Hour of Code:

Saluda Trail Middle School

Rock Hill, SC

December 6, 2017

https://goo.gl/Rf6EC2

DELL Technologies

Goals

- Whirlwind Tour of IoT
- Explore the Possibilities
- Hands-On
- Hardware
- Front-end and Back-end coding
- Have Fun

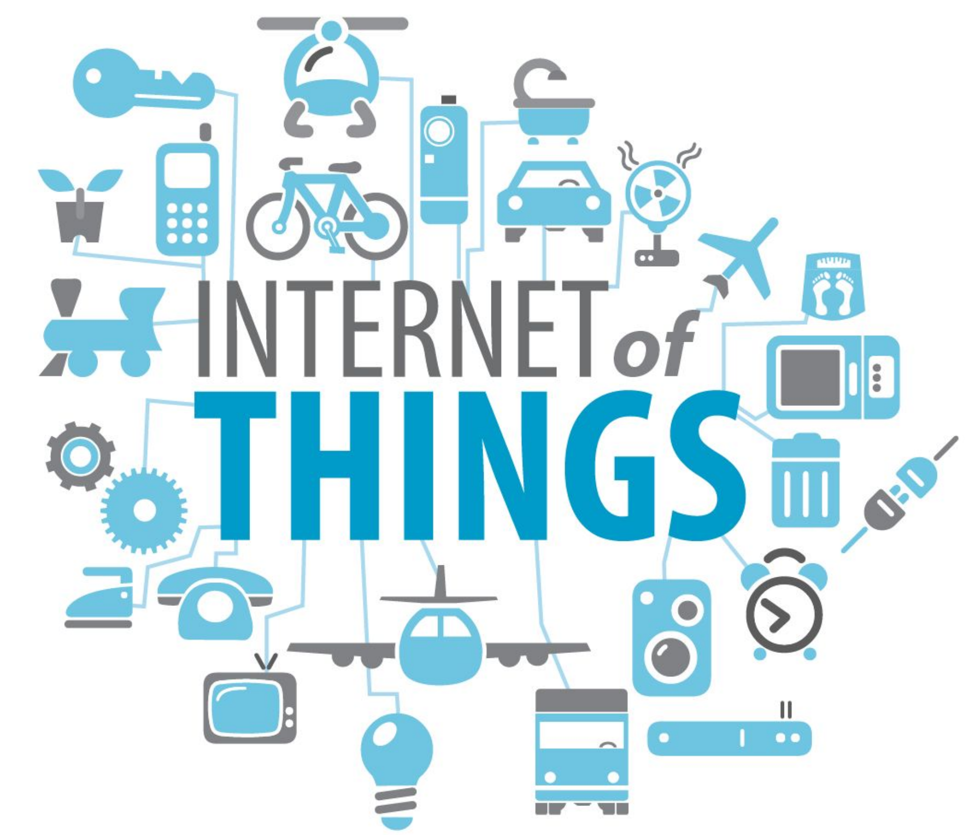
Agenda

- What is IoT
- Particle Photon
  - IoT Hardware
- Back-end Programming
  - Particle Photon Firmware
- Front-end Programming
  - Create Simple Web Form to Manipulate Photon
- If This Then That (IFTTT)
  - Photon Communication with other Web Services

Day of Code Links

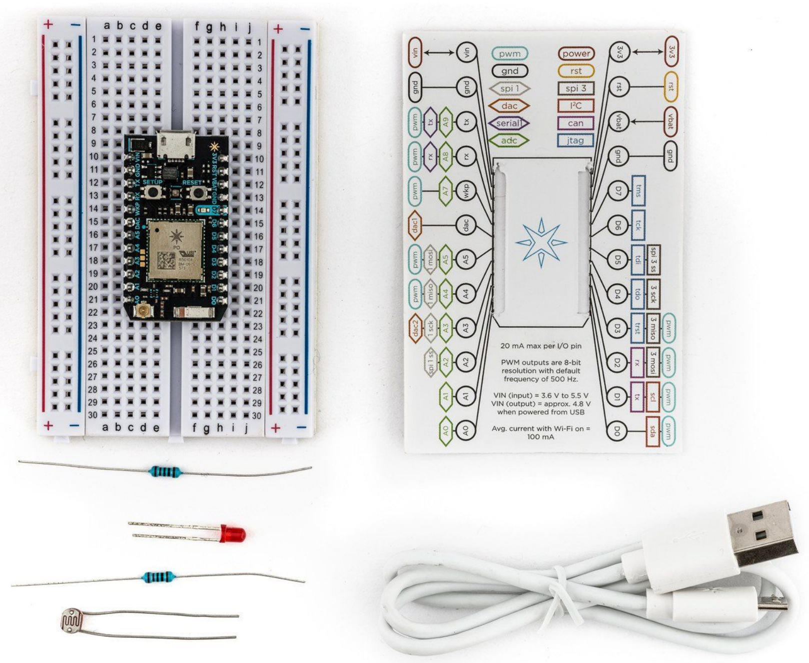
- GitHub Code Repository
  - https://github.com/sctutor/HourOfCode2017
- Particle Integrated Development Environment (IDE)
  - https://build.particle.io/build/new
- If This Then That (IFTTT) IoT Aggregation Service
  - https://ifttt.com/discover

