USER GUIDE

1 Description

Intelli BG96 NB-IoT board is a complete IoT wireless communication board produced by Fusi. The main communication chip is based on Quectel LTE Cat M1/Cat NB1/EGPRS BG96 IC. It features global frequency bands, ultra-low power consumption, and packed with onboard positioning using GPS, GLONASS, BeiDou/Compass, Galileo, QZSS standard.

On Processing side this board equipped with ESP32 which widely supported by Arduino IDE and communities. It is the best solution for applications that need low power consumption, integrated IoT (WIFI and BLE). Intelli BG96 NB-IoT board will help developer to evaluate and design any IoT solution in no time.

2 Features & Specifications

- Input Voltage: 5VDC from USB micro port or 2.54 pitch male Header
- Communication Module: BG96
    - Quectel LTE Cat M1/Cat NB1/EGPRS with global frequency bands (B1/ B2/ B3/ B4/ B5/ B8/ B12/ B13/ B18/B19/ B20/ B25/ B26*/ B28)
    - ultra-low power consumption
    - GPS, GLONASS, BeiDou/Compass, Galileo, QZSS standard positioning
- WIFI/BLE support
- Module interfaces support SD card, UART, SPI, SDIO, I 2 C, LED PWM, Motor PWM, I 2 S, IR, pulse counter, GPIO, capacitive touch sensor, ADC, DAC
- Operating Temperature ： -25℃~+85℃
- Dimension: 5,85 cm x 5.6 cm

