

AT Command Demo Description

Name: Xiao Wang

Supervisor: Kun Yang

Date: 16 Nov. 2015

Contents

1	INTRODUCTION	3
2	THE ZIGBEE DEVICES.....	3
2.1	Three sensors	3
	<i>Lighting sensors</i>	4
	<i>Body sensors (Motion detector)</i>	4
	<i>Temperature sensors</i>	5
2.2	ZigBee Socket.....	6
2.3	ZigBee dongle.....	7
2.4	Reminder.....	7
3	EXAMPLE TO EXPLAIN AT COMMAND.....	8
4	AT COMMAND ON ANDROID PHONE	8
4.1	Server on computer	8
4.2	Android App	11
5	FAQS:.....	14
5.1	The end device cannot connected to the coordinator	14
5.2	How to get lightness sensor value	14
5.3	How to get motion detector value	15
5.4	Why Bind.....	15
5.5	The socket and a lightness sensor are bound, but when the day is dark, it turn off the socket. How to set that it turns on the socket when the day is dark?	15
6	REFERENCE	15

1 Introduction

This description mainly focuses on how to use 3 kinds of ZigBee sensors, a ZigBee socket, a simple win7 GUI server and an android App help to understand the AT command interface. Before do this demo, a basic understanding to AT command is needed, which can be found in [2] that is the other one assay to briefly describe how to use the AT command. I will first give a review on the ZigBee devices, and then a solution to control the devices by a phone with a GUI server on computer is given to demonstrate in an interesting way.

2 The ZigBee devices

The clusters of the sensors and sockets are implemented under ZIGBEE CLUSTER LIBRARY SPECIFICATION [1].

2.1 Three sensors

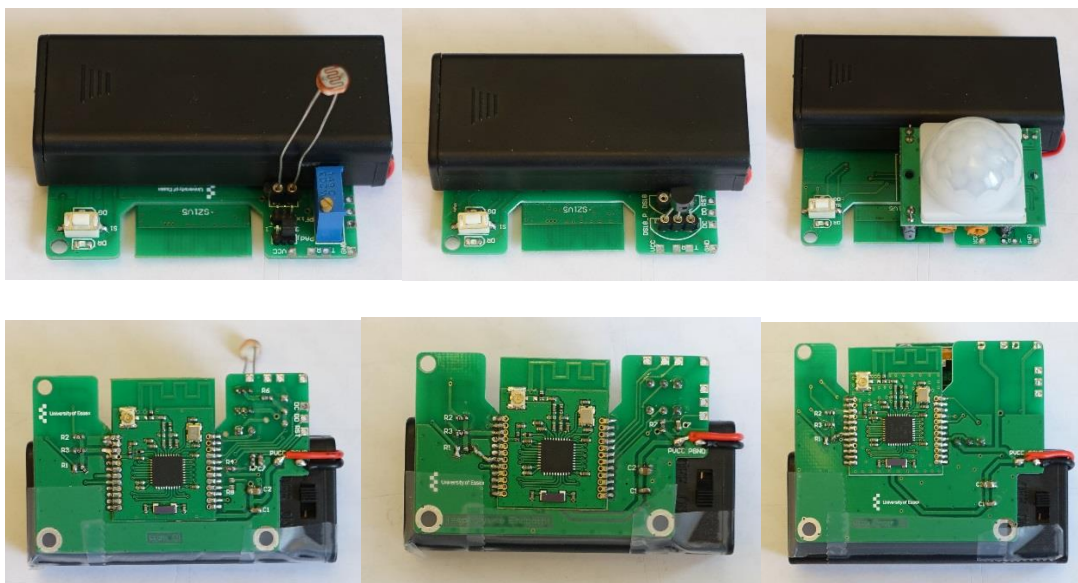


Fig. 8. The ZigBee sensors and their backside view.

- ZigBee lighting sensor (left)
- ZigBee temperature sensor (middle)
- ZigBee motion detector (right)

A sensor has two LEDs: green one and red one. The red one indicates the network states and the green one indicates the working state of the sensor. There is a button on the each sensor. The button is a multiple function button:

1. Clicking: switch on/off the sensor. When the sensor is turned off, the green LED stop flashing indicating the sensor stop working. When turned on, the green LED stay flashing.
2. Long press for 5 ~ 10 seconds and release: when pressing the button for 5~10 seconds, the LEDs flash rapidly. If release the button in such a situation, the sensor will broadcast and announce in the ZigBee network. All the other nodes will receive the annunciation from this node. If it is a motion detector or lighting sensor, their key attribute will be toggled. In other word, if we read the lighting sensor attribute, we get the value is "01" when the day is dark and the value is "00" when the day is light. However, When press the button 5~10 seconds and release, the value will be "00" when it is dark and "01" when it is light.
3. Long press for 10~15 second and release: when pressing the button for 10~15 seconds, the LEDs will flash slowly. If release the button in such a situation, the sensor will be reset to factory settings.
4. Long press more than 15 seconds: nothing happens.