Internet of Things



Source

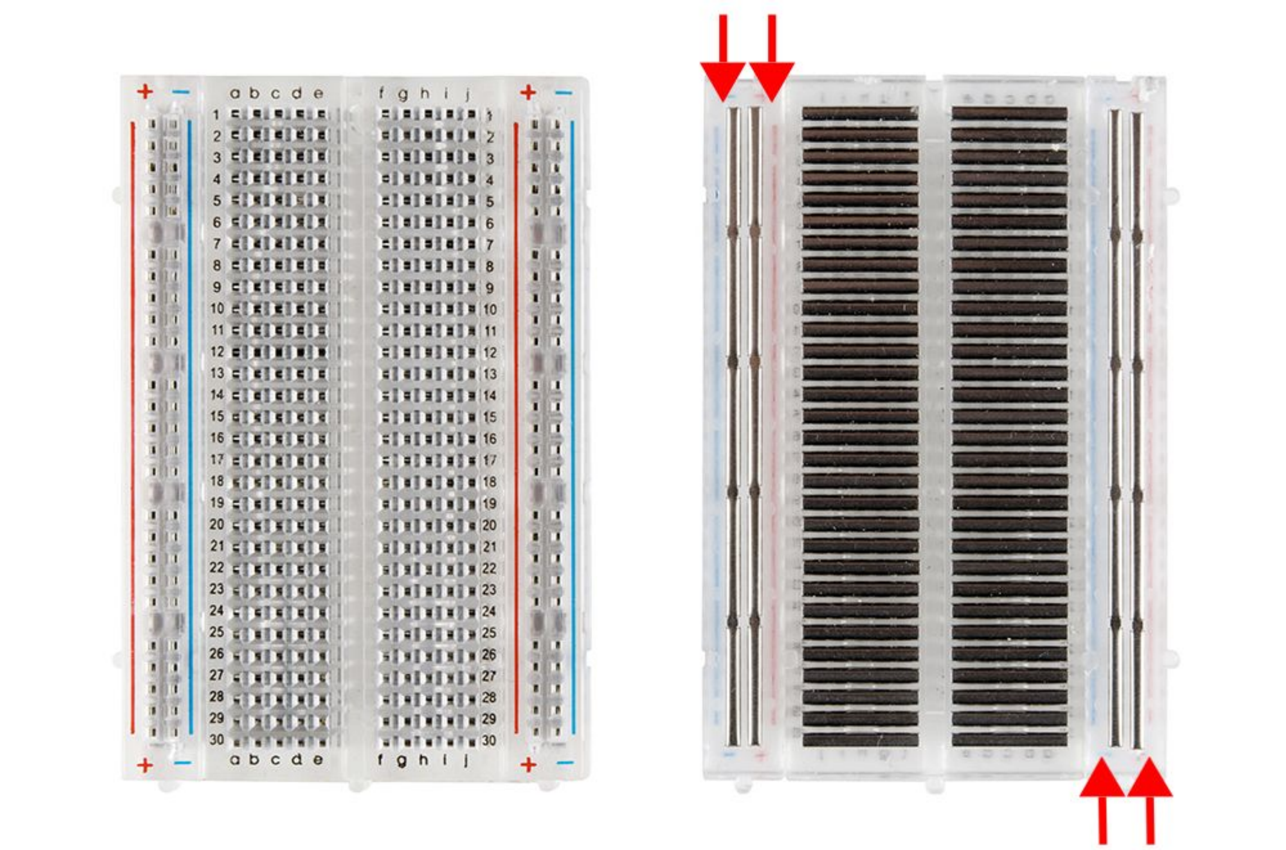
Particle Photon


pwm
gnd
spi 1
dac
serial1
adc
power
rst
spi 3
I²C
can
jtag
20 mA max per I/O pin
PWM outputs are 8-bit resolution with default frequency of 500 Hz.
VIN (input) = 3.6 V to 5.5 V
VIN (output) = approx. 4.8 V when powered from USB
Avg. current with Wi-Fi on = 100 mA

The Photon is a $29 tiny Wi-Fi development kit for creating connected projects and products for the Internet of Things.

