Email Notifier

Pieter P

Email notifier

Another great use for IoT devices is displaying things like traffic information, weather forecast, social media updates ... This requires us to send an HTTP GET request to the server of the service we'd like to access. Most popular services have API (Application Programming Interface) documents that explain that explain how you can retrieve certain information, and what format that information is in. In the following example, we'll look at Gmail specifically, but the code should be similar for other services.

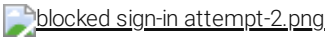
Showing the number of unread emails

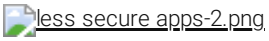
To communicate with Google's Gmail servers, we have to establish a secure connection to the server and send a secure HTTPS request with our email address and password. Gmail will then respond with an XML document containing all kinds of information, like (parts of) your most recent messages and the number of unread emails.

To make sure we don't send our Google password to a malicious server, we have to check the server's identity, using the SHA-1 fingerprint of the SSL certificate. This is a unique sequence of hexadecimal characters that identifies the server.

Allowing access to the email feed

The only way (I know of) to get email information from Google on the ESP currently is the Google Atom Feed. This is an older method, so you have to change your Gmail settings to allow access to the feed.
Go to https://www.google.com/settings/security/lesssecureapps to enable access for "less secure apps":





Until there's support for the new OAuth2 protocol on the ESP, we'll have to use the old, less secure method.

Hardware

Connect an LED (+ resistor) to pin 13, as an *unread email indicator*.

The Code

```
#include <WiFiClientSecure.h>   // Include the HTTPS library
#include <ESP8266WiFi.h>        // Include the Wi-Fi library
#include <ESP8266WiFiMulti.h>   // Include the Wi-Fi-Multi library

ESP8266WiFiMulti wifiMulti;     // Create an instance of the ESP8266WiFiMulti class, called 'wifiMulti'

const char* host = "mail.google.com"; // the Gmail server
const char* url = "/mail/feed/atom";  // the Gmail feed url
const int httpsPort = 443;            // the port to connect to the email server

                                      // The SHA-1 fingerprint of the SSL certificate for the Gmail server (see below)
const char* fingerprint = "D3 90 FC 82 07 E6 0D C2 CE F9 9D 79 7F EC F6 E6 3E CB 8B B3";

                                      // The Base64 encoded version of your Gmail login credentials (see below)
const char* credentials = "ZW1haWwuYWRkcmVzc0BnbWFpbC5jb206cGFzc3dvcmQ=";

const byte led = 13;

void setup() {
  Serial.begin(115200);         // Start the Serial communication to send messages to the computer
  delay(10);
  Serial.println('\n');

  pinMode(led, OUTPUT);

  wifiMulti.addAP("ssid_from_AP_1", "your_password_for_AP_1");   // add Wi-Fi networks you want to connect to
  wifiMulti.addAP("ssid_from_AP_2", "your_password_for_AP_2");
  wifiMulti.addAP("ssid_from_AP_3", "your_password_for_AP_3");

  Serial.println("Connecting ...");
  int i = 0;
  while (wifiMulti.run() != WL_CONNECTED) { // Wait for the Wi-Fi to connect: scan for Wi-Fi networks, and connect to the
strongest of the networks above
    delay(250);
    Serial.print('.');
  }
  Serial.println('\n');
  Serial.print("Connected to ");
  Serial.println(WiFi.SSID());              // Tell us what network we're connected to
  Serial.print("IP address:\t");
  Serial.println(WiFi.localIP());           // Send the IP address of the ESP8266 to the computer
  Serial.println('\n');
```

```
}

void loop() {
  int unread = getUnread();
  if (unread == 0) {
    Serial.println("\r\nYou've got no unread emails");
    digitalWrite(led, LOW);
  } else if (unread > 0) {
    Serial.printf("\r\nYou've got %d new messages\r\n", unread);
    digitalWrite(led, HIGH);
  } else {
    Serial.println("Could not get unread mails");
  }
  Serial.println('\n');
  delay(5000);
}

int getUnread() {    // a function to get the number of unread emails in your Gmail inbox
  WiFiClientSecure client; // Use WiFiClientSecure class to create TLS (HTTPS) connection
  Serial.printf("Connecting to %s:%d ... \r\n", host, httpsPort);
  if (!client.connect(host, httpsPort)) {   // Connect to the Gmail server, on port 443
    Serial.println("Connection failed");    // If the connection fails, stop and return
    return -1;
  }

  if (client.verify(fingerprint, host)) {   // Check the SHA-1 fingerprint of the SSL certificate
    Serial.println("Certificate matches");
  } else {                                  // if it doesn't match, it's not safe to continue
    Serial.println("Certificate doesn't match");
    return -1;
  }
```

How it works

The setup should be pretty familiar by now.
The only new thing is the getUnread() function:
First, it starts an HTTPS connection to the Gmail server on port 443. Then it checks if the fingerprint of the certificate matches, so it knows that it's the real Google server, and not some hacker. If the certificate doesn't match, it's not safe to send the credentials to the server.