3 Board Overview

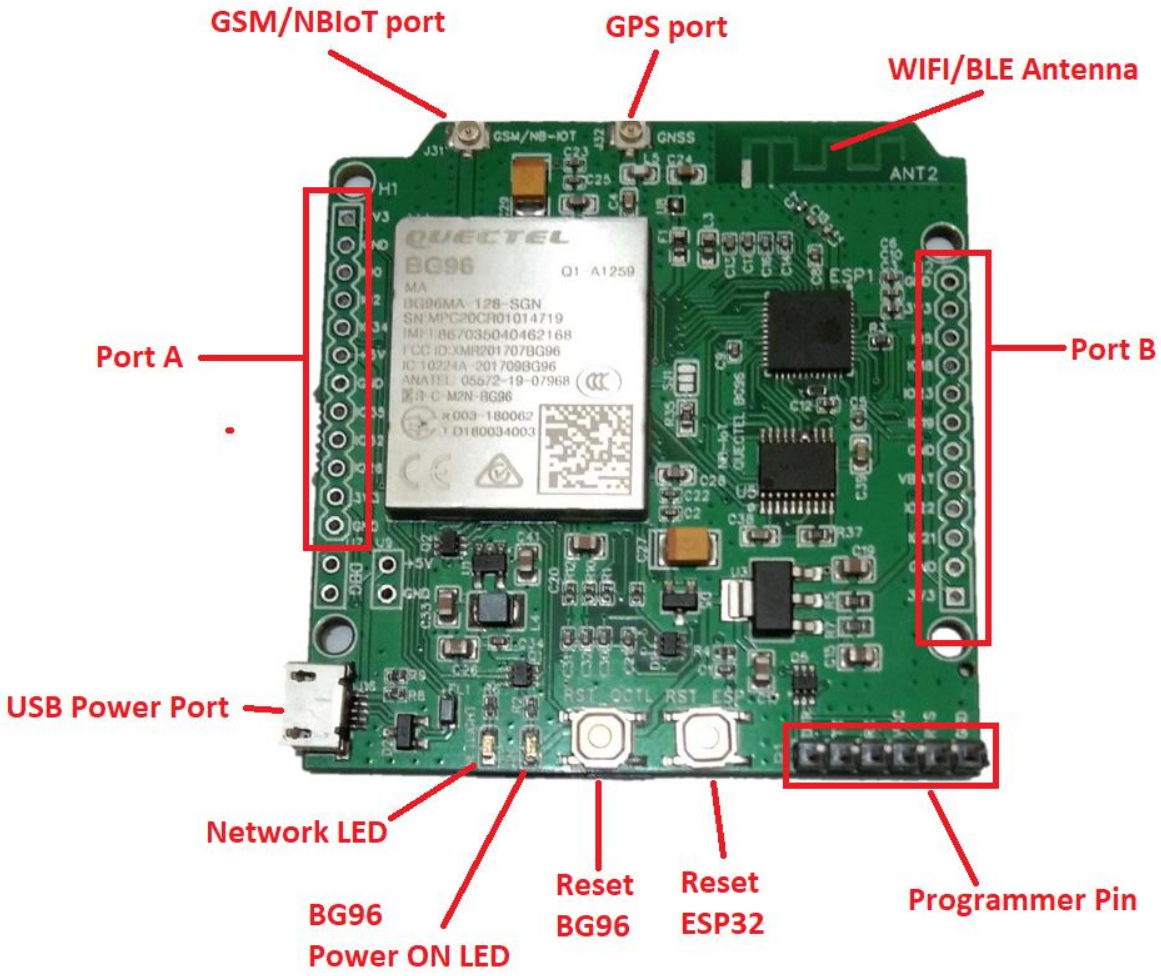


Fig 3.1. Front View

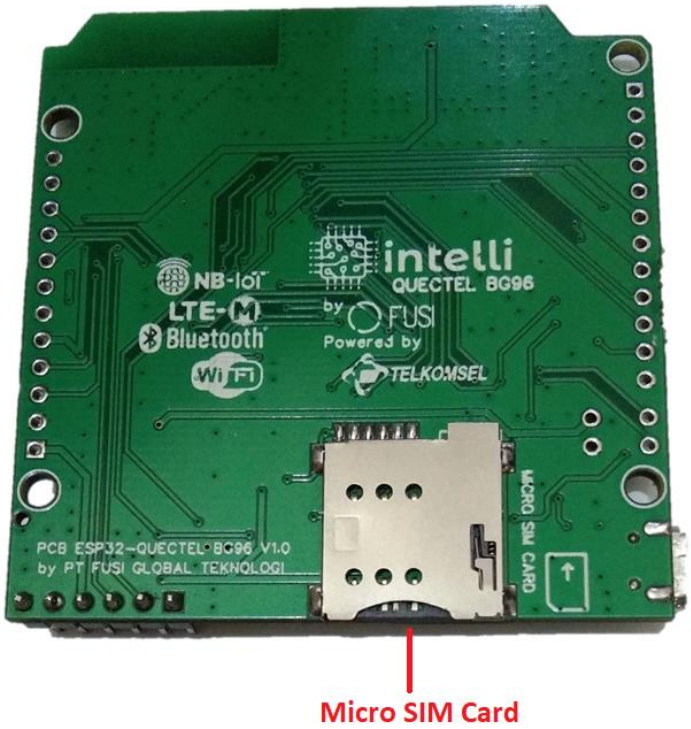


Fig 3.2. Rear View

Port Description

1. Port A
   Contain Power/GND/IO pin from ESP32
2. Port B
   Contain Power/GND/IO pin from ESP32
3. Programmer Port
   Pin for ESP32 programming or access BG96 AT Command
4. USB Power Port
   USB port for 5 VDC main power line and for updating BG96 firmware
5. Micro SIM Card
   Insert micro SIM Card here
6. Reset BG96
   Press to Reset BG96 chip state
7. Reset ESP32
   Press to Reset ESP32chip state
8. GSM/NB-IoT port
   U.fl port standard for GSM/NB-IoT antenna
9. GPS port
   U.fl port standard for GPS antenna, support 5V active antenna or passive
10. Power On LED

Led indicator, turn on when BG96 is powered ON

11. Network LED
    Led indicator, blinking to indicate BG96 network activity

Logic Level Changes	Network Status
Flicker slowly (200ms High/1800ms Low)	Network searching
Flicker slowly (1800ms High/200ms Low)	Idle
Flicker quickly (125ms High/125ms Low)	Data transfer is ongoing
Always high	Voice calling

4 Getting Started

4.1 AT Command Mode

The board is shipped with default "**serial passthrough**" firmware so users can directly access BG96 AT command using any serial terminal program.