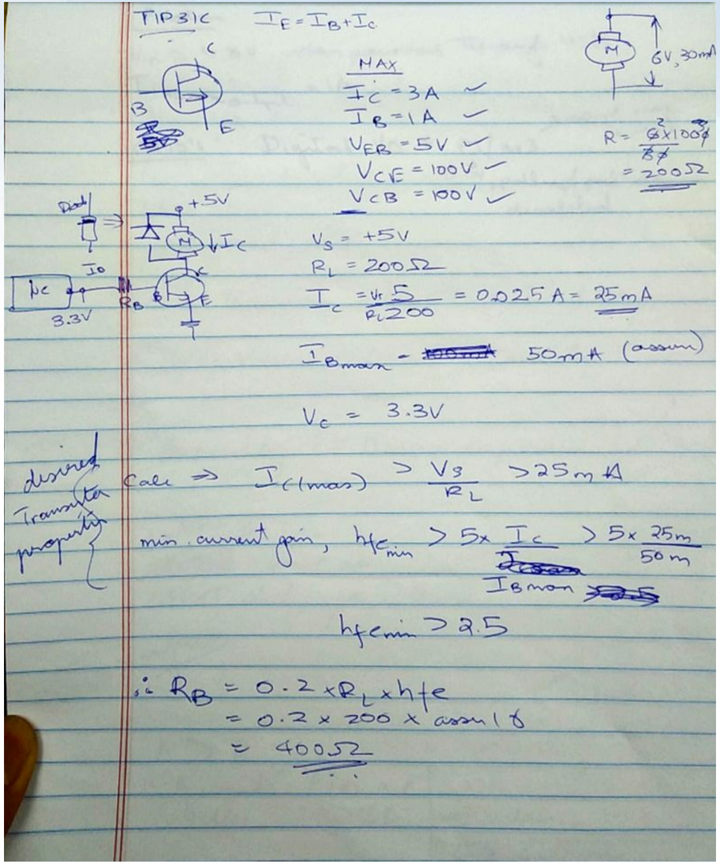
Source

Prototype Breadboard



Source

Mini-Fan Design Math


C
B
E
Diode
+5V
M
I_C
I_O
μc
R_B
B
C
E
3.3V
M
6V, 30mA

TIP31C

$I_E = I_B + I_C$

MAX

$I_C = 3A$ ✓

$I_B = 1A$ ✓

$V_{EB} = 5V$ ✓

$V_{CE} = 100V$ ✓

$V_{CB} = 100V$ ✓

$R = \frac{\cancel{6}^{2} \times 100\cancel{0}}{\cancel{3}\cancel{0}}$

$= \underline{200\Omega}$

$V_S = +5V$

$R_L = 200\Omega$

$I_C = \frac{V_S\ 5}{R_L\ 200} = 0.025A = \underline{25mA}$

$I_{B_{max}}$ - ~~100mA~~ 50mA (assum)

$V_c = 3.3V$

desired Transistor properties

Calc ⇒ $I_{C(max)} > \frac{V_S}{R_L} > 25mA$

min. current gain, $h_{fe_{min}} > 5 \times \frac{I_C}{I_{B\,max}} > 5 \times \frac{25m}{50m}$