If it matches, we send a HTTP GET request to the server:

```
GET /mail/feed/atom HTTP/1.1\r\n
Host: mail.google.com\r\n
Authorization: Basic aVeryLongStringOfBase64EncodedCharacters=\r\n
User-Agent: ESP8266\r\n
Connection: close\r\n\r\n
```

The request contains the URI we want to access (in this case this is the Atom feed URL), the host (which is mail.google.com), and the base64-encoded version of your login credentials.
As you can see, the different lines of the header are separated by a CRLF (Carriage Return + Line Feed, \r\n). Two CRLF's mark the end of the header.
The Gmail server will process our request, and send the feed as a response over the same HTTPS connection. This response is an XML document, that consists of tags with angled brackets, just like HTML. If you need a lot of data, it's recommended to use a proper XML parser library, but we only need one tag, so we can just skim through the response text until we find the <fullcount>x</fullcount> tag. The number inside this tag is the number of unread emails in the inbox.
We can just convert it to an integer, and stop reading.

This is the format of the XML feed, you can see the fullcount tag on line 5:

```
<?xml version="1.0" encoding="UTF-8"?>
<feed xmlns="http://purl.org/atom/ns#" version="0.3">
    <title>Gmail - Inbox for esp8266.test.mail@gmail.com</title>
    <tagline>New messages in your Gmail Inbox</tagline>
    <fullcount>5</fullcount>
    <link rel="alternate" href="https://mail.google.com/mail" type="text/html" />
    <modified>2017-03-05T15:54:06Z</modified>
    <entry>
        <title>New sign-in from Firefox on Linux</title>
        <summary>New sign-in from Firefox on Linux Hi ESP8266, Your Google Account esp8266.test.mail@gmail.com was just used
to sign in from Firefox on Linux. ESP8266 Test esp8266.test.mail@gmail.com Linux Sunday,</summary>
        <link rel="alternate" href="https://mail.google.com/mail?
account_id=esp8266.test.mail@gmail.com&amp;message_id=123456789&amp;view=conv&amp;extsrc=atom" type="text/html" />
        <modified>2017-03-05T15:52:45Z</modified>
        <issued>2017-03-05T15:52:45Z</issued>
        <id>tag:gmail.google.com,2004:12345678912345678 9</id>
        <author>
            <name>Google</name>
            <email>no-reply@accounts.google.com</email>
        </author>
    </entry>

    ...

</feed>
```

The loop just prints the number of unread emails, and turns on an LED if you have unread messages.

Getting the fingerprint of the Gmail server

Like I mentioned before, we need a fingerprint to check the identity of the server. To get this fingerprint, execute the following command in a terminal (Linux & Mac):

```
openssl s_client -connect mail.google.com:443 < /dev/null 2>/dev/null | openssl x509 -fingerprint -noout -in /dev/stdin | sed 's/:/ /g'
```

Copy the hexadecimal fingerprint string and paste it into the sketch on line 12. For example:

```
const char* fingerprint = "D3 90 FC 82 07 E6 0D C2 CE F9 9D 79 7F EC F6 E6 3E CB 8B B3";
```

Encoding your login credentials

To get access to the feed, you have to enter your email address and password. You can't send them as plain text, you have to encode them to base64 first. Use the following command in a terminal (Linux & Mac):

```
echo -n "email.address@gmail.com:password" | base64
```

Then add it to line 15 of the sketch. For example:

```
const char* credentials = "ZW1haWwuYWRkcmVzc0BnbWFpbC5jb206cGFzc3dvcmQ=";
```

Other APIs

Many services send their data in JSON format. If you just need one piece of information, you may be able to use the same approach of scanning the entire JSON text for a certain word, but it's much easier to use a JSON parser, like the ArduinoJson library. It will deserialize the JSON text, and create a JSON object, you could compare it to an associative array. You can browse the entire tree structure, and easily find the data you're looking for.
The downside is that it uses more memory.