Smart charger cabinets

MQTT protocol proposal

v0.6

Voltz Motors

2021

Version Record:

Serial number	Protocol number	Version number	Modify the content	Modifier	Update time
1	V101	V101			
2	V101	V101	Revise: 1. Added"Events notification" topic key: value in Event 2. Blue mark used		
3	V101	V101	Revise: 1.Revise MQTT's BMS information content based on BMS information		
4	V101	V101	Revise: 1.Sample error change		
5	V101	V101	Revise: 1.Add soc in “notification”		
6	V101	V102	Revise: 1. Add threshold configuration topic publication and threshold configuration subscription response		

Emphasize:

1. MQTT protocol support version
   V3.1/V3.1.1
2. QoS class：2

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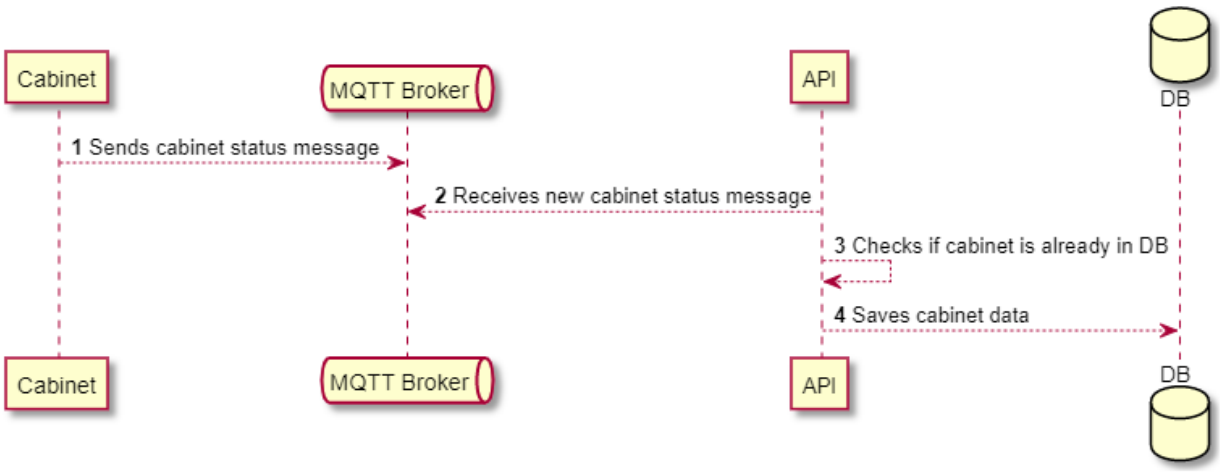
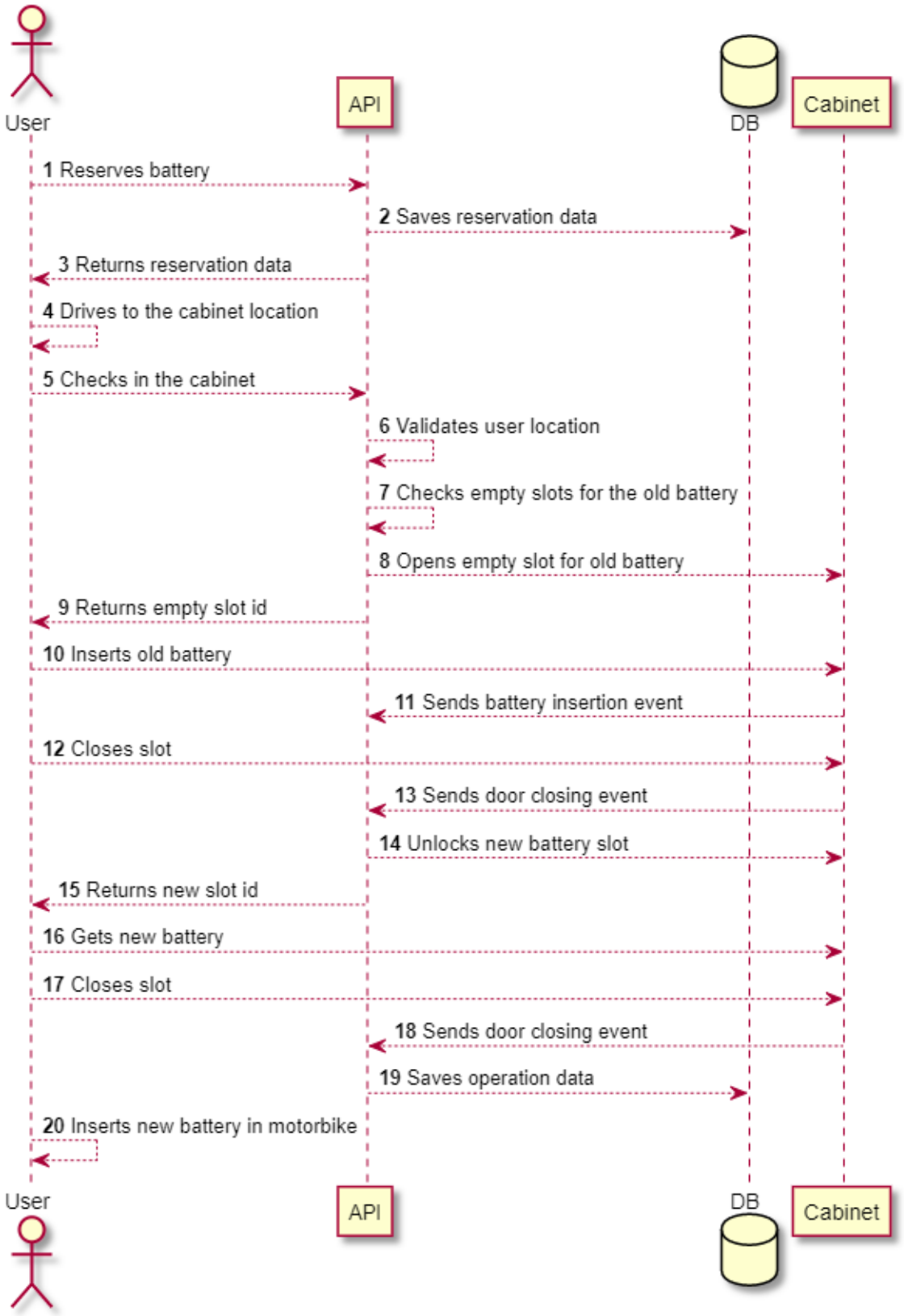
Workflow representation

