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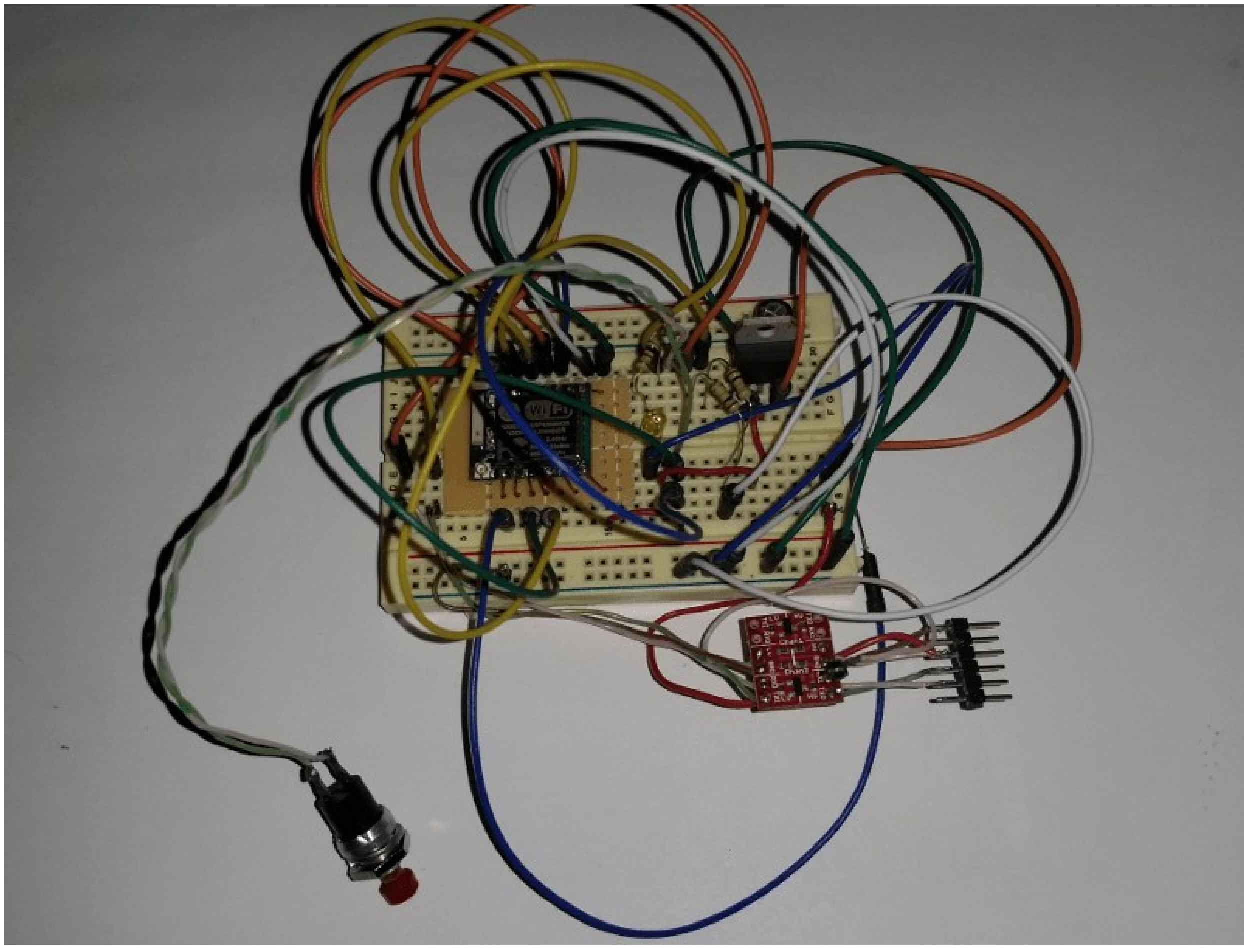
Off-The-Shelf Hacker: Two-Way Comms with the ESP8266

2 Apr 2016 9:21am, by drtorq



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With all the talk of the Internet of Things (IoT), the ESP8266 WiFi system-on-a-chip (SoC) is certainly a good candidate for those types of projects. It's fairly easy to program, has a small physical footprint and is inexpensive. IoT applications for the ESP8266 modules might include sensors, actuators, indicators and projects that need remote two-way communications.

communication between the remote node (the ESP8266 device) and my LAN, servers, the Cloud or user applications.