$h_{fe_{min}} > 2.5$

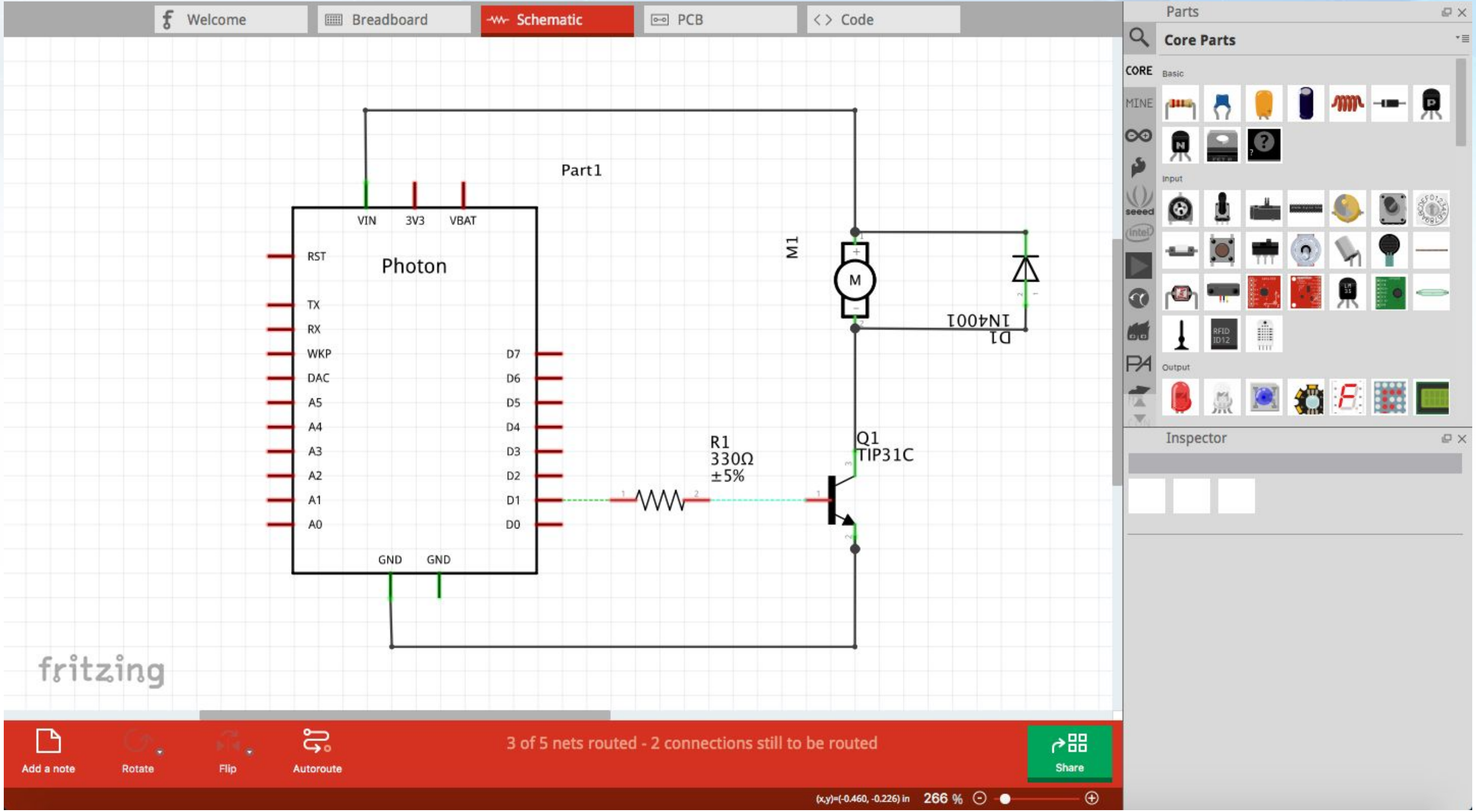
∴ $R_B = 0.2 \times R_L \times h_{fe}$

$= 0.2 \times 200 \times$ assum 10

$= \underline{400\Omega}$

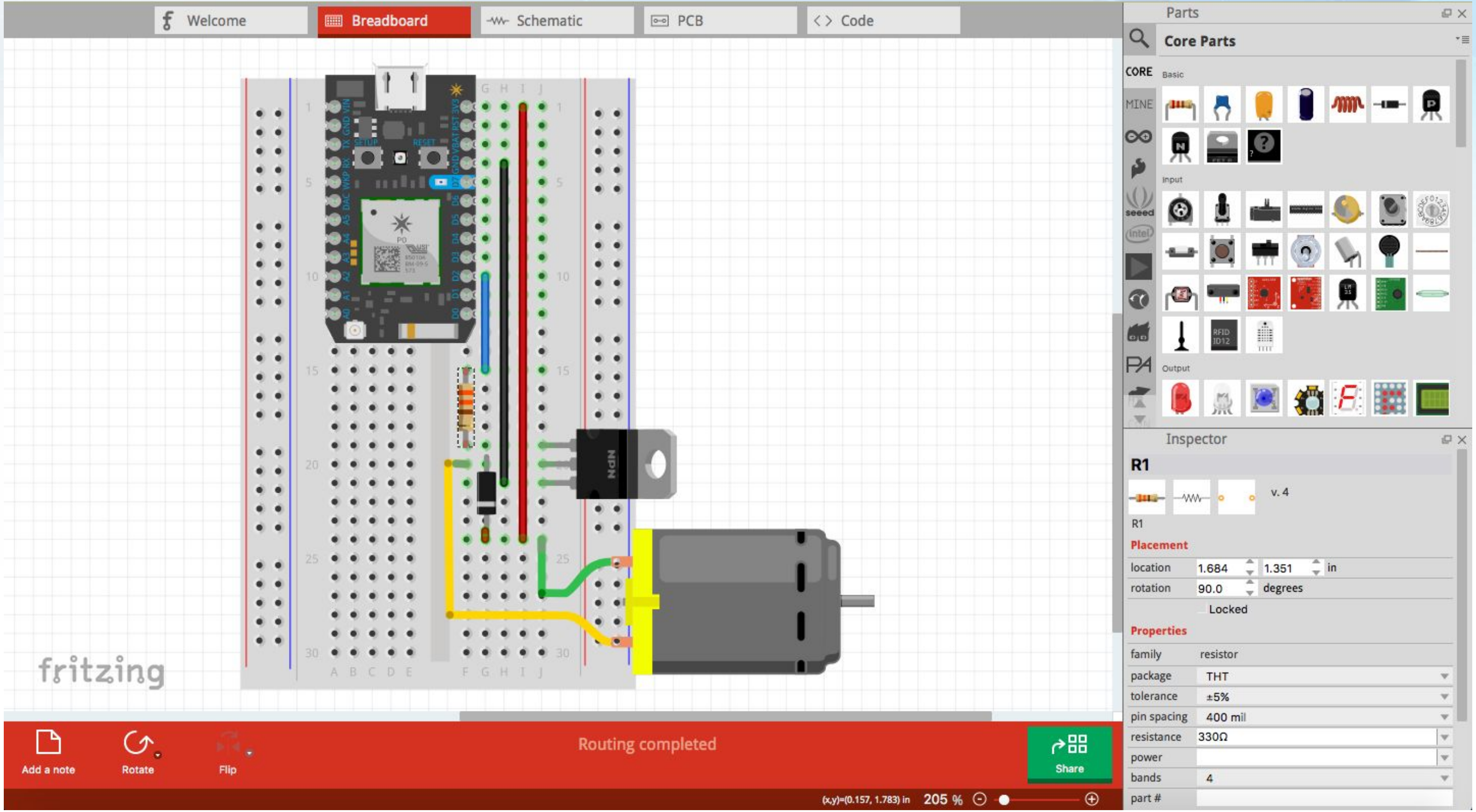
Source

Fritzing - Mini-Fan Circuit



3 of 5 nets routed - 2 connections still to be routed

Fritzing - Mini-Fan Breadboard



Routing completed