Lighting sensors

The lighting sensor detail as below:

Device type: End device, reduced function device (RFD)

Endpoint: 05

Including Clusters: 0000,0003,0006,0007

Cluster 0000: this is the general basic cluster, implemented attributes:

BASIC_MANUFACTURER_NAME: 0004

BASIC_MODEL_ID:0005

BASIC_DATE_CODE:0006

BASIC_POWER_SOURCE:0007

BASIC_LOCATION_DESC:0010

BASIC_DEVICE_ENABLED:0012

Cluster 0003: this is the general identify cluster, implemented attributes:

IDENTIFY_TIME:0000

Cluster 0006: general on/off cluster, implemented attributes:

ON_OFF:0000

Cluster 0007: this is On/Off Switch Cluster, implemented attributes:

ON_OFF_SWITCH_TYPE:0000

ON_OFF_SWITCH_ACTIONS:0010

Body sensors (Motion detector)

Device type: End device, reduced function device (RFD)

Endpoint: 07

Including Clusters: 0000,0003,0006,0007

Cluster 0000: this is the general basic cluster, implemented attributes:

BASIC_MANUFACTURER_NAME: 0004

BASIC_MODEL_ID:0005

BASIC_DATE_CODE:0006

BASIC_POWER_SOURCE:0007

BASIC_LOCATION_DESC:0010
BASIC_DEVICE_ENABLED:0012
Cluster 0003: this is the general identify cluster, implemented attributes:
IDENTIFY_TIME:0000
Cluster 0006: general on/off cluster, implemented attributes:
ON_OFF:0000
Cluster 0007: this is On/Off Switch Cluster, implemented attributes:
ON_OFF_SWITCH_TYPE:0000
ON_OFF_SWITCH_ACTIONS:0010

Temperature sensors

Device type: End device, reduced function device (RFD)
Endpoint: 04
Including Clusters: 0000, 0002, 0003, 0006, 0402
Cluster 0000: this is the general basic cluster, implemented attributes:
BASIC_MANUFACTURER_NAME: 0004
BASIC_MODEL_ID:0005
BASIC_DATE_CODE:0006
BASIC_POWER_SOURCE:0007
BASIC_LOCATION_DESC:0010
BASIC_DEVICE_ENABLED:0012
Cluster 0002: this the Device Temperature Configuration Cluster, implemented attributes:
DEV_TEMP_CURRENT: 0000
Cluster 0003: this is the general identify cluster, implemented attributes:
IDENTIFY_TIME:0000
Cluster 0006: general on/off cluster, implemented attributes:
ON_OFF:0000
Cluster 0402: this is the Temperature Measurement Cluster, implemented attributes:
MS_TEMPERATURE_MEASURED_VALUE:0000
MS_TEMPERATURE_MIN_MEASURED_VALUE:0001
MS_TEMPERATURE_MAX_MEASURED_VALUE:0002

2.2 ZigBee Socket



ZigBee socket

The socket has two LEDs.

One on the top of the socket indicates the network state:

1. Flashing: the socket is scanning the networking and is not in a ZigBee network
2. Light: the socket is successfully connected into a ZigBee network

The other one is on the side of the socket under the power button, indicating power states:

1. Light: on
2. Dark: off

The button of the socket is also a multiple function button:

1. Clicking: turn on/off the socket. When the socket is turned off, the power LED on the side become dark indicating the socket is turned off.
2. Long press for 5 ~ 10 seconds and release: when pressing the button for 5~10 seconds, the LED on top flash rapidly. If release the button in such a situation, the socket will broadcast and announce in the ZigBee network. All the other nodes will receive the annunciation from this node.
3. Long press for 10~15 second and release: when pressing the button for 10~15 seconds, the LED on top will flash slowly. If release the button in such a situation, the sensor will be reset to factory settings.
4. Long press more than 15 seconds: nothing happens.