4.1.1 Board setup:

1. Place SIMCard on SIM card connector and put the GSM antenna to ufl GSM/NBIoT connector
2. Optional, put the GPS antenna to ufl GPS connector
3. Connect the USB FTDI Serial to programmer port on Intelli Board

No	USB FTDI pin		Intelli BG96 NB IoT pin
1	TXD	<->	RX
2	RXD	<->	TX
3	GND	<->	GND

4. Open and connect serial terminal software using this configurations:
    a. Baudrate : 115200
    b. Parity : none
    c. Data Bits : 8 bits
    d. Stop Bits : 1 bit
    e. Hardware Flow Control : None
    f. End of Line : CR & LF
5. Power up the board (5V DC) via usb micro port
6. Wait until "Ready for AT command" message appears. Or the LED indicator on board "ON" is turned on, and "NETLIGHT" is blinking.
7. Write "ATI" on terminal program and send it. If the board respond with BG96 response detail then the board is ready for AT command.

4.1.2 AT Command

AT command summary for LTE

No	Command	Description
1	ATI	Command for request product information text
2	AT+QCCID	Command to check ICCID simcard
3	AT+QCFG="nwscanmode",3,1	Command for set to LTE mode
4	AT+QCFG="nwscanseq",030201,1	Command for set network priority NB1 > M1 > 2G
5	AT+QCFG="iotopmode",1,1	Command for select CAT-NB1
6	AT+CGDCONT=1,"IP","nb1internet"	Command for assign APN
7	AT+CFUN=1	Command for setting BG96 to full functionality
8	AT+COPS= ?	Command for query network available, it might takes several minutes
9	AT+COPS= 1,2,"22001",0	Command for assign network operator
10	AT+QIACT=1	Activate PDP context
11	AT+CEREG=1 AT+CEREG?	Command for set EPS Network registration status Command for query EPS Network registration status
12	AT+QCSQ	Command for query and report the signal strength of the current service network
13	AT+QGPS=1	Command for activate GPS.Please put GPS antenna to u.fl connector first. To achieve GPS lock you might need to place the board outdoor or near windows.
14	AT+QGPSLOC=2	Query Coordinate position on decimal format
15	AT+QPRTPARA=3	Command for restore setting to default, in case some miss configuration happened. **Warning!!** do not use this command too often because it affect flash write lifecycle

4.2 Arduino IDE Dev

This instruction is used for develop and evaluate Intelli board using Arduino IDE

4.2.1 Board Setup

Board setup instructions:

1. Place SIMCard on SIM card connector and put the GSM antenna to ufl GSM/NBIoT connector
2. Optional, put the GPS antenna to ufl GPS connector
3. Connect the USB FTDI Serial to programmer port on Intelli Board

No	USB FTDI pin		Intelli BG96 NB IoT pin
1	TXD	<->	RX
2	RXD	<->	TX
3	GND	<->	GND
4	RTS	<->	RTS
5	DTR	<->	DTR

