W device communications protocol

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## I. Hardware Description

This file provide the communication protocol for wristband Wave device, hardware statement, etc.

Note, all the communications formats are hexadecimal format.

### 1.1 Bluetooth：

Support Bluetooth Low Energy 4.0 device, eg. IOS 6.0 and above iPhone, iPad, iPod, or other Bluetooth devices with BLE 4.0. Bluetooth module provides following service and Characteristic s to communicate :

#### 1.1.1. Data Channel（Service ID：0xFFE9）

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Characteristics UUID** | **Properties** | **Total Bytes** | **Defaults** | **Remark** |
| FFE9 | Write | 50 | N/A |  |

#### 1.1.2. Data Channel（Service ID：0xFFE4）

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Characteristic UUID** | **Properties** | **Total Bytes** | **Defaults** | **Remark** |
| FFE4 | Notify | 50 | N/A |  |

### 1.2 Remark

*1、The “XX” in this file can be* [*arbitrary*](javascript:void(0);)[*number*](javascript:void(0);).

*2、Based on the data format in this file, if data is wrong, then possibly returns failure (Negative Response ).*

## II．Communication Protocol

### 2.1 Message Structure.

Message structure for Data Transmission and Reception is as below:

|  |  |  |  |
| --- | --- | --- | --- |
| **Opcode** | **Length** | **Parameters** | **Checksum** |
| 1byte | 1bytes | N bytes(<200) | 1bytes |

**Opcode**: Operation code,to define different operation orders/commands according to different service demand. Refer to [Opcode Table](#_2.2_Opcode_Table).

**Length**: the length of Parameters’ byte, the max is 200.

**Parameters:** define different transmission and return parameters according to Commands or Response data.

**Checksum**： do XOR operation to all data in the Parameters.

### 2.2 Opcode Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Opcode** | **Description** | **Service identifier**  **positive response** | **Negative response code** | **Remark** |
| 0x85 | Set blue tooth match password | 0x25 | 0x05 | Need to use any service to establish communication. |
| 0xC4 | Read sport data curve graph | 0x24 | 0x04 |
| 0xC6 | Read device data | 0x26 | 0x06 |
| 0xC2 | Set device time | 0x22 | 0x02 |
| 0x89 | Read device time | 0x29 | 0x09 |
| 0x90 | Read device version No. | 0x30 | 0x0A |
| 0x91 | Read device serial number | 0x31 | 0x0B |

### 2.3 Checksum：

|  |  |  |  |
| --- | --- | --- | --- |
| **Opcode** | **Length** | **Parameters** | **Checksum** |
| 1byte | 1bytes | N bytes | 1bytes |
| OPCODE | LENGTH | BYTE1/BYTE2/BYTE3/BYTE4/BYTE5 | CHECKSUM |

CHECKSUM = BYTE1 *xor* BYTE2 *xor* BYTE3 *xor* BYTE4 *xor* BYTE5

## III. Service Description

**3.1 Set BT match Password**

#### 3.1.1 Description

This service is used to set the BT match password(4 numbers), preventing other‘s vicious connection.

#### 3.1.2 Performance

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0x85 | Set BT match password |  |
| #2 | 0x04 | Data length |  |
| #3~#6 | XX/XX/XX/XX | Password input | (XX data range is 0x00~0x09),Total 4 bytes,Support password : 0000~9999 |
| #7 | XX | Checksum |  |

#### 3.1.3 Positive response

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0x25 | Set BT Password success |  |
| #2 | 0x00 | Data length |  |
| #3 | 0x00 | Checksum |  |

#### 3.1.4 Negative Response

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0x05 | Set BT password failure |  |
| #2 | 0x00 | Data length |  |
| #3 | 0x00 | Checksum |  |

### 3.2 Read the device system time

#### 3.2.1 Description

This service is used to read device system date and time. Meanwhile this is one of the 2 services that can be used to build communication with devices. Please refer to “**Set device system time**” for another service.