Device type: Router, full function device (FFD)

Endpoint: 01

Including Clusters: 0000, 0003, 0006

Cluster 0000: this is the general basic cluster, implemented attributes:

BASIC_MANUFACTURER_NAME: 0004

BASIC_MODEL_ID:0005

BASIC_DATE_CODE:0006

BASIC_POWER_SOURCE:0007

BASIC_LOCATION_DESC:0010

BASIC_DEVICE_ENABLED:0012

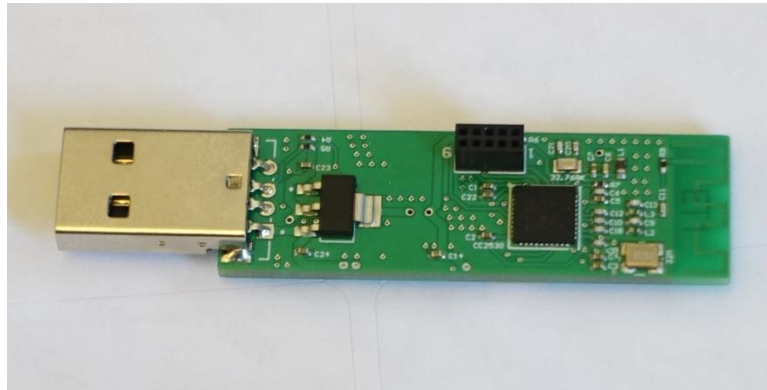
Cluster 0003: this is the general identify cluster, implemented attributes:

IDENTIFY_TIME:0000

Cluster 0006: general on/off cluster, implemented attributes:

ON_OFF:0000

2.3 ZigBee dongle



The ZigBee Dongle

The USB Dongle is designed to plug into a computer and provide a serial interface through which we can control the devices in the ZigBee network with AT command.

Device type: Coordinator, full function device (FFD).

The dongle does not need to implement the ZCL (ZigBee Cluster library).

2.4 Reminder

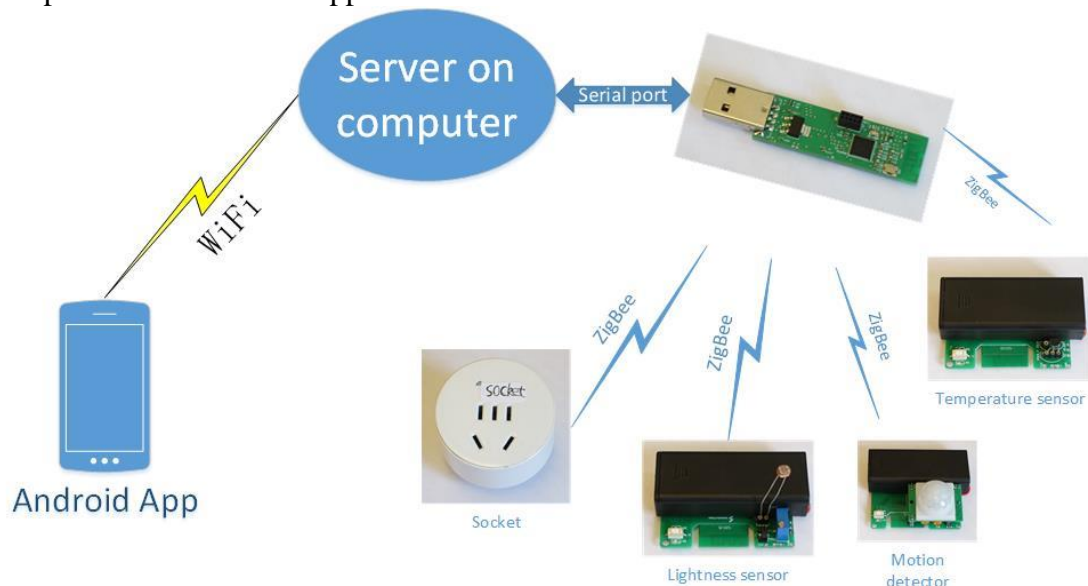
1. The attributes can be read or written by at command: AT+READATR and AT+WRITEATR
2. To get light sensor or motion detector value, we can read attributes in 0007 cluster of the sensors.
3. To get temperature value, we can read attributes in 0402 cluster of a temperature sensor. For example: at+readatr:<address>,04,0,402,0
4. To control an on/off device, such as a socket, try AT+RONOFF command to turn on/off the device and use AT+READATR (cluster 0006 attribute 0000) to get the on/off status.

3 Example to explain AT command

Please reference [2].

