Parking Occupation Detector
DO201_NB-IoT Protocol

V1.1
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Changed

V1.0 Initial version.

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1 Special Notes

This file is only disclosed to the client who purchased CNDingtek product and signed NDA (non-disclosed agreement). If the reader does not purchased CNDingtek product or signed NDA, please stop reading of this file.

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2 Terminal Uplink Data Format

Field	Packet head	Forced bit	Device type	Report data type	Packe size	Payload	Packet tail
Instruction	Packet header	Forced bit	Device type	Active reporting or reply	Packet size	Data content	Packet tail
size	1byte	1byte	1byte	1byte	1byte	0-255byte	1byte

Note:The sensor with tcp protocol transfer data by TCP directly, not http. And Data is sent in hexadecimal.

2.1 Field Definition

2.1.1 Packet Header

Packet head:0x80;1byte.

2.1.2 Forced Bit

Forced bit:0x00; 1byte.

2.1.3 Device Type

Device type, 1byte,

Command	Device type
0x31	DO201

2.1.4 Report Data Type

Report data type, 1byte,

Command	Type
0x01	Active reporting of information
0x02	Heartbeat data
0x03	Reply to downlink command

2.1.5 Packet Size

The size of the packet, 1byte, in hex. For example, 0x15 means 21byte.

2.1.6 Payload

The payload format1 of Report data type0x01 and 0x02:

No.	1	2	3	4	5	6	7
Payload	Height	Parking status	Ultra status	Mag status	Battery status	Battery volt	MagX
Size(byte)	2	0.5	0.5	0.5	0.5	2	2
No.	8	9	10	11	12	13	14
Payload	MagY	MagZ	Temperature	Humidity	RSRP	Frame counter	Device ID
size(byte)	2	2	1	1	4	2	8

Payload field definition:

S/N	Function	Description	Example
1	Height	The height from sensor to car. 2bytes, in hex; Unit: mm;	Report 0x060E means 1550mm
2-5	Parking/ Ultra/Mag/Battery status	Total 2bytes; Each state occupies 4 bits; Parking status: whether the parking space is occupied; 0: not car; 1:car Ultra status: indicates ultrasonic status; 0: not car; 1:car Mag status: indicates geomagnetic status; 0: not car; 1:car Battery Status: indicates battery status; 0: battery normal; 1:battery lower	Report 0x1110 means parking status: occupied, Ultrasonic status: has car, Geomagnetic: has car, Battery status: battery is normal.
6	Battery volt	Battery volt; 2bytes, in hex, Unit: 10mV;	Report 0x0168 means 3.6V
7	MagX	X-axis magnetic field strength; 2bytes; Short int; Unit: 1.5mGauss	
8	MagY	Y-axis magnetic field strength; Z-2bytes; Short int; Unit: 1.5mGauss	
9	MagZ	Z-axis magnetic field strength;	

		AA-2bytes; Short int; Unit: 1.5mGauss	
10	Temperature	Temperature inside the sensor; 1bytes; in hex, unit:℃	Report 0x10 means 16℃
11	Humidity	Humidity inside the sensor; 1bytes; in hex, unit:%	Report 0x28 means 40%°
12	RSRP	Reference Signal Receiving Power; 4byte,in hex; High in the front and low in the back; Floating point;	0x004059C4-->C4594000-->-869
13	Frame count	Frame counter, Number of packets reported after power-on; 2bytes; in hex;	Report 000A means the tenth data after power-on
14	Device ID	Device unique Identity;1+IMEI; 8byte;	For example:1867725034085278, so the IMEI is 867725034085278;

The payload format2 of Report data type0x03:

No.	1	2	3	4	5	6	7	8
Payload	FW	Upload Time	Cycle Detect Time	Height Threshold	Mag Threshold	Battery Threshold	Server address	Device ID
size(byte)	2	1	1	1	2	1	1	8

Payload field definition:

S/N	Function	Description	Example
1	FW	The firmware version; 2byte; The upper 8 bits are the main version number, in hex, and the lower 8 bits are the small version number, in hex;	Report 0x050A means V5.10.
2	Upload Time	Cycle upload time interval; Unit:h(hours); 1byte,in hex;	Report 0x18 means 24hours.
3	CycleDetectTime	Cycle detection time interval; Unit:min(minutes); 1byte, in hex;	Report 0x1E means 30min.
4	Height Threshold	when measured height is less than height threshold, Ultrasonic status is 1, otherwise Ultrasonic status is 0. Unit:cm;1byte, in hex;	Report 0x3C means 60cm.
5	MagThre	Magnetic threshold;	Report 0x003C means

	shold	2byte,in hex; Unit: 1.5mGauss.	60*1.5mGs=90mGss
6	BatteryThreshold	Lower battery alarm threshold, Unit: %, in hex, 1byte.	Report 0x14 means 20%.
7	Server address	IP&PORT, MAX50byte, in hex. 3132302E39322E38392E3132323B23823B means 120.92.89.122:90902	
8	Device ID	Device unique Identity;1+IMEI; 8byte;	For example:1867725034085278, so the IMEI is 867725034085278;

2.1.7 Reserved Filed

Reserved filed: 0x00,1byte.

2.1.8 Packet Tail

Packet tail: 0x81,1byte.

2.2 Example

Upload data 0x01:

80 00 31 02 26 270F 0000 0165 010D FC31 F868 1D 13 000070C4 659CF806 0001 1869738069175805 81

Description:

80: Packet head

00: Forced bit

31: Device type

02: Report data type

26: Packet size, 38byte

270F:Height, 9999mm;

0000: Parking/Ultrasonic/ Geomagnetic/Battery status; parking status: no car, Ultrasonic status: no car, Geomagnetic status: no car, battery is normal.