1.1. Sequence diagram for the process of saving cabinets data to our database



1.2. Sequence diagram for the battery swapping operation



Topics description

2.1. Cabinet information

Topic where the cabinet will send the complete status of the cabinet and the batteries inside of it every 30s and after a new battery is inserted or removed from one of the slots.

topic: /stations/info/{cabinet_mac_addr}

Field name	Type	Description
mac_addr	String	cabinet's mac address
device_id	String	Device ID
coordinates	String	cabinet's location (longitude, latitude)
ctr_pro	String	Ctr Board Protocol
ctr_softver	String	Ctr Board Software version
ctr_warning	BOOL	true:cabinet exist warning false:No warning
env_temperature	Integer	Environment temperature
total_slots	Integer	Total slots in cabinet
empty_slots	Integer	Total empty slots in cabinet
slots	List<Slot>	Information about individual slots (3.1. Slot description)
timestamp	DateTime	timestamp of message creation

Example:


```
{
    "mac_addr": "00-88-14-4D-4C-FB",
    "device_id": "2600401516050001",
    "coordinates": "-8.06232309651, -34.8712023897282",
    "ctr_pro": "V101",
    "ctr_softver": "V101",
    "ctr_warning": false,
```

```
"total_slots": 12,
"empty_slots": 3,
"slots": [
    {
        "sub_pro": "V101",
        "sub_softver": "V101",
        "id": 1,
        "slot_status": false,
        "sub_Exit_Err": false,
        "battery": {
            "id": "BT104802012SZHL200414313",
            "max_ChgVol": 725,//72.5V
            // BMS the limited charge voltage
            "max_ChgCur": 900,//90.0A
            // BMS the limitedcharge current
            "charger_CtrSW": 0,//0:Charger is on
            // the switcher of charger
```

0：充电机开启 Charger is on
1：充电机关闭输出 Charge is off
2：充电机连接 Charger is connecting
3：充电机未连接 Charger is not connected

```
            "ctr_WorkMode" 0,//Charge mode
            //working mode
```

0：充电模式 Charge mode 1：加热模式 heating mode
（加热模式是充电机给电池内的加热膜加热，该模式下充电机不需要检测到输出端电压即可工作，设计加热膜的阻值时需注意加热膜工作电压必须介于该电池的最低电压与最高电压之间，最好是接近电池的最高电压。）

```
            "bat_Vol": 725,//72.5V
            "bat_Cur": 900,//90.0A
            "bat_MaxTemp": 25,
            "bat_MinTemp": 25,
```