4 AT command on android phone

To enable to send AT command from android phones, we need a server running on a computer and an android application.



Deploy of the demo

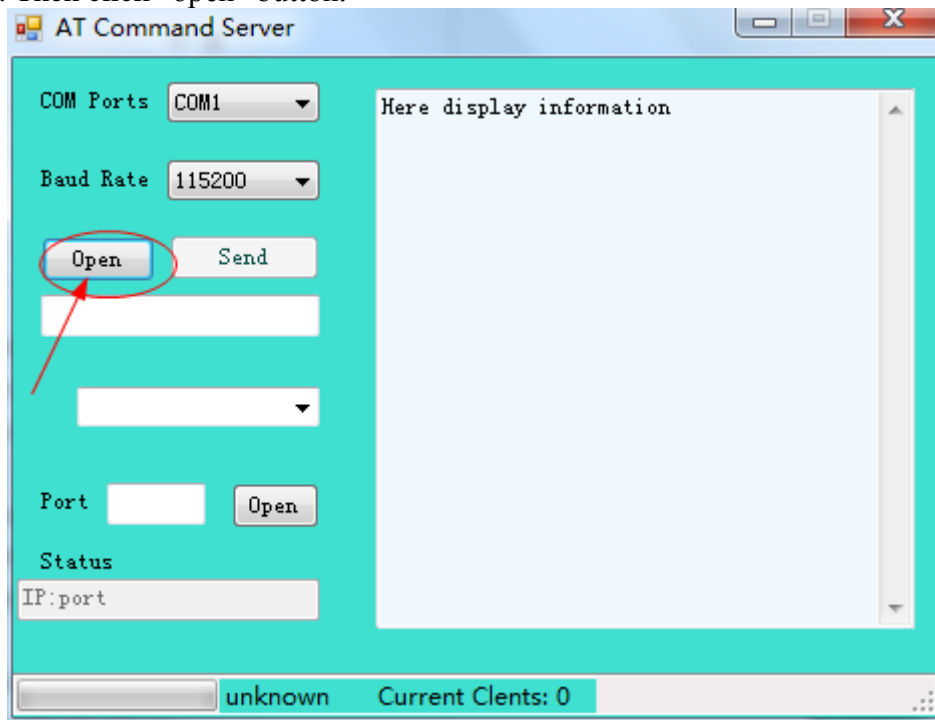
As shown above, the Android phone runs an App that communicate with the server on computer through WiFi. The server on computer deliver the message from the phone to the ZigBee dongle and collect the message from the ZigBee dongle to the phone. Therefore, we can send AT command through the android app to control the sockets and sensors.

4.1 Server on computer

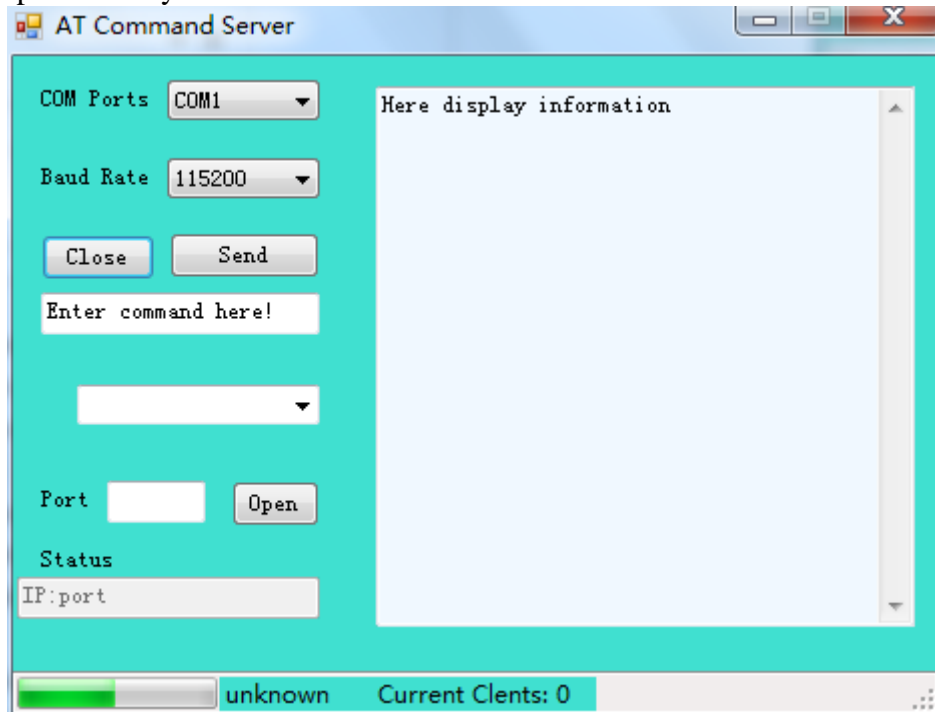
The server on computer has a GUI interface which is recommended to run in Win7 OS. The interface as below. To start the server, please follow below steps.