(x,y)=(0.157, 1.783) in 205 %

Inspector

R1

v. 4

R1

Placement

location 1.684 1.351 in

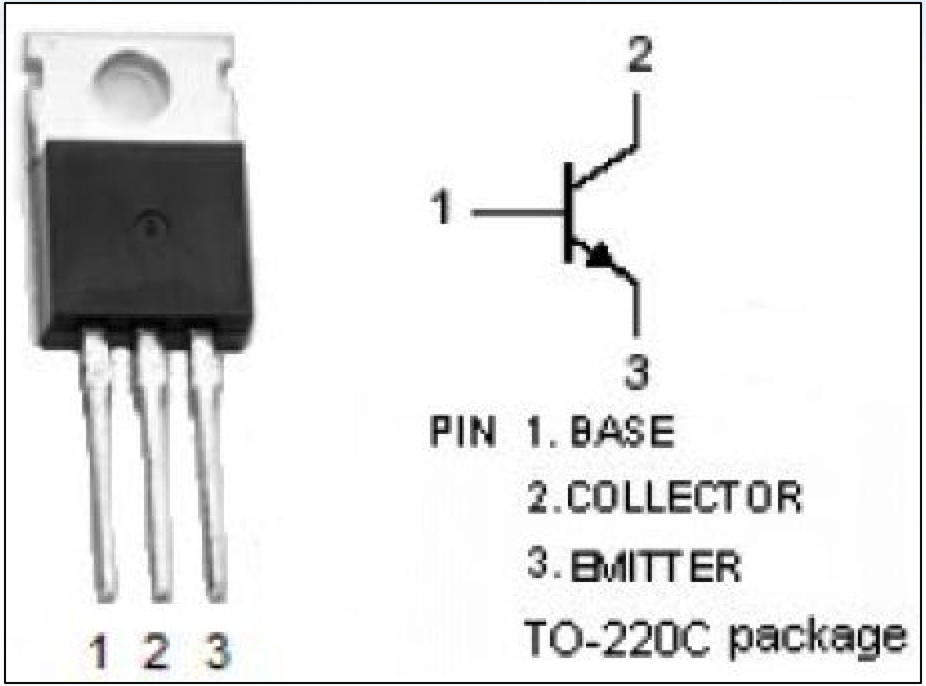
rotation 90.0 degrees

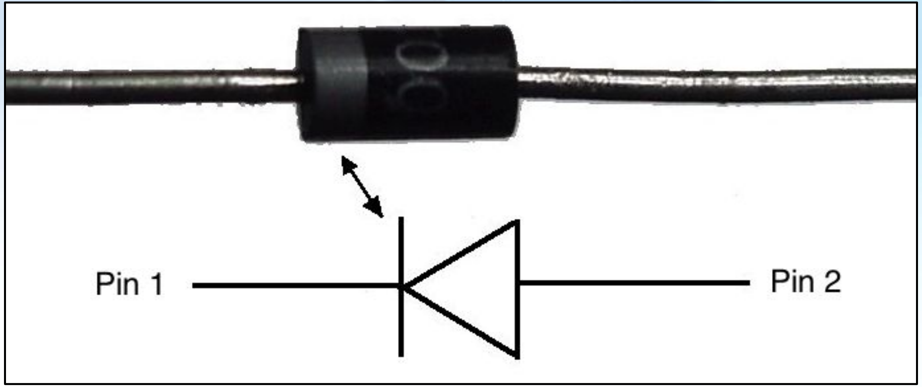
Locked

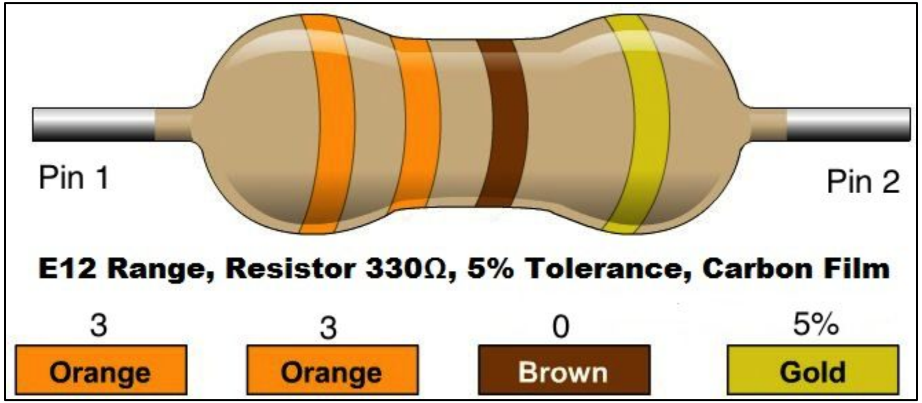
Properties

family	resistor
package	THT
tolerance	±5%
pin spacing	400 mil
resistance	330Ω
power	
bands	4
part #	