8位，单位℃，+127 ~ -128
8-bit, in ℃, -128 ~ 127

```
            "soc": 95,
            "soh", 99,
            "chging_Err": 3,//0x0003 -->bit0:cell over charge warning
                                     -->bit1:cell over charge error
             //Charge Error
```

bit0	cell充电过压告警 cell over charge warning
bit1	cell充电过压 cell over charge error
bit2	电池包充电过温告警 pack charge over heat warning
bit3	电池包充电过温 pack charge over heat error
bit4	电池包充电欠温告警 pack charge low temperatue warning
bit5	电池包充电欠温 pack charge low temperatue error
bit6	Pack充电过流告警 pack chare over current warning
bit7	Pack充电过流 pack chare over current error
bit8	Pack过压告警 pack over voltage warning
bit9	Pack过压 pack over voltage error
bit10	充电机通讯超时 communication error with charger
bit11	PACK充电缓启动故障 pack charge soft start error
bit12	充电继电器粘连 charging relay stuck
bit13	x
bit14	x
bit15	x

"disChging_Err: 3": //0x0003-->bit0:cell discharge under voltage warning

-->bit1: cell discharge under voltage error

//Discharge Error

bit0	cell放电欠压告警 cell discharge under voltage warning
bit1	cell放电欠压 cell discharge under voltage error
bit2	cell深度欠压 cell deep under voltage
bit3	电池包放电过温告警 pack discharge over heat warning
bit4	电池包放电过温 pack discharge over heat error
bit5	电池包放电欠温告警 pack discharge low temperature warning
bit6	电池包放电欠温 pack discharge low temperature error
bit7	Pack放电过流告警 pack dischage over current waning
bit8	Pack放电过流 pack dischage over current error
bit9	Pack欠压告警 pack under voltage warning
bit10	Pack欠压 pack under voltage error
bit11	VCU通讯超时 Communication error to VCU
bit12	PACK放电缓启动故障 pack discharge soft start error
bit13	放电继电器粘连 discharging relay stuck
bit14	Pack放电短路 pack discharge short
bit15	x

"max_Dischg_Cur": 200,//20A

"comm_Err" 3,//0x0003 -->bit0:pack excessive temperature differentials

-->bit1:cell excessive voltage differentials

// Common Error

bit0	PACK温差过大 pack excessive temperature differentials
bit1	CELL压差过大 cell excessive voltage differentials
bit2	AFE故障 AFE Error
bit3	MOS过温 MOS over temperature
bit4	外部EEPROM失效 external EEPROM failure
bit5	RTC失效 RTC failure
bit6	并机ID检测异常 ID conflict
bit7	并机内CAN通讯丢失 CAN message miss
bit8	并机压差过大 pack excessive voltage differentials
bit9	充放电电流方向异常 charge and discharge current conflict
bit10	并机输出动力线连接异常 cable abnormal
bit11	x
bit12	x
bit13	x
bit14	x
bit15	x

```
    }
},
{
    "sub_pro": "V101",
    "sub_softver": "V101",
    "id": 2,
    " slot_status ": false,
    "sub_Exit_Err": false,
```

```
            "battery": null
        }
    ],
    "timestamp": "2021-08-03 17:04:54.123Z"
}
```

2.2. Open Slot

Topic where the cabinet will receive the command to open specific slots.

topic: /stations/open_slot/{cabinet_mac_addr}

Field name	Type	Description
slot_id	Integer	Slot identification
slot_info	integer	0x01:empty slot 0x02:battery slot
order_number	String	Order number
timestamp	DateTime	timestamp of message creation

Example:

```
{
    "slot_id": 1,
    "slot_info": 1,
    "order_number": "VOLTZ20210817000001",
    "timestamp": "2021-08-03 17:04:54.123Z"
}
```

2.3. Close Slot(Meaningless-->delete)

Topic where the cabinet will receive the command to close specific slots.

topic: base-url/cabinets/close_slot/{cabinet_mac_addr}

Field name	Type	Description
slot_id	Integer	Slot identification
timestamp	DateTime	timestamp of message creation

Example:

```
{
    "slot_id": 1,
    "timestamp": "2021-08-03 17:04:54.123Z"
}
```

2.4. Events notification

Topic where the cabinet will send notifications after every action it takes (for example: closing or opening a slot).