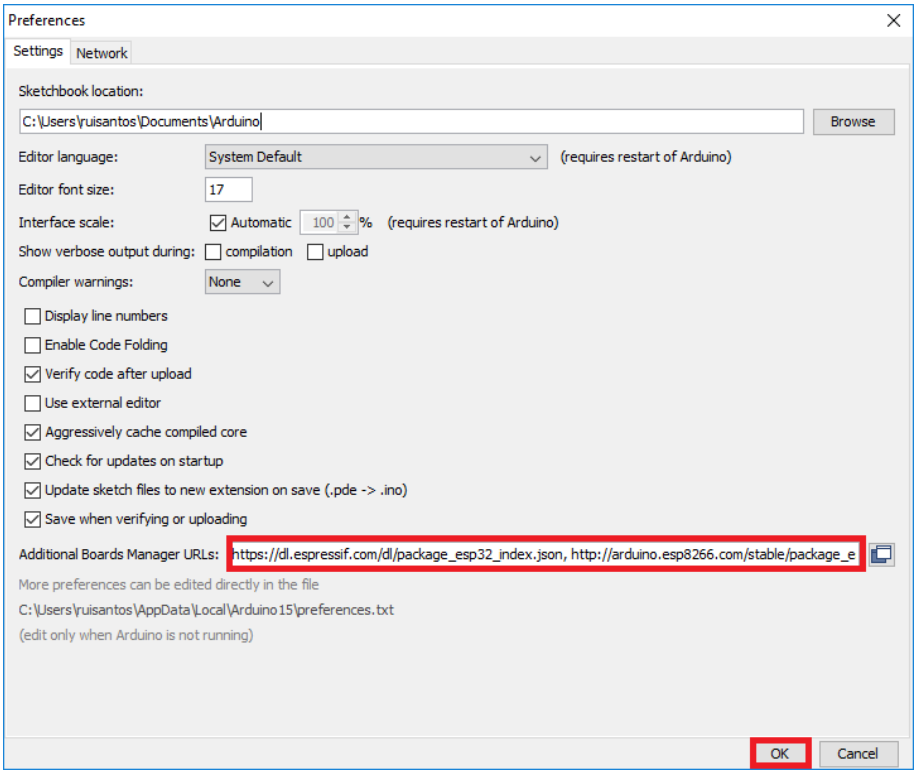
4. Power up the board (5V DC) via usb micro port

4.2.2 Arduino IDE Setup

Arduino IDE setup instructions:

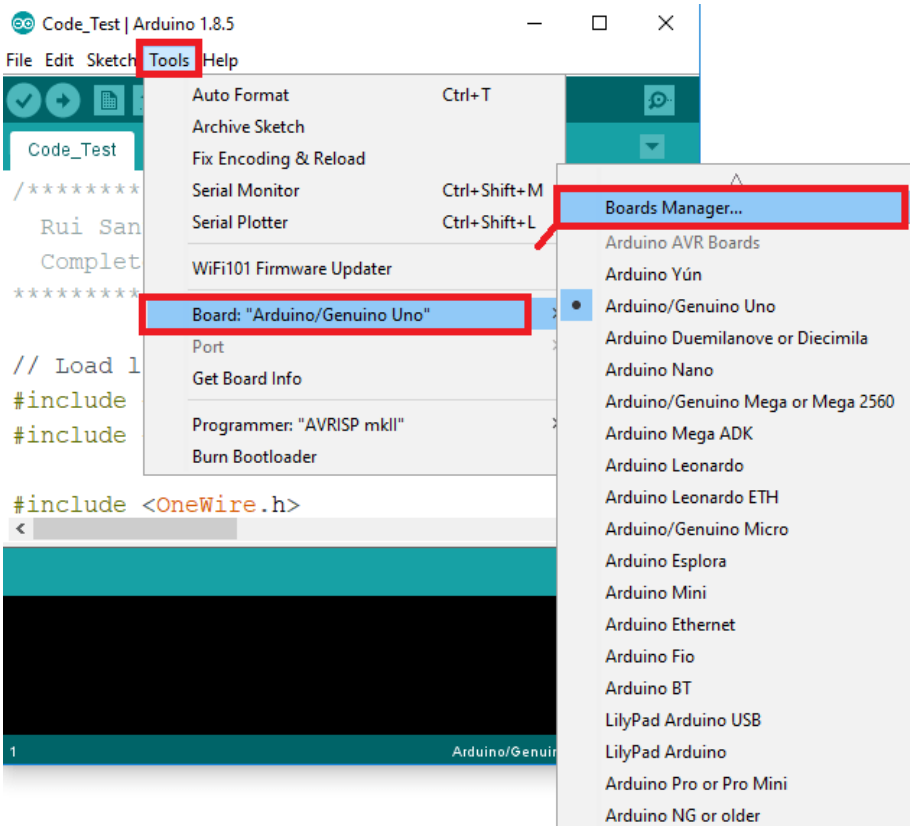
1. Install ESP32 board (summary from https://randomnerdtutorials.com/installing-the-esp32-board-in-arduino-ide-windows-instructions/)