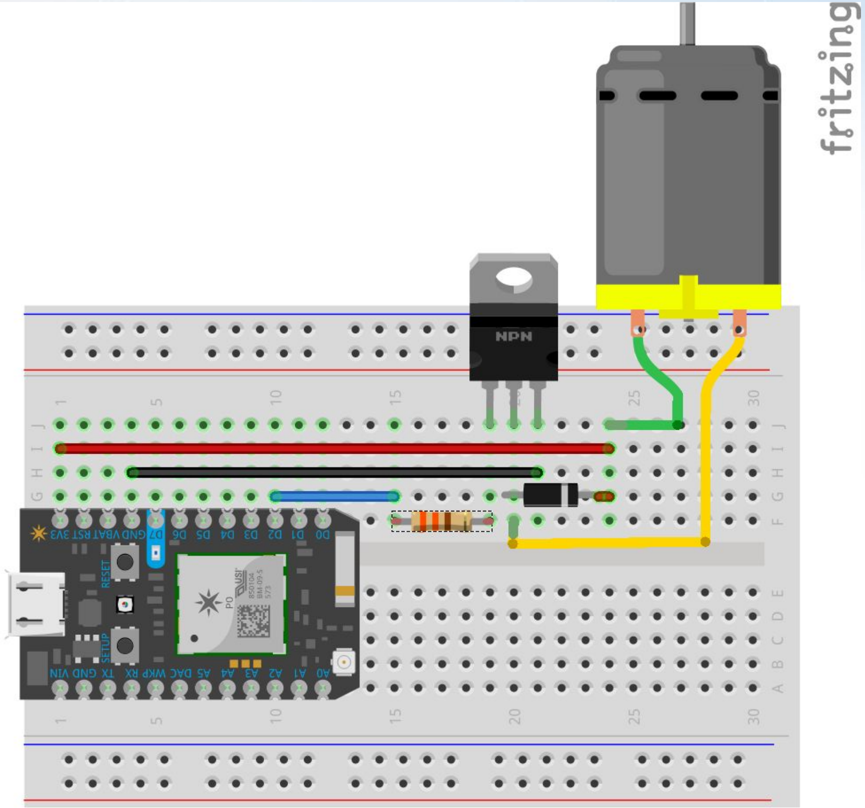
Orientation Matters - Pin #1

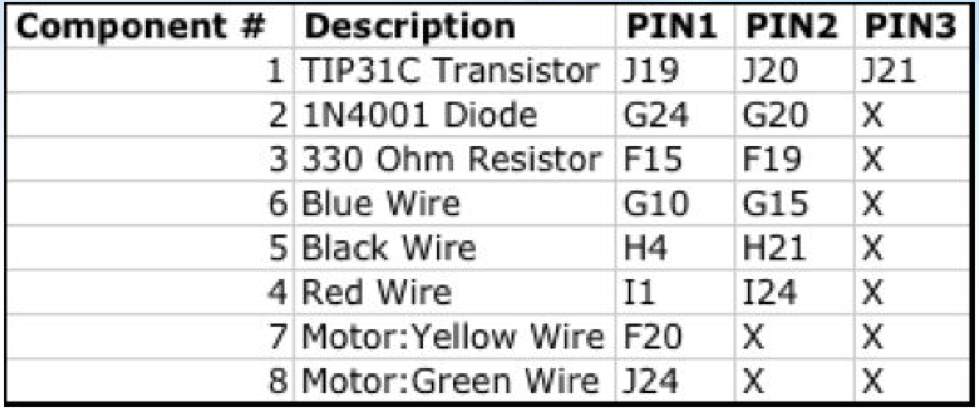






Insert Components in Breadboard


fritzing
NPN
RESET
SETUP
3V3 RST VBAT GND D7 D6 D5 D4 D3 D2 D1 D0
VIN GND TX RX WKP DAC A5 A4 A3 A2 A1 A0
1
5
10
15
20
25
30
J
I
H
G
F
E
D
C
B
A