0165: Battery voltage, 3.57v

010D: X-axis magnetic, 269*1.5mGauss=403.5mGauss

FC31: Y-axis magnetic, (64561-65536)*1.5mGauss=-1,462.5mGauss

F868: Z-axis magnetic, (63592-65536)*1.5mGauss=-2,916mGauss

1D: Temperature, 29℃

13: Humidity, 19%

000070C4: RSRP, -960. *Calculation*: First change the 008027C4 to C4278000, then change it from float to dec, that is -670.

659CF806: Timestamp, 1704785926
0001: Frame count 1
1869738069175805: Device ID, 1+IMEI, the IMEI is 869738069175805
81: Packet tail

Upload data 0x03:

80 00 31 03 27 0102 18 05 3C 003C 14 3132302E39322E38392E313232 3B 2382 3B 1869738069175805 81

Description:

80: Packet head
00: Forced bit
31: Device type
03: Report data type
27: Packet size, 39byte
0102: Firmware version, V1.2
18: Upload time, 24h
05: Cycle detection interval, 5min
3C: Height threshold, 60cm
003C: Magnetic threshold, 60mGs
14: Battery alarm threshold, 20%
3132302E39322E38392E313232 3B 2382 3B: IP,120.92.89.122, port:9090
1869738069175805: Device ID, 1+IMEI, the IMEI is 869738069175805
81: Packet tail

3 Terminal Downlink Commands Format

Field	Packet head	Command type	Payload			Packet tail
Instruction	Packet head	The function of commands	Header	Command code	Data section	Packet tail
Size	1byte	1byte	2byte	1byte	n	1byte

Field Definition:

Packet Header: packet header is 0x80; length:1byte.

Command Type:

Command type	Instruction
0x02	Configure device parameters through the downlink

Payload: Configure device parameters through the downlink type0x02

Header	Command code	Data Section
2 bytes, 0x9999	1 byte,	

Header:9999

Command code list:

Command code	Function
0x01	Setting upload time
0x02	Setting height threshold
0x05	Setting battery alarm threshold
0x08	Setting cycle detection time
0x0F	Setting Magnetic threshold
0x09	Reboot sensor/Open debug mode
0x06	Setting IP and port
0x0D	Setting APN

Data Section: please check the detailed command3.1-3.8.

Packet Tail: packet tail is 0x81,1byte

3.1 0x01 Set Upload Time

Function: Set the upload time

Default :24h

Format:

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	01	Content	81
Size	1byte	1byte	2byte	1byte	1byte	1byte

Content: 1byte, in hex; Unit: h(hour); The range: 01-168.

Note: This command will restart the DO201 sensor.

Example1: Set the upload time to 24hours,

Command:80029999011881

3.2 0x02 Set height Threshold

Function: Set height threshold

Default :60cm

Format:

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	02	Content	81
Size	1byte	1byte	2byte	1byte	1byte	1byte

Content: 1byte, in hex; The range: 15-255; Unit: cm

Example1: Set the height threshold to 60cm,
Command: 80029999023C81

3.3 0x05 Set Battery Alarm Threshold

Function: Set battery alarm threshold;
Default :20%
Format:

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	05	Content	81
Size	1byte	1byte	2byte	1byte	1byte	1byte

Content: 1byte, in hex; The range: 5-99; Unit: % .

Example1: Set the battery alarm threshold to 20%,
Command: 80029999051481

3.4 0x08 Set cycle detection time

Function: Set cycle detection time
Default :30min
Format:

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	08	Content	81
Size	1byte	1byte	2byte	1byte	1byte	1byte

Content: 1byte, in hex; The range: 1-60; Unit: min .

Example1: Set the cycle detection time to 30min,
Command: 80029999081E81

3.5 0x0F Set Magnetic threshold

Function: Set magnetic threshold

Default :40mGs

Format:

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	0F	Content	81
Size	1byte	1byte	2byte	1byte	2byte	1byte

Content: 2byte, in hex; The range: 1-65535; Unit: 1.5mGuass .

Example1: Set the cycle detection time to 40*1.5mGs,
Command: 800299990F002881

3.6 0x06 Set IP and PORT

Function: Set the IP and port address for the device

Format:

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	06	Content	81
Size	1byte	1byte	2byte	1byte	n	1byte

The content format: IP1;PORT1;
Note:Two English semicolons can not be less. Otherwise it will go wrong! ! !

For example: set the server1 address, IP:156.23.68.110 , PORT is 5000
The command is 80029999061156.23.68.110;5000;81

3.7 0x0D Set APN

Function: Set the APN

Format:

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	0D	Content	81
Size	1byte	1byte	2byte	1byte	n	1byte

The content format: APN;USERNAME;PASSWORD; ,in hex.

Note: Three English semicolons can not be less. Otherwise it will go wrong! ! !

Note: the user and password are leave blank when there is no user and password.

For example: set APN to internet, no username and password,

The command is 8002999990Dinternet;;;81

3.8 0x09 Reboot/Open debug mode

Function: Reboot sensor

Format:

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	09	Content	81
Size	1byte	1byte	2byte	1byte	1byte	1byte

Content: 1byte, Value: 02, 0B/0C, 11/12

02: Restart sensor

0B/0C: Open/close serial echo;

11/12: Close/open bluetooth. If close it, the Bluetooth only works when restart.

Example1: Reboot sensor,

Command 1:8002999909081

4 Demo Code

4.1 Java script code

Integrate code of ChirpStack server:

https://github.com/cndingtek/Chirpstack_Http_JS