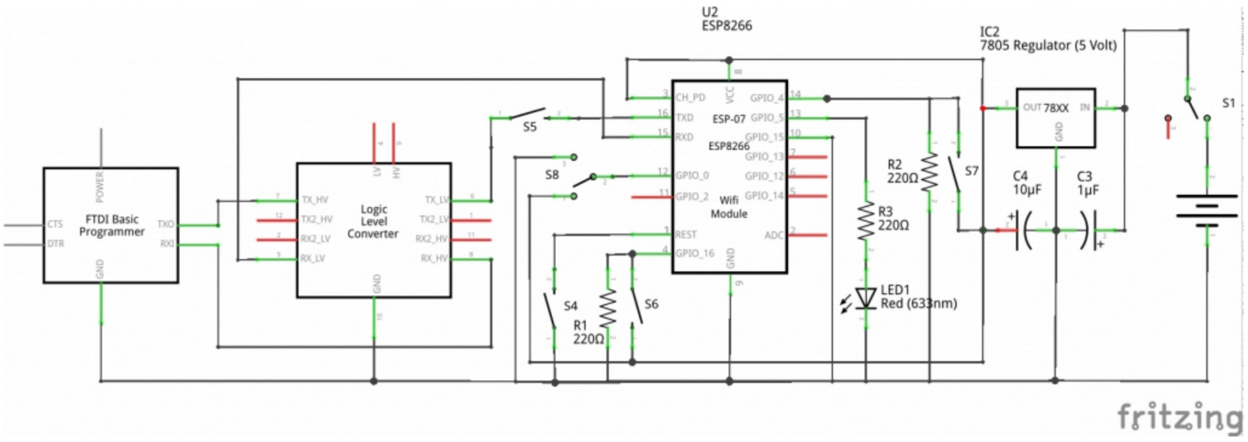
In this installment, I'll cover a basic communication scheme for the ESP8266-07 model. Feel free to expand the concepts to create your own IoT projects.

Frameworks and Setups

As we've discussed in earlier Off-The-Shelf Hacker stories, the ESP8266 chips are programmed using a variety of languages and frameworks. Personally, I like the Arduino IDE. The code syntax makes sense to me, the function libraries are pretty comprehensive and the environment is the same for 8266s, the Arduino and Processing project work. Be sure to review the previous "Read Schematics Like A Pro", "Add WiFi Connectivity to Your DIY Projects with the ESP8266" and "The Split Personality Of The ESP8266 WiFi Chip" The New Stack stories.

The setup for using an ESP8266-07 is similar to the -01 version, except that the -07 has an external antenna connector and more general purpose input/output (GPIO) pins. The physical break board looks pretty complicated.

The circuit is actually pretty straightforward, as shown in this schematic.



ESP8266-07 2-Way Comms Schematic

started with my 2-way communication routine.

The code is broken down into two parts, connecting to an access point (AP) and handling the GPIO.

Part 1 handles joining an access point and comes from the "AutoConnectWithFeedback" example program under the "WiFiManager" category. If the 8266 device hasn't connected to a particular access point before, it starts it's own access point and posts a page on its Web server (http://192.168.4.1), giving a user on a WiFi/browser equipped device (like a Galaxy 5 super phone) the option of choosing which AP to join. At this point, there is a temporary LAN between the 8266 device and the phone. The page then prompts the user for an AP access password. The 8266 will do a reset and connects to the chosen LAN while shutting down the temporary LAN and Web server. If the wifiManager.resetSettings(); line is commented out, it remembers AP credentials, so you don't have to enter the SSID and password each time. Uncomment the line to reset the settings, during programming and troubleshooting.

After the WiFi part of the code is initialized we move on to part 2.