topic: /stations/notifications/{cabinet_mac_addr}

Field name	Type	Description
slot_id	Integer	Slot identification
order_number	String	Order number
event	String	name of the event. (open_slot, close_slot, battery_inserted, battery_removed,open_slot_busy,open_slot_success,open_slot_sub_no_execution,door_err,sub_execution_timeout,sub_offline,open_empty_slot_bat_Online,open_bat_slot_bat_offline,insert_faulty_battery,close_empty_no_save_bat,opt_success,close_slot_timeout,waiting_open_full_timeout)
battery_id	String	Battery identification (null if the slot is empty)
soc	Integer	Battery soc
timestamp	DateTime	timestamp of message creation

Example:

```
{
    "slot_id": 1,
    "order_number": "VOLTZ20210817000001",
    "event": "open_slot",
    "battery_id": "BT104802012SZHL200414313",
    "soc": 72,
    "timestamp": "2021-08-03 17:04:54.123Z"
}
```

2.5. Alerts

Topic where the cabinet will send alerts if it identifies any software or hardware alerts or errors.

topic: /stations/alerts/{cabinet_mac_addr}

Field name	Type	Description
slot_id	Integer	Slot identification (null if the alert isn't for a specific slot)
type	String	message type (alert, error)
message	String	message describing the problem (Error:)(cabinet_alert:"Lightning warning",bat_type_err:"bat reverse connection","Subsequent updates for the remaining labels";"Internal battery failure" charger_type_err:"Charger temperature is too high","Subsequent updates for the remaining labels")
timestamp	DateTime	timestamp of message creation

Example:

```
{
    "slot_id": 1,
    "type": "Error",
    "message": "Charging failure",
    "timestamp": "2021-08-03 17:04:54.123Z"
}
```

2.6. Thresholds

The topic can be used for subscription thresholds and update thresholds. It is mainly used for debugging and initial production configuration. It is not recommended to publish the topic during use, because the service will restart after receiving the topic

topic: /stations/thresholds/{cabinet_mac_addr}

Field name	Type	Description
charge_over_temp_period	Integer	charger over temperature threshold
bat_over_temp_period	Integer	battery over temperature threshold
soc_period	Integer	battery full threshold
charge_time_period	Integer	charging time threshold(min，150~720)
info_up_period	Integer	cabinet information reporting cycle
log_up_period	Integer	reporting cycle of log file to FTP server
ftp_url	String	FTP server address for log upload
ftp_user	String	FTP username
ftp_password	String	FTP password
ftp_port	Integer	FTP port
ftp_remote_dir	String	FTP server remote root
enable_gzip	BOOL	Enable gzip

Example:

```
{
    "charge_over_temp_period": 70,
```

```
    "bat_over_temp_period": 80,
    "soc_period": 95,
    "charge_time_period": 600,
    "info_up_period": 10,
    "log_up_period": 2,
    "ftp_url": ”192.168.0.109”,
    "ftp_user":”logs”,
    "ftp_password":”imCbe2ZHmpAEJGe”,
    "ftp_port": 21,
    "ftp_remote_dir": "/",
    "enable_gzip": false
}
```

2.7. ThresholdsResponse

It is mainly used to confirm whether the threshold is successfully set to the cabinet

topic: /stations/thresholds_response/{cabinet_mac_addr}

Field name	Type	Description
charge_over_temp_period	BOOL	true:success false:failed
bat_over_temp_period	BOOL	true:success false:failed
soc_period	BOOL	true:success false:failed
charge_time_period	BOOL	true:success false:failed
info_up_period	BOOL	true:success false:failed
log_up_period	BOOL	true:success false:failed
ftp_url	BOOL	true:success false:failed
ftp_user	BOOL	true:success false:failed
ftp_password	BOOL	true:success false:failed
ftp_port	BOOL	true:success false:failed
ftp_remote_dir	BOOL	true:success false:failed
enable_gzip	BOOL	true:success false:failed

Example:

```
{
      "charge_over_temp_period":true,
      "bat_over_temp_period":true,
      "soc_period":true,
      "charge_time_period":true,
      "info_up_period":true,
      "log_up_period":true,
      "ftp_url":true,
      "ftp_user":true,
      "ftp_password":true,
      "ftp_port":true,
      "ftp_remote_dir":true,
      "enable_gzip":true
}
```

Extra information

3.1. Slot description

Field name	Type	Description
sub_pro	String	Sub Board Protocol
sub_softver	String	Sub Board Software version
id	Integer	Slot identification
sub_Exit_Err	BOOL	true:sub exist warning false:No warning
battery	Battery	Battery complete information
slot_status	Intger	0：close 1：open 2：fault

Questions to the supplier

1. Do the cabinets have a unique ID other than the Mac Address?

NOTE: