

# MQTT Client using SIM900A GPRS and PIC18F4550

## Introduction to MQTT

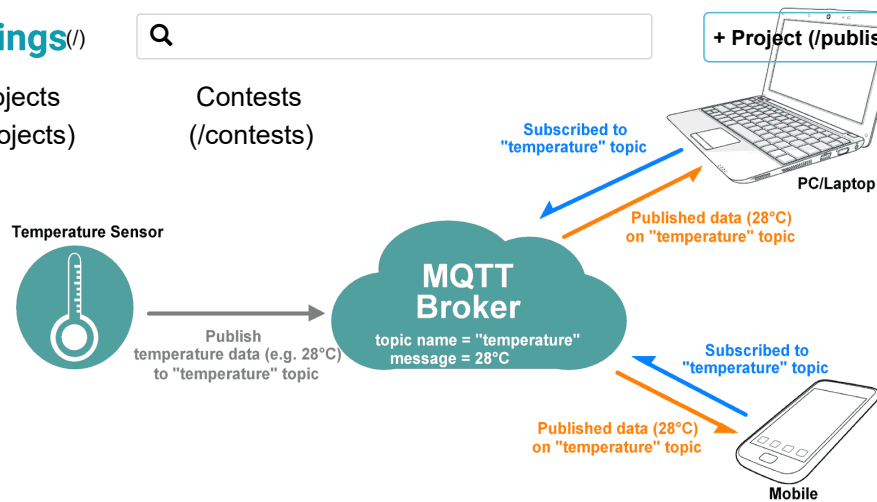


SIM900

SIM900 enables GPRS for embedded applications. We can implement MQTT (<https://en.wikipedia.org/wiki/MQTT>) (Message Queue Telemetry Transport) Client protocol using SIM900 TCP function AT Commands.

MQTT is a lightweight publish-subscribe-based messaging protocol.

- It is quicker (faster) than other request-response based APIs like HTTP.
- It is developed on the base of the TCP/IP protocol.
- It allows remote location devices to connect, subscribe, publish, etc. to a specific topic on the server with the help of a message broker.
- MQTT Broker/Message broker is a module in between the sender and the receiver. It is an element for message validation, transformation, and routing.
- The broker is responsible for distributing messages to the interested clients (subscribed clients) of their interested topic.



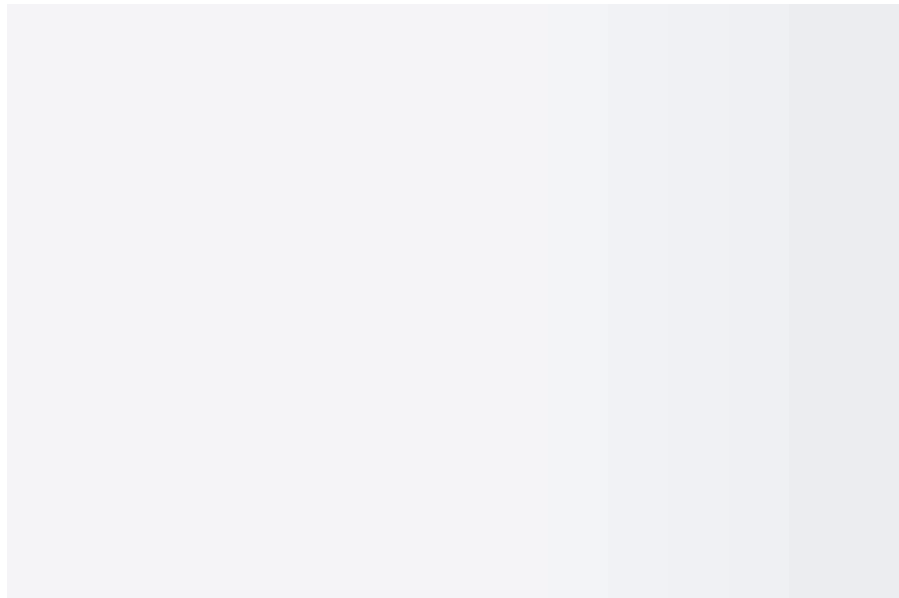
- For example, if the temperature sensor publishes the temperature data (message) on the topic "temperature" then interested clients who have subscribed to the "temperature" topic get that published temperature data as shown in the above figure.

MQTT is widely used in IoT (Internet of Things) embedded applications, where every sensor is connected to a server and we have access to control them over the internet.

To know about SIM900 GSM/GPRS Module refer to SIM900

(<http://electronicwings.com/sensors-modules/sim900a-gsmgprs-module>)

## Connection Diagram of SIM900 GSM Module with PIC18F4550



PIC18F4550 Interface with SIM900

## MQTT Client over GPRS

Let's program PIC18F4550 to configure SIM900A as MQTT Client and Subscribe/Publish data from/to Server using GPRS.

Here we are using the Adafruit server for MQTT Client demo purpose.



In the IOT platform, Adafruit IO Dashboard allows us to visualize and provides control over the connected device to the internet. Anyone can visualize and analyze live data from their sensor devices. To learn more and start with Adafruit IO Dashboard refer link <https://learn.adafruit.com/adafruit-io-basics-dashboards/creating-a-dashboard> (<https://learn.adafruit.com/adafruit-io-basics-dashboards/creating-a-dashboard>)

Just sign up and create a dashboard. After the successful creating of the dashboard, we will get the AIO key which is later used to access feed data.

### Example

Now let's program PIC18F4550 to control LED brightness and monitor POT status on a remote location from the Adafruit dashboard.

Once we created a dashboard on Adafruit we can add various blocks that can be used to control devices as well as monitor the status of devices. To see more about blocks, refer link <https://learn.adafruit.com/adafruit-io-basics-dashboards/adding-blocks> (<https://learn.adafruit.com/adafruit-io-basics-dashboards/adding-blocks>)

In the below program of MQTT Client, do the following

### For MQTT Client Subscribe Demo

```
#define SUBSRCIBE_DEMO          /* Define SUBSRCIBE demo */
// #define PUBLISH_DEMO        /* Define PUBLISH demo */
```

### For MQTT Client Publish Demo

```
// #define SUBSRCIBE_DEMO      /* Define SUBSRCIBE demo */
#define PUBLISH_DEMO          /* Define PUBLISH demo */
```

### Edit Fields below with respective data

```
/* Define Required fields shown below */
#define AIO_SERVER      "io.adafruit.com" /* Adafruit server */
#define AIO_SERVER_PORT "1883"           /* Server port */
#define AIO_BASE_URL    "/api/v2"         /* Base URL for api */
#define AIO_USERNAME    "Enter Username" /* Enter username here */
#define AIO_KEY          "Enter AIO key"   /* Enter AIO key here */
#define AIO_FEED         "Enter Feed Key"  /* Enter feed key */

#define APN              "internet"        /* APN of n/w service provider */
#define USERNAME         ""
#define PASSWORD          ""
```

In the below program, we are using response-based functions to get the better status if things deviate from normal.

### MQTT Packet Formation

MQTT uses many packet formats that used to connect to the server and subscribe or publish to the topic on the server.

Refer below link for MQTT OASIS standard. It will help to understand MQTT packet formations.


[http://docs.oasis-open.org/mqtt/mqtt/v3.1.1/os/mqtt-v3.1.1-os.html#\\_Toc398718027](http://docs.oasis-open.org/mqtt/mqtt/v3.1.1/os/mqtt-v3.1.1-os.html#_Toc398718027)
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## MQTT Client Code for PIC18F4550

```

/*
 * PIC_GPRS_MQTTClient
 * http://www.electronicwings.com
 *
 */

#include "SIM900TCPClient.h"    /* Include TCP Client header file */
#include "math.h"

#define MQTT_PROTOCOL_LEVEL    4

#define MQTT_CTRL_CONNECT      0x1
#define MQTT_CTRL_CONNECTACK   0x2
#define MQTT_CTRL_PUBLISH      0x3
#define MQTT_CTRL_PUBACK       0x4
#define MQTT_CTRL_PUBREC       0x5
#define MQTT_CTRL_PUBREL       0x6
#define MQTT_CTRL_PUBCOMP      0x7
#define MQTT_CTRL_SUBSCRIBE     0x8
#define MQTT_CTRL_SUBACK       0x9
#define MQTT_CTRL_UNSUBSCRIBE   0xA

```

Components Used

Powered By

**SIM900A GSM GPRS Module**  
SIM900A is dual band GSM/GPRS 900/1800MHz modul...  
**X 1**

(https://www.mouser.com/ProductDetail/M5Stack/M031-D?qs=%2Fha2pyFadugEKx3cUjc5DGB4hxc12iWakV7YxEmv6c%3D&utm\_source=electronicswings&utm\_medium=display&utm\_campaign=mouser-componentslisting&utm\_content=0x0)

Datasheet (/components/sim900a-gsm-gprs-module/1/datasheet)

**PIC18f4550**  
PIC18f4550  
**X 1**

(https://www.mouser.in/ProductDetail/Microchip-Technology/PIC18F4550-I-P?qs=oKK8NaWdAJs8nLDXBGwMXw%3D%3D&utm\_source=electronicswings&utm\_medium=display&utm\_campaign=mouser-componentslisting&utm\_content=0x0)

Datasheet (/components/pic18f4550/1/datasheet)

EW

ElectronicWings

(/)

Q

MOUSER

+ Project electronicswing/project

(https://www.mouser.in?utm\_source=electronicswing&utm\_medium=display&utm\_campaign=mouser-componentslisting&utm\_content=0x0)

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## Components Used

Powered By


LED 5mm

LED 5mm

X 1






(https://www.mouser.in/ProductDetail/Lite-On/LTL-307EE?qs=Yz4wJs0d%252BpgyXm%2FpkMp2pg%3D%3D&utm\_source=electronicswings&utm\_medium=display&utm\_campaign=mouser-componentslisting&utm\_content=0x0)



Datasheet (/components/led-5mm/1/datasheet)

## Downloads

<div></div> <div>SIM900 AT Commands</div>	<div>Dow (/api/download/platform-attachment/520) d</div>
<div></div> <div>SIM900 TCP/IP Application Note</div>	<div>Dow (/api/download/platform-attachment/521) d</div>
<div></div> <div>PIC18F4550 GPRS MQTT Client Project file</div>	<div>Dow (/api/download/platform-attachment/522) d</div>

## Comments

jperrijap

[\(/users/jperrijap/profile\)](#)  
 2019-03-29 06:35:14

Hello, thank you very much for this tutorial. It really is very interesting and I'm trying to get it going. I have never used the XC8 compiler but I use it in CCS. It is generating these errors when compiling the code with XC8 compiler. Does anybody have any suggestions?

From already thank you very much. Greetings jose from Argentina.

```
CLEAN SUCCESSFUL (total time: 12ms)
make -f nbproject/Makefile-default.mk SUBPROJECTS= .build-conf
make[1]: Entering directory 'C:/Users/JOSE/Desktop/PIC_GPRS_MQTTClient.X'
make -f nbproject/Makefile-default.mk
dist/default/production/PIC_GPRS_MQTTClient.X.production.hex
make[2]: Entering directory 'C:/Users/JOSE/Desktop/PIC_GPRS_MQTTClient.X'
"C:\Program Files (x86)\Microchip\xc8\v2.05\bin\xc8-cc.exe" -mcpu=18F4550 -c -fno-
short-double -fno-short-float -memi=wordwrite -fasmfile -maddrqual=ignore -
xassembler-with-cpp -Wa,-a -DXPRJ_default=default -msummary=-psect,-
class,+mem,-hex,-file -ginhx032 -WI,--data-init -mno-keep-startup -mno-download -
mdefault-config-bits -std=c99 -gdwarf-3 -mstack=compiled:auto:auto:auto -o
build/default/production/USART_Source_File.p1 USART_Source_File.c
"C:\Program Files (x86)\Microchip\xc8\v2.05\bin\xc8-cc.exe" -mcpu=18F4550 -c -fno-
short-double -fno-short-float -memi=wordwrite -fasmfile -maddrqual=ignore -
xassembler-with-cpp -Wa,-a -DXPRJ_default=default -msummary=-psect,-
class,+mem,-hex,-file -ginhx032 -WI,--data-init -mno-keep-startup -mno-download -
mdefault-config-bits -std=c99 -gdwarf-3 -mstack=compiled:auto:auto:auto -o
build/default/production/SIM900TCPCClient.p1 SIM900TCPCClient.c
"C:\Program Files (x86)\Microchip\xc8\v2.05\bin\xc8-cc.exe" -mcpu=18F4550 -c -fno-
short-double -fno-short-float -memi=wordwrite -fasmfile -maddrqual=ignore -
xassembler-with-cpp -Wa,-a -DXPRJ_default=default -msummary=-psect,-
class,+mem,-hex,-file -ginhx032 -WI,--data-init -mno-keep-startup -mno-download -
mdefault-config-bits -std=c99 -gdwarf-3 -mstack=compiled:auto:auto:auto -o
build/default/production/PIC_GPRS_MQTTClient.p1 PIC_GPRS_MQTTClient.c
PIC_GPRS_MQTTClient.c:117:13: warning: implicit declaration of function 'min' is
invalid in C99 [-Wimplicit-function-declaration]
sendlen = min(len, 250);
^
PIC_GPRS_MQTTClient.c:154:6: warning: address of array 'will_topic' will always
evaluate to 'true' [-Wpointer-bool-conversion]
if (will_topic && strlen(will_topic) != 0) {
^~~~~~
PIC_GPRS_MQTTClient.c:181:6: warning: address of array 'will_topic' will always
evaluate to 'true' [-Wpointer-bool-conversion]
if (will_topic && strlen(will_topic) != 0) {
^~~~~~
PIC_GPRS_MQTTClient.c:154:6: warning: comparison of array 'will_topic' not equal to
a null pointer is always true [-Wtautological-pointer-compare]
if (will_topic && strlen(will_topic) != 0) {
^~~~~~
PIC_GPRS_MQTTClient.c:181:6: warning: comparison of array 'will_topic' not equal to
a null pointer is always true [-Wtautological-pointer-compare]
if (will_topic && strlen(will_topic) != 0) {
^~~~~~
5 warnings generated.
```



```

"C:\Program Files (x86)\Microchip\xc8\v2.05\bin\xc8-cc.exe" -mcpu=18f4550 -Wl,-
Map=dist/default/production/PIC_GPRS_MQTTClient.X.production.map
DXPRJ_default=default -Wl,-defsym=__MPLAB_BUILD=1 -fno-short-double -fno-
short-float -mno-asmwrite -fasmf -maddrqual=ignore -xassembler-with-cpp -
Wa,-a -msummary -pscc,-class,+mem,-hex,-file -ginhx032 -Wl,-data-init -mno-keep-
startup -mno-download -mdefault-config-bits-std=c99 -gdwarf-3 -
mstack=compiled:auto:auto:auto -Wl,-
memorysummary,dist/default/production/memoryfile.xml -o
dist/default/production/PIC_GPRS_MQTTClient.X.production.elf
build/default/production/USART_Source_File.p1
build/default/production/PIC_GPRS_MQTTClient.p1
build/default/production/SIM900TCPClient.p1
PIC_GPRS_MQTTClient.c:154:: warning: (750) constant operand to || or &&
PIC_GPRS_MQTTClient.c:181:: warning: (750) constant operand to || or &&
USART_Source_File.c:23:: warning: (520) function "_USART_RxChar" is never called
PIC_GPRS_MQTTClient.c:198:: warning: (520) function "_MQTT_publishPacket" is
never called
PIC_GPRS_MQTTClient.c:304:: warning: (520) function "_ADC_Init" is never called
PIC_GPRS_MQTTClient.c:313:: warning: (520) function "_ADC_Read" is never called
SIM900TCPClient.c:76:: warning: (520) function "_GetResponseBody" is never called
SIM900TCPClient.c:258:: warning: (520) function "_interrupt_ISR" is never called
PIC_GPRS_MQTTClient.c:115:: warning: (1518) direct function call made with an
incomplete prototype (TCPClient_connected)
PIC_GPRS_MQTTClient.c:117:: warning: (1518) direct function call made with an
incomplete prototype (min)
PIC_GPRS_MQTTClient.c:117:: warning: (1464) number of arguments passed to
function "_min" does not match function's prototype
PIC_GPRS_MQTTClient.c:130:: warning: (1518) direct function call made with an
incomplete prototype (TCPClient_DataRead)
PIC_GPRS_MQTTClient.c:128:: warning: (1518) direct function call made with an
incomplete prototype (TCPClient_DataAvailable)
PIC_GPRS_MQTTClient.c:83:: warning: (759) expression generates no code
PIC_GPRS_MQTTClient.c:230:: warning: (1350) pointer operands to "-" must reference
the same array
PIC_GPRS_MQTTClient.c:345:: warning: (1518) direct function call made with an
incomplete prototype (SIM900_Start)
PIC_GPRS_MQTTClient.c:346:: warning: (1518) direct function call made with an
incomplete prototype (TCPClient_Shut)
PIC_GPRS_MQTTClient.c:349:: warning: (1518) direct function call made with an
incomplete prototype (AttachGPRS)
PIC_GPRS_MQTTClient.c:396:: warning: (1518) direct function call made with an
incomplete prototype (TCPClient_connected)
:0:: error: (499) undefined symbol:
    _min(dist/default/production\PIC_GPRS_MQTTClient.X.production.o)
(908) exit status = 1
nbproject/Makefile-default.mk:169: recipe for target
'dist/default/production/PIC_GPRS_MQTTClient.X.production.hex' failed
make[2]: Leaving directory 'C:/Users/JOSE/Desktop/PIC_GPRS_MQTTClient.X'
nbproject/Makefile-default.mk:90: recipe for target 'build-conf' failed
make[1]: Leaving directory 'C:/Users/JOSE/Desktop/PIC_GPRS_MQTTClient.X'
nbproject/Makefile-impl.mk:39: recipe for target 'build-impl' failed
make[2]: *** [dist/default/production/PIC_GPRS_MQTTClient.X.production.hex] Error
1
make[1]: *** [build-conf] Error 2
make: *** [build-impl] Error 2

BUILD FAILED (exit value 2, total time: 5s)
Reply Like

lokeshc
(/users/lokeshc/profile)
2019-03-29 14:47:27

```





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It will not directly compile on CCS. As a definition of XC8 & CCS are not same.

Also, you can see there is header file pic18f4550.h or xc.h which are specific to

XC compiler. So configuration bits header file will not also directly compile on CCS, as it is generated using XC compiler.

Reply Like

Project (/publish/project)



jesech1978

(/users/jesech1978/profile)  
2019-04-12 18:11:06

I'm trying to port this code to the MikroC compiler and I've issues on the same part of the code. Is located on MQTT\_connectpacket function, and the problem is with the definition of Will\_topic variable (array) and later comparations using && comparations. Can you review it? Thanks!!!

Reply Like

AshutoshP

(/users/AshutoshP/profile)  
2021-05-17 18:00:20

I am able to publish with this programm But cant subscribe. That is I dont see any data in Buffer eventhough I enter data in AIO feed.

Also when we send connect packet Why cant we see CONNACK received in the serial buffer array. I cant see any ack recived in serrial buffer register

Reply Like

nnguyenvnhi

(/users/nnguyenvnhi/profile)  
2021-06-27 10:20:57

hello, can you show me your code, i can't PUBLISH the data, if so please email it to nnguyenvnhi@gmail.com, thanks so much, i'm from vietnam

Reply Like

nnguyenvnhi

(/users/nnguyenvnhi/profile)  
2021-06-10 18:46:18

sorry, I can't find AIO FEED, help me, thank you

Reply Like

GulzarSingh

(/users/GulzarSingh/profile)  
2023-06-07 19:48:10

Hi.. I modified the code for ESP8266. I try to connect to thingspeak.com. The connectivity to mqtt3.thingspeak.com over TCP,1883 is successful. Thereafter CONNECT packet is sent. SEND OK response is received and immediately closed response is also received in new line. I can not debug that is this closed sent by ESP8266 or Thingspeak ?

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igshid=1cip10jjttko)

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