ⊡ Enab | le Screen Logging | Date 2019 SI Avtive Sense segmentNumber/c Data Acq Cycl Data Acq Duratio | 10/04 11:35: R 100 r 3 r 8190 n 110 e 0 n 0 l 165 | 49.022 Hz | |

Figure 11 : MQTT toolkit interface

3. RELATED DOCUMENTS & VIDEOS

In addition to this technical note, please consult the related User guide, technical notes and videos:

| Document name (Click on the web link) | Related product | Description |
|---|----------------------------------|--|
| TN RF 004 «MQTT Communication Protocol » | Wilow [®] products line | MQTT Communication Protocol for a seamless integration into a third-party IOT software |
| TN RF 005 «Building a reliable Wi-Fi network with Wilow sensors» | Wilow [®] products line | The aim of this document is to describe the autonomy performance of the BeanDevice [®] SmartSensor [®] and ProcessSensor [®] product line in streaming and streaming packet mode. |
| UM RF 007 «UM-RF-07-ENG-Wilow- Wifi-Sensor» | Wilow [®] products line | BeanDevice [®] Wilow [®] user manual |

| Beanair video link (YouTube) | Related products |
|--|--|
| Getting started with BeanDevice [®] Wilow - Wi-Fi Low Power Sensors | BeanDevice [®] Wilow |
| Wilow - Wi-Fi Sensors-Low duty cycle data acquisition mode on BeanDevice [®] Wilow | BeanDevice [®] Wilow |
| Wilow - Wi-Fi Sensors-Streaming mode with continuous monitoring on BeanDevice® Wilow | <u>BeanDevice[®] Wilow</u> |
| Wilow - Wi-Fi Sensors-How to setup Wilow Datalogger | BeanDevice [®] Wilow |
| Wilow - Wi-Fi Sensors-Smart Shock Detection (SSD) mode | BeanDevice [®] Wilow [®] |

All the videos are available on our YouTube channel

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