#### 3.2.2 Performance

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0x89 | Read device system time |  |
| #2 | 0x00 | Data length |  |
| #3 | XX | Checksum |  |

#### 3.2.3 Positive response

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0x29 | Read device system time success |  |
| #2 | 0x07 | Data length |  |
| #3 | XX | year(0~99) | System date and time on the device |
| #4 | XX | Month (1~12) |
| #5 | XX | day |
| #6 | XX | Hour (0~23) |
| #7 | XX | Minute (0~59) |
| #8 | XX | Second (0~59) |
| #9 | XX | Week (1~7) |
| #10 | 0x00 | Checksum |  |

#### 3.2.4 Negative Response

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0x09 | Read device system time failure |  |
| #2 | 0x00 | Data length |  |
| #3 | 0x00 | Checksum |  |

### 3.3 Set device system time

### 3.3.1 Description

This service is used to set device system date and time. Meanwhile this is one of the 2 services that can build communication with devices, please refer to “Read device system time” for the other one.

#### 3.3.2 Performance

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0xC2 | Set device system time |  |
| #2 | 0x07 | Data length |  |
| #3 | XX | Year (0-99) | System date and time  (Data must conform to the data and time format) |
| #4 | XX | Month (1-12) |
| #5 | XX | Day |
| #6 | XX | Hour (0~23) |
| #7 | XX | Minute (0~59) |
| #8 | XX | Second (0~59) |
| #9 | XX | Week (1~7) |
| #10 | XX | Checksum |  |

#### 3.3.3 Positive response

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0x22 | Set device system time success |  |
| #2 | 0x04 | Data length |  |
| #3-#6 | xx/xx/xx/xx | Device connect password | Blue tooth match password |
| #7 | 0x0 | Checksum |  |

#### 3.3.4 Negative Response

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0x02 | Set device system time success failure |  |
| #2 | 0x00 | Data length |  |
| #3 | 0x00 | Checksum |  |

**3.4 Read Movement data Curve Graph**

**3.4.1 Description**

This service is used to read the movement point every hour(record data every 30 minutes), movement curve gragh about the whole hour can be drawed according to every movement point.

**3.4.2 Performance**

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0xC4 | Read movement data curve gragh |  |
| #2 | 0x03 | Data Length |  |
| #3 | XX | Year | Read given date’s data |
| #4 | XX | Month |
| #5 | XX | Day |
| #6 | XX | Checksum |  |

**3.4.3 Positive Response**

|  |  |  |  |
| --- | --- | --- | --- |
| Bytes no. | Value(Hex) | Description | Remark |
| #1 | 0x24 | Read movement data curve successfully |  |
| #2 | 0xB7 | data length | Fixed length of data is 99 |
| #3~#5 | XX/XX | date | Year(1byte)+month(1byte)+day(1byte) |
| #6~#7 | XX/XX | The first data Data\_1 | XX/XX means MSB/LSB  Example:  Data1: 0x20 0x01  Means the step of data1 is 288 steps Calculate: Data1=0x01<<8 | 0x20 |
| … | XX/XX | …. |
| #100~#101 | XX/XX | Last data Data\_48 |
| #102 | XX | checksum |  |

using 16 bits of data to represent the steps in 30 minutes, use the small Endian transfer, #6~#101, total 96 data, recording a day’s data.

MSB/LSB=0xFFFF means invalid data.

**3.4.4 Negative Response**

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0x04 | Fail in reading movement  data curve gragh |  |
| #2 | 0x00 | Data Length |  |
| #3 | 0x00 | Checksum |  |

### 3.5 Read Device Data

#### 3.5.1 Description

The service is used to read everyday’s total steps and remaining battery capacity. The parameters can be referred to as below form in the service parameter：

**LocalIdentifier (LID) Table**

|  |  |  |
| --- | --- | --- |
| **LID** | **Description** | **Remark** |
| 0x01 | Read Monday total steps | Step data returned in 3 bytes xx/xx/xx, e.g. 01/23/45, corresponding to 0x012345→decimalism 74565 |
| 0x02 | Read Tuesday total steps |
| 0x03 | Read Wednesday total steps |
| 0x04 | Read Thursday total steps |
| 0x05 | Read Friday total steps |
| 0x06 | Read Saturday total steps |
| 0x07 | Read Sunday total steps |
| 0x09 | Read current total steps |
| 0x08 | Read remaining battery capacity % | Data returned is 1 byte, Battery Capacity%: 0xx0~0x64: 0%~100%, 0xFF: charging |