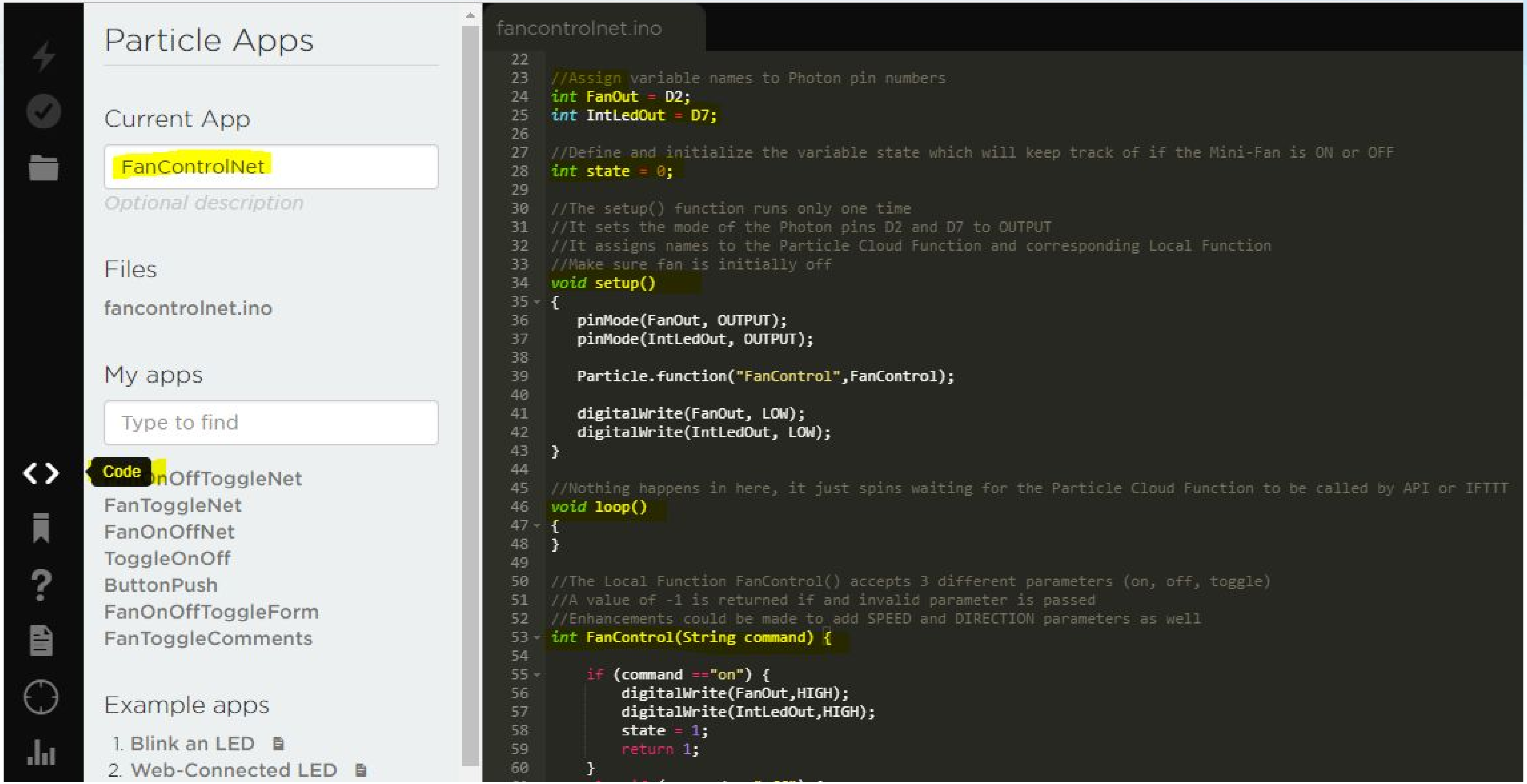


Component #	Description	PIN1	PIN2	PIN3
1	TIP31C Transistor	J19	J20	J21
2	1N4001 Diode	G24	G20	X
3	330 Ohm Resistor	F15	F19	X
6	Blue Wire	G10	G15	X
5	Black Wire	H4	H21	X
4	Red Wire	I1	I24	X
7	Motor:Yellow Wire	F20	X	X
8	Motor:Green Wire	J24	X	X