   From **File > Preferences**

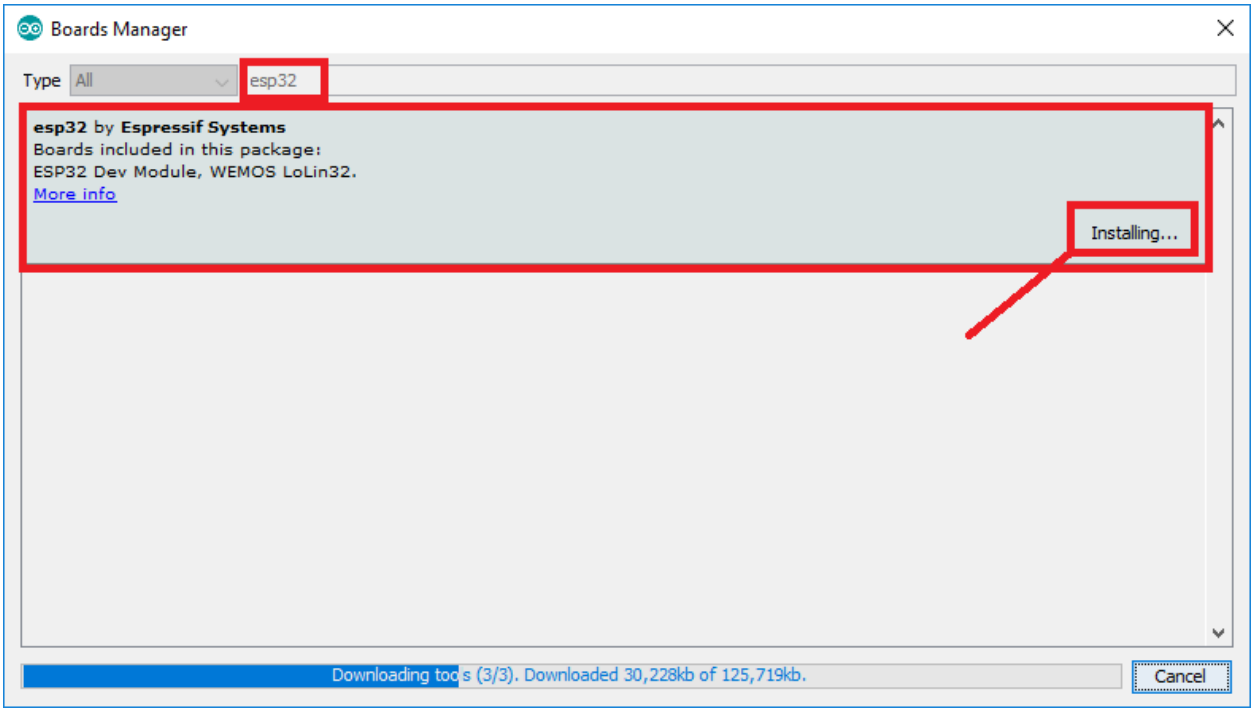


   Enter **https://dl.espressif.com/dl/package_esp32_index.json** into the "Additional Board Manager URLs" field as shown in the figure above. Then, click the "OK" button.