#### 3.5.2 Performance

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0xC6 | Read device data(by week) |  |
| #2 | 0x01 | Data Length |  |
| #3 | XX | **Local Identifier** (LID) | Refer to [LocalIdentifier Table](#_3.7.1服务描述) |
| #4 | XX | Checksum |  |

#### 3.5.3 Positive Response

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0x26 | Succeed in reading device data |  |
| #2 | XX | Data Length | 3 or 1,others are invalid values |
| #3~#n | XX/../XX | Steps or battery capacity % |  |
| #n+1 | XX | checksum |  |

#### 3.5.4 Negative Response

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0x06 | Fail in reading device data |  |
| #2 | 0x00 | Data Length |  |
| #3 | 0x00 | Checksum |  |

### 

### 3.6 Read device version number

#### 3.6.1 Description

#### This command is used to read the version number Of device.

#### 3.6.2Performance

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0x90 | Read device version No. |  |
| #2 | 0x00 | Data Length |  |
| #3 | 0x00 | Checksum |  |

#### 3.6.3 Positive Response

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0x30 | Succeed in reading device version No. |  |
| #2 | XX | Data Length |  |
| #3~#n | XX/XX/… | Device version data |  |
| #n+1 | XX | Checksum |  |

#### 3.6.4 Negative Response

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0x0A | Fail in reading device version No. |  |
| #2 | 0x00 | Data Length |  |
| #3 | 0x00 | Checksum |  |

### 3.7 Read device serial number

#### 3.7.1Service

This service is used to read the device serial number.

#### 3.7.2 Performance

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0x91 | Read device serial number |  |
| #2 | 0x00 | Data length |  |
| #3 | XX | Checksum |  |

#### 3.7.3 Positive response

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0x31 | Read device serial number success |  |
| #2 | 0x07 | Data length |  |
| #3~#9 | XX/XX/… | Device serial number | Data transfer to character |
| #10 | 0x00 | Checksum |  |

#### 3.7.4 Negative Response

|  |  |  |  |
| --- | --- | --- | --- |
| **Bytes no.** | **Value(Hex)** | **Description** | **Remark** |
| #1 | 0x0B | Read device serial number failure |  |
| #2 | 0x00 | Data length |  |
| #3 | 0x00 | Checksum |  |

### IV、1. Data computing method and formula

Distance:（total steps - running steps）× walking stride + running steps × running stride （KM）

Cal：Distance（cm）×Weight（kg）×6.53/1000000 Unit：Kcal

Fat：Fat =Calorie/9 Unit：g

Standard of aerobics judgment: Aerobics==( continuous>=10 minutes)&&(Step>=100/minute)

### 2. Example of the communications process（examine via PC)

**OUT：**89 00 00 //Read the device system time

**IN ：**07 0d **0c 02 0d 2b 26 01** 02 //Return to：12/2,2013 13:43:38,Monday

**OUT：**c2 07 **0d 0c 02 0e 01 09 01** 04 //Set device system time

**IN ：**22 00 00 //Succeed

**OUT：**c6 01 09 09 //Read current step

**IN ：**26 03 **00 0b cd** c6 //Return to 0x000bcd 🡪3021 steps

**OUT：**c4 03 01 06 03 04 //Read data from curve graph

**IN ：**24 B7 **0E 02 03** **00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00** 0F

**OUT：**83 2f **00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 27 10 00 00** 37 //Set up target as 10000steps

**IN ：**23 00 00 //Set up success

**OUT：**87 00 00 //Reset to defaults

**IN ：**27 00 00 //Reset to defaults success

**OUT：**c6 01 08 08 //Read the battery remaining capacity

**IN ：**26 01 **60** 60 //Succeed：Return to 0x60🡪Capacity 100%

**OUT：**85 04 **31 32 33 34** 04 //Set blue tooth match password

**IN ：**05 00 00 //Set up success

**OUT：**90 00 **00** //Read device version number

**IN ：**30 04 4E 4F 2E 31 1E //Read success, version number as NO.1

**OUT：**91 00 00 //Read device serial number

**IN ：**31 08 57 61 76 65 00 00 00 01 24 //Read success, device serial number as Wave00000001