1. Install the driver on computer first. If the driver for ZigBee is correctly installed on the computer and a ZigBee dongle is plugged in the computer, the serial port will appear on the COM Ports list once the server open. The select the baud rate

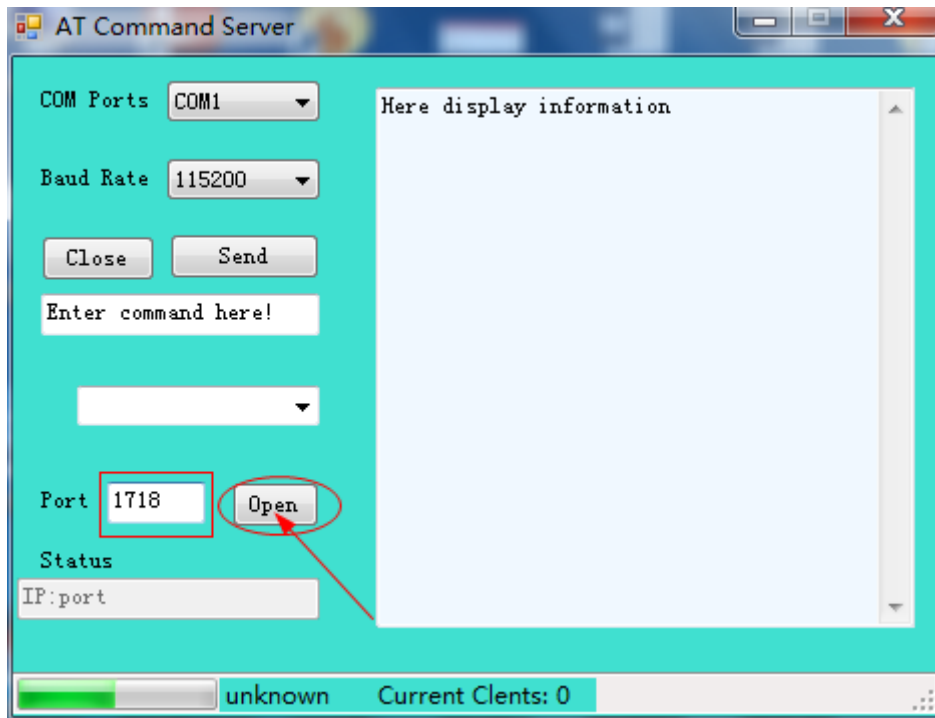
(the baud rate of ZigBee dongle is set to 115200 by default, please do not change it). Then click “open” button.



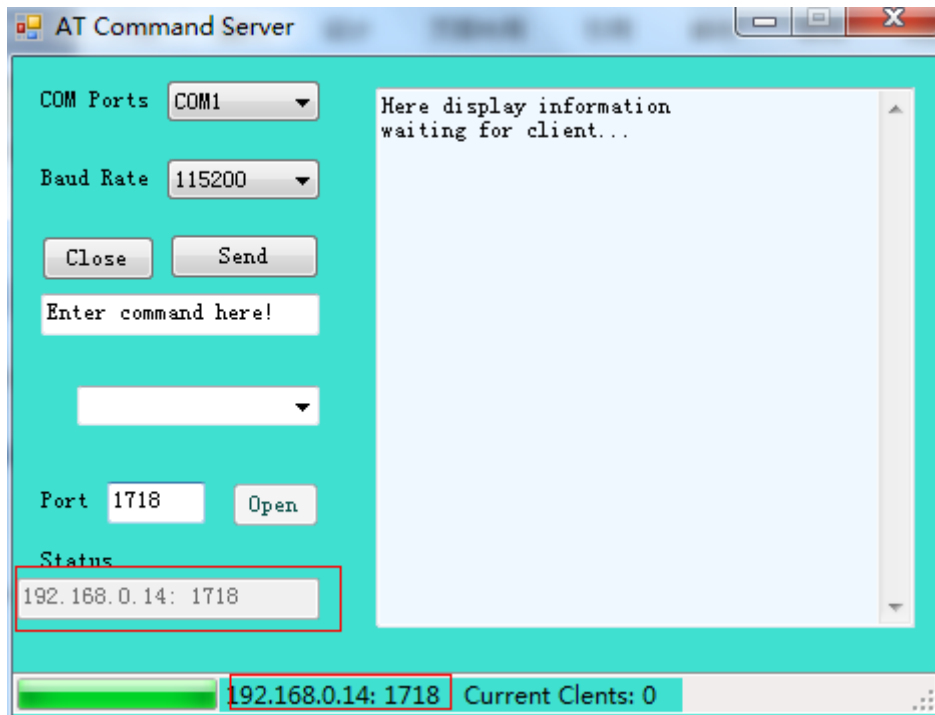
2. To check whether the port is open, please enter “at” in the input box below the send button and then click send. If an “OK” is appear on the right of the widow, the port is ready to use.