Here's the code for part 1.

```
#include &lt;ESP8266WiFi.h&gt;
#include &lt;DNSServer.h&gt;
#include &lt;ESP8266WebServer.h&gt;
#include &lt;WiFiManager.h&gt;

void configModeCallback (WiFiManager *myWiFiManager) {
Serial.println("Entered config mode");
Serial.println(WiFi.softAPIP());
//if you used auto generated SSID, print it
Serial.println(myWiFiManager-&gt;getConfigPortalSSID());
}

const int ledPin = 5;
const int buttonPin4 = 4;
```

```
void setup(void) {
  Serial.begin(115200);

  WiFiManager wifiManager;
  wifiManager.resetSettings();
  wifiManager.setAPCallback(configModeCallback);

  if(!wifiManager.autoConnect()) {
    Serial.println("failed to connect and hit timeout");
    ESP.reset();
    delay(1000);
  }

  // Configure GPIO2 as OUTPUT.
  pinMode(ledPin, OUTPUT);
  pinMode(buttonPin4, INPUT);

  // Start TCP server.
  server.begin();
```

Manageable Code – Part 2

Part 2 handles reading the button, sending messages to remote machines (like my Galaxy superphone or Linux notebook) and optionally turning an LED on or off.

Interestingly, Part 2 just naturally breaks out in the looping part of the firmware, which actually does the work of the device. Additional functionality would most likely be inserted in this section.

Here's the code for Part 2.

```
void loop(void) {

  // Check if module is still connected to WiFi.
  if (WiFi.status() != WL_CONNECTED) {
    Serial.println("WiFi connected inside void loop");
    while (WiFi.status() != WL_CONNECTED) {
      Serial.println("WiFi.status connected loop");
      delay(500);
  WiFiClient client = server.available();

  if (client) {
    Serial.println("Client connected.");

    while (client.connected()) {

      buttonState4 = digitalRead(buttonPin4);
        // Serial.println(buttonState4);
        if (buttonState4 == HIGH) {
          // digitalWrite(5, HIGH);
          Serial.println("Button pushed");
          client.write("Button pushed\n");
        }

      if (client.available()) {

        char command = client.read();
        if (command == 'H') {
          digitalWrite(ledPin, HIGH);
          Serial.println("LED is now on.");
          client.write("LED is now on.");
        }
        else if (command == 'L') {
          digitalWrite(ledPin, LOW);
          Serial.println("LED is now off.");
          client.write("LED is now off.");
        }
     }
    }
    Serial.println("Client disconnected.");
    client.stop();
  }
}

void printWiFiStatus() {
  Serial.println("");
  Serial.print("Connected to ");
  // Serial.println(ssid);
  Serial.print("IP address: ");
  Serial.println(WiFi.localIP());
}
```

both a Linux notebook and my Galaxy 5 phone while assembling this story. When the button is pushed, the 8266 sends a "button pushed" text message to the remote client machine. If the remote machine sends an "H" character to the 8266 device, it lights up the LED. Likewise, sending an "L" character turns the LED off. Make your messages depending on your functional needs.

The printWiFiStatus() code simply sends status information to the serial terminal and is useful for development and troubleshooting.

Going Further

A basic two-way communication scheme is a reasonable starting point for expansion, with more buttons, sensors, outputs and so on. Since the LAN configuration code is built-in using library functions, it's also easy to use the device in different locations, with little extra effort. A little bit of planning and logistics could make the concepts outlined today scalable to larger projects with multiple devices and locations.

Once you have the buttons or sensors and output devices established, it's easy to change behavior by just modding and uploading new firmware.

You might look at the ESP8266WiFiMesh and ESP8266WiFi examples for additional project ideas.

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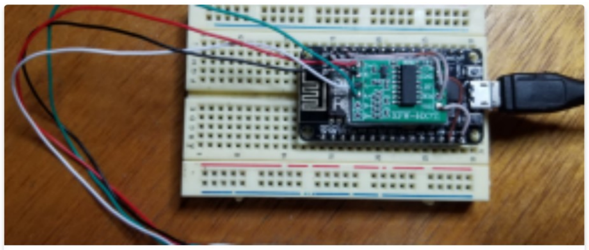

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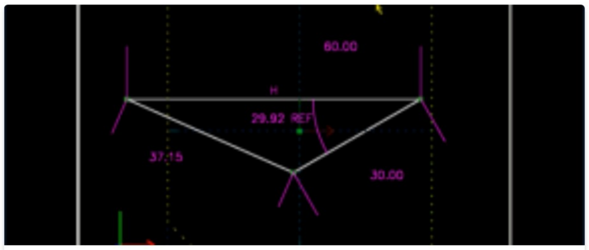

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