   Go to **Tools** > **Board** > **Boards Manager**



Search for **ESP32** and press install button for the "**ESP32 by Espressif Systems**"

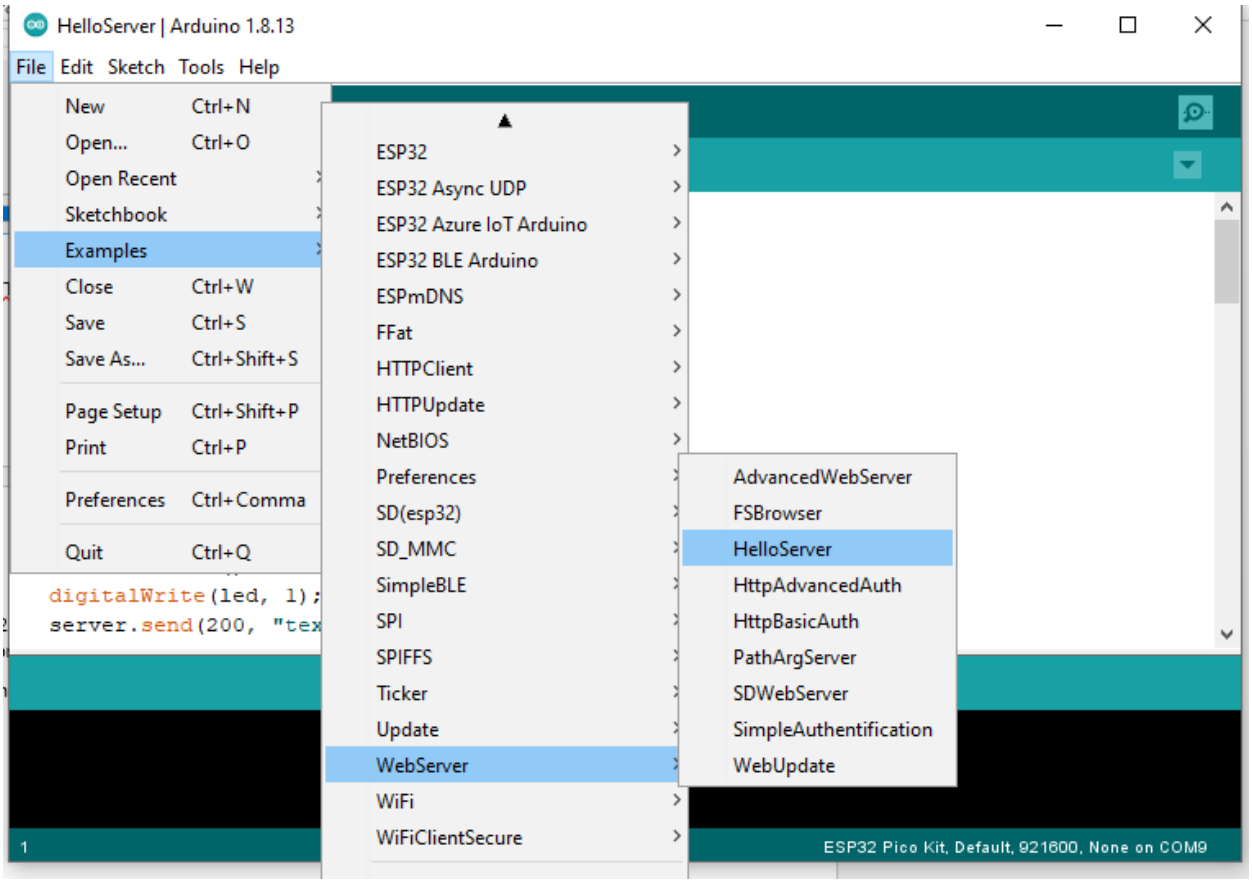


4.2.3 NB-IoT evaluation using MQTT protocol and Octopus IoT cloud

4.2.4 ESP32 example

WIFI evaluation using Hello Server

1. Open **HelloServer.ino** sketch from **File > Examples > WebServer > HelloServer**

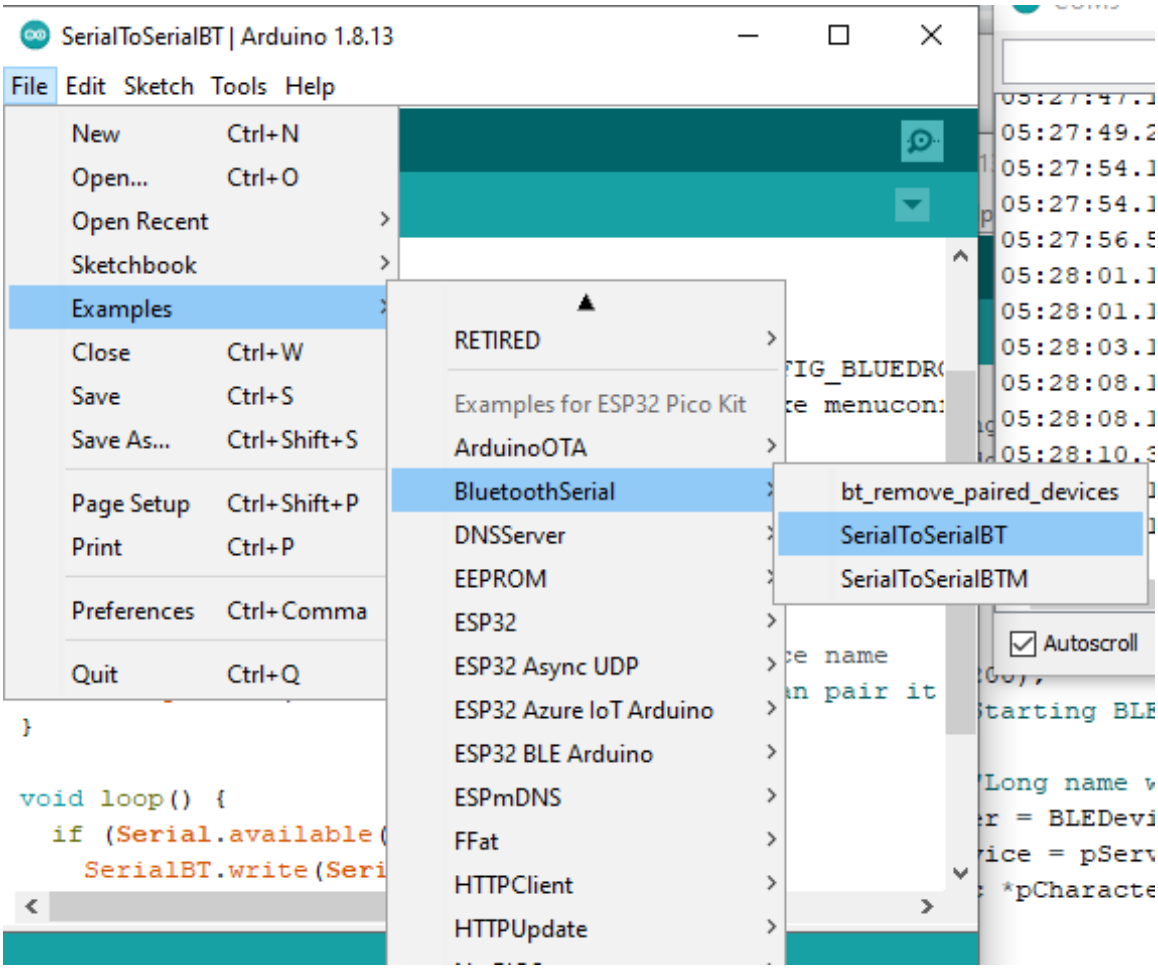


2. Edit the “ssid” and “password” field according to available access point on your location

3. Compile and download by clicking right-arrow button  .
4. After successful download, on serial port you will get information about current esp32 IP Address.
5. Open any browser and enter the IP address
6. You will see “HelloServer” page displayed on browser

BLE Evaluation using SerialToSerialBT

1. Open **SerialToSerialBT.ino** sketch from **File > Examples > BluetoothSerial > SerialToSerialBT**



2. Modify Bluetooth device name if you want
3. Compile and download by clicking right-arrow button  .
4. After successful download, open serial port with baudrate set to 115200
5. Install “Bluetooth Chat” from android playstore
6. Pair the smartphone to ESP32 bluetooth device
7. Try to write some message on Bluetooth Chat App and send it, the ESP32 will receive the message and display it on serial port. Vice versa