3. Chose a port greater than 1024 and click open to open a port which can use for communication with the phone through WiFi.

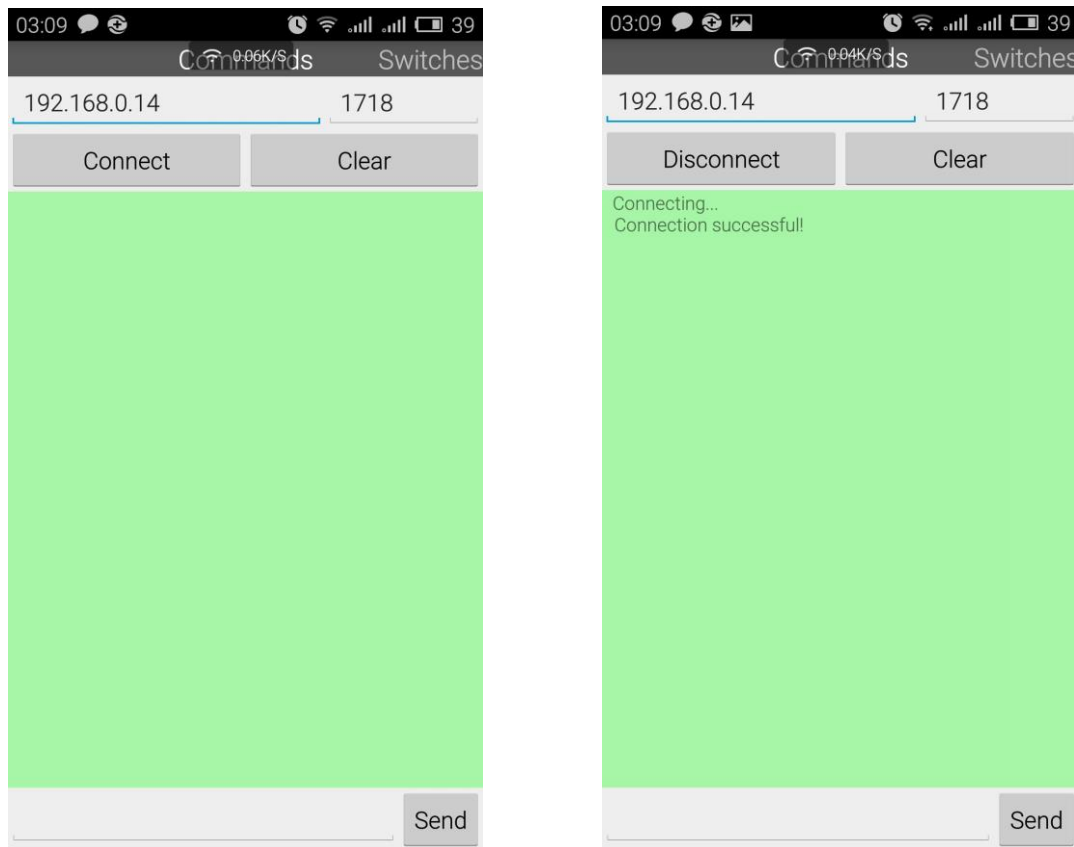


4. If the port is ready to be connected by a phone, the address of the server will display in the status box and the bottom of the window.

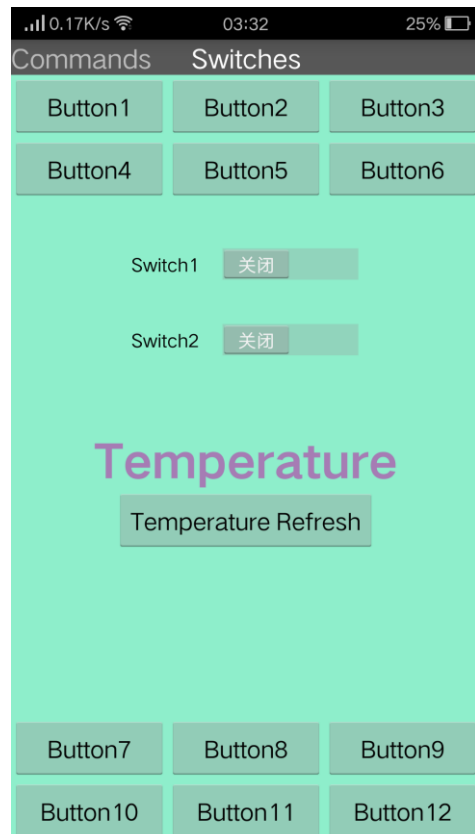
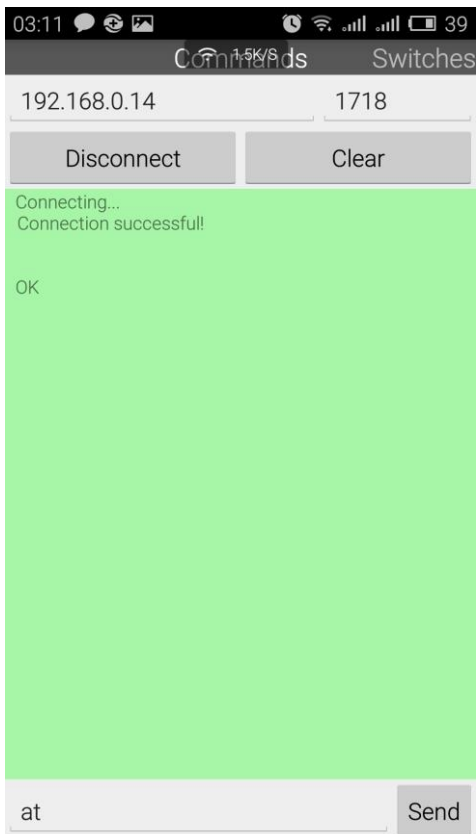


4.2 Android App

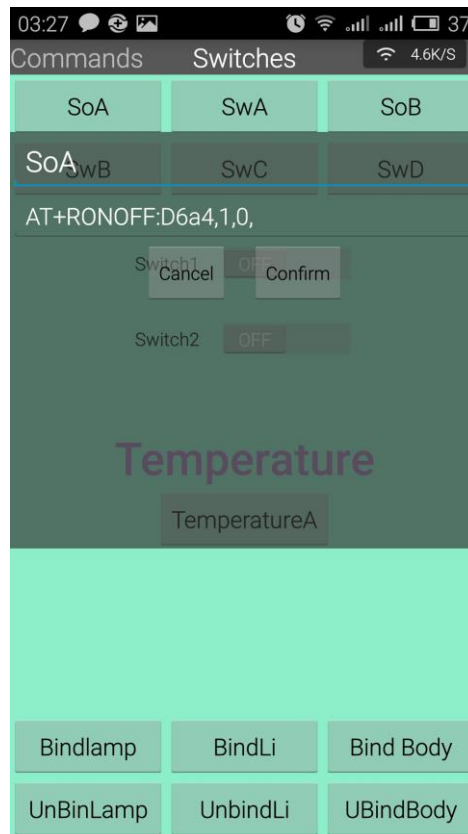
The android app help to send at command at an easy way. Please find android apk file in the material package and install on an android phone. The interface is below:



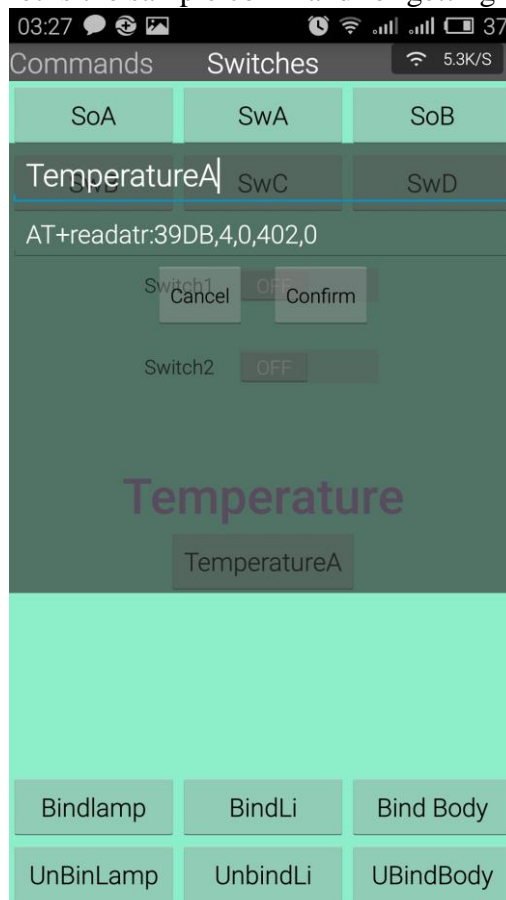
1. Connect the phone to WiFi that is in the same network with the server
2. Type in the ip address and port number that appear on the server
3. Click "Connect", if "Connection successful!" display below, it means that the phone has connected to the server.
4. Type "at" in the command line (app bottom) and Send. If "OK" is received, indicating everything is OK.



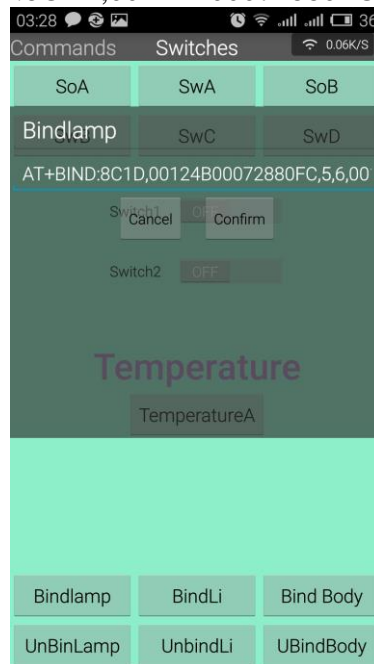
5. Swipe left, then the other tab shows. The panel includes many buttons. Button1 ~ Button12 are normal buttons that can be defined to send general command. The Big button in the centre is a special button that can get temperature sensor value and display on above the button if it is properly configured. The two switches in the middle have not been implemented.
6. Following is what I configured. The top 6 button is defined to send AT+RONOFF command to turn on/off ZigBee sockets or ZigBee bulbs. The sample command configuration is on the right. (prompt: long press the button, the configuration window appears)



7. The below screen shot is the sample command for getting temperature.



- Some buttons are configured to bind or unbind device. We can bind the lightness sensor or body sensor with a socket. Thus, the socket will be controlled by sensors automatically. (AT+BIND:8C1D,00124B00072880FC,5,6,00124B00012B85E0,1)



5 FAQs:

5.1 The end device cannot connected to the coordinator

- The coordinator does not permit to be joined by default. Try command AT+PJOIN:
If no parameter is given, it allows to be joined within 60 second(colon symbol cannot be ignored). Parameter FF, permit join forever.
- The device had been connected to other ZigBee before. Try to forget the previous network by press the button 10 ~ 15 seconds.
- The coordinator may not have established a PAN, try AT+N to check the network state. If there is not a PAN, try command: AT+EN.

5.2 How to get lightness sensor value

The lightness sensor value is stored in cluster 0007 attribute 0010 on endpoint 05. In fact, according to ZCL, the lightness is treated as basic on/off switch server.

The possible value of lightness sensor may be '00' or '01'.
AT+READATR:<ADDRESS>,05,0,0007,0010

5.3 How to get motion detector value

Similar with the lightness sensor, the motion detector value is stored in cluster 0007 attribute 0010 on endpoint 07.

AT+READATR:<ADDRESS>,7,0, 7, 10

5.4 Why Bind

Bind allow sensors control actuators, for example, when a socket and a lightness are bound. The lightness sensor will controlled the socket on/off according the environment lightness. One typical case: when the day is dark, turn on the socket.

5.5 The socket and a lightness sensor are bound, but when the day is dark, it turn off the socket. How to set that it turns on the socket when the day is dark?

Try to press the button on the lightness sensor for 5 ~ 10 seconds, it toggles the key status. Please read [2.1 Three sensors](#).

6 Reference

[1] "ZigBee Cluster Library", 075123r04ZB, ZigBee Alliance

[2] "AT command system for dancer project", Xiao Wang (in the same folder with this essay)