In Order of Component List

1. Discrete Components
2. Wires
3. Motor

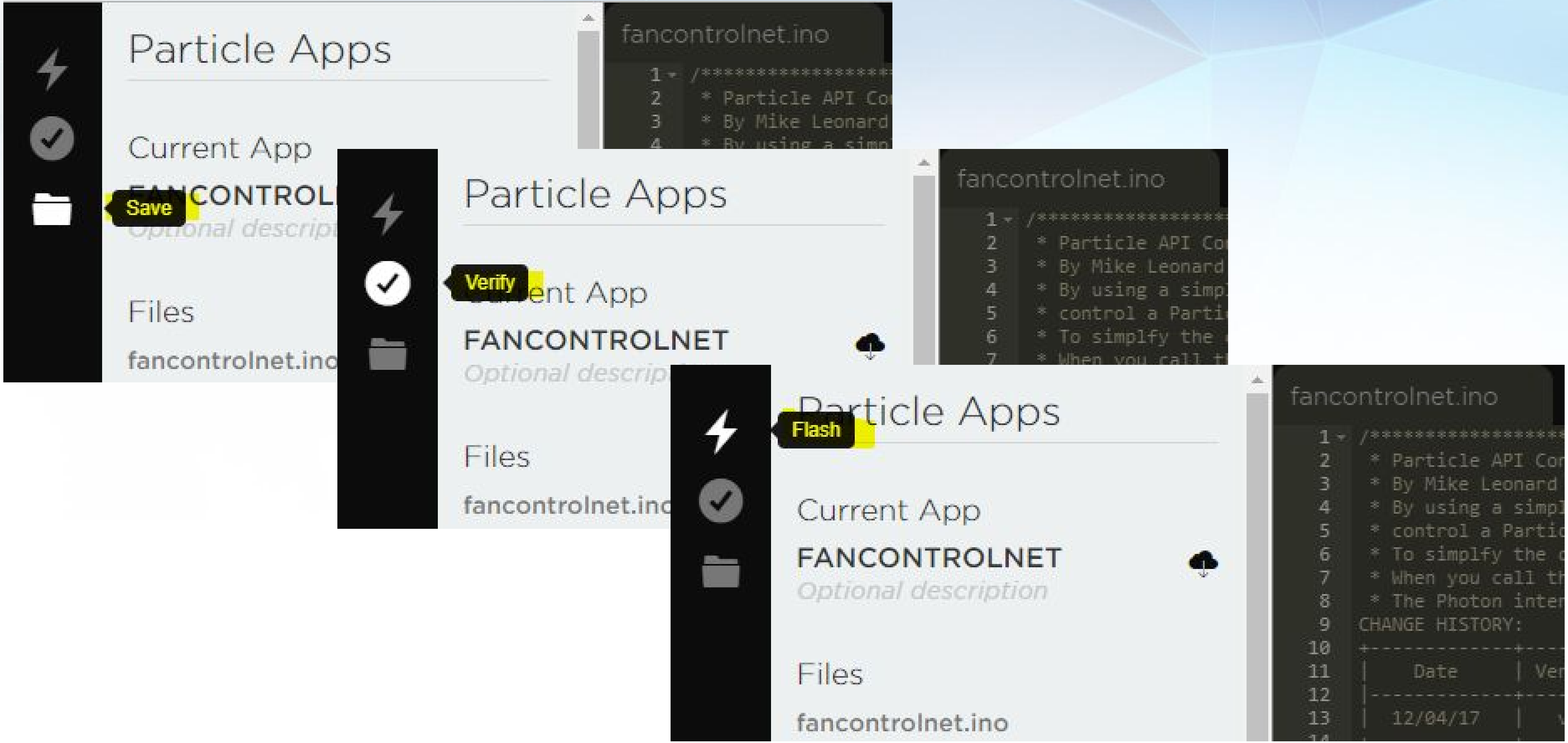
Back-end Coding - Firmware



Current App: FanControlNet

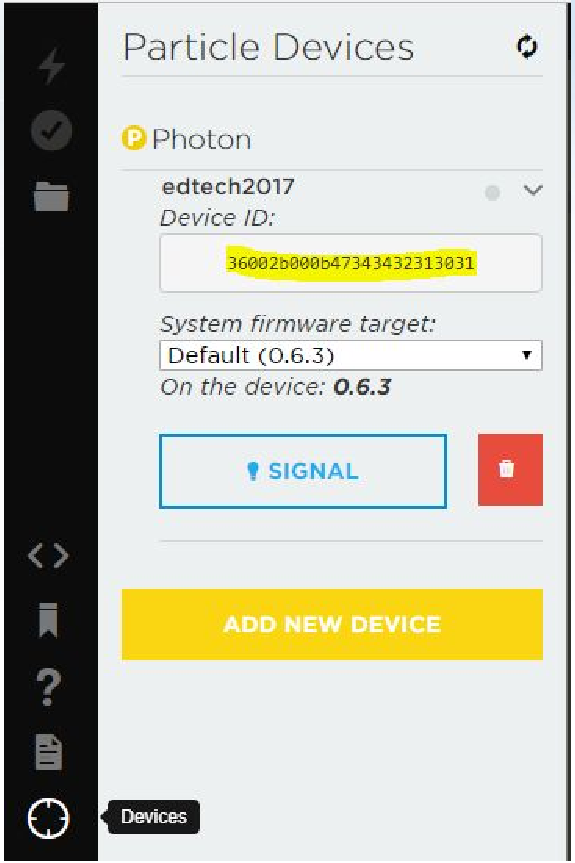
```

//Assign variable names to Photon pin numbers
int FanOut = D2;
int IntLedOut = D7;

//Define and initialize the variable state which will keep track of if the Mini-Fan is ON or OFF
int state = 0;

//The setup() function runs only one time
//It sets the mode of the Photon pins D2 and D7 to OUTPUT
//It assigns names to the Particle Cloud Function and corresponding Local Function
//Make sure fan is initially off
void setup()
{
   pinMode(FanOut, OUTPUT);
   pinMode(IntLedOut, OUTPUT);

   Particle.function("FanControl",FanControl);

   digitalWrite(FanOut, LOW);
   digitalWrite(IntLedOut, LOW);
}

//Nothing happens in here, it just spins waiting for the Particle Cloud Function to be called by API or IFTTT
void loop()
{
}

//The Local Function FanControl() accepts 3 different parameters (on, off, toggle)
//A value of -1 is returned if and invalid parameter is passed
//Enhancements could be made to add SPEED and DIRECTION parameters as well
int FanControl(String command) {

    if (command =="on") {
        digitalWrite(FanOut,HIGH);
        digitalWrite(IntLedOut,HIGH);
        state = 1;
        return 1;
    }
```

Back-end Coding - Update Firmware



```
/******************
 * Particle API Co
 * By Mike Leonard
 * By using a simpl
 * control a Partic
 * To simplfy the c
 * When you call th
 * The Photon inter
CHANGE HISTORY:
+-------------+----
|    Date     | Ver
|-------------+----
|  12/04/17   |
```

Front-end Coding - DeviceID/DeviceToken



Particle Devices

Photon

edtech2017

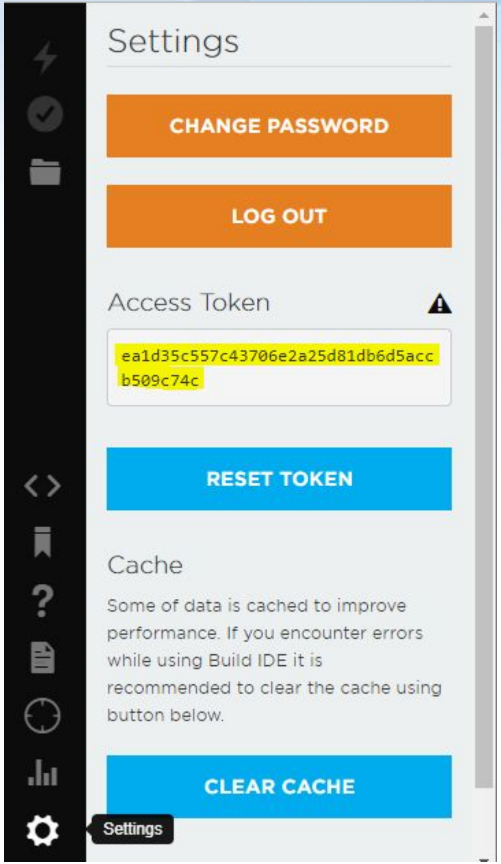
Device ID:

36002b000b47343432313031

System firmware target:

Default (0.6.3)

On the device: ***0.6.3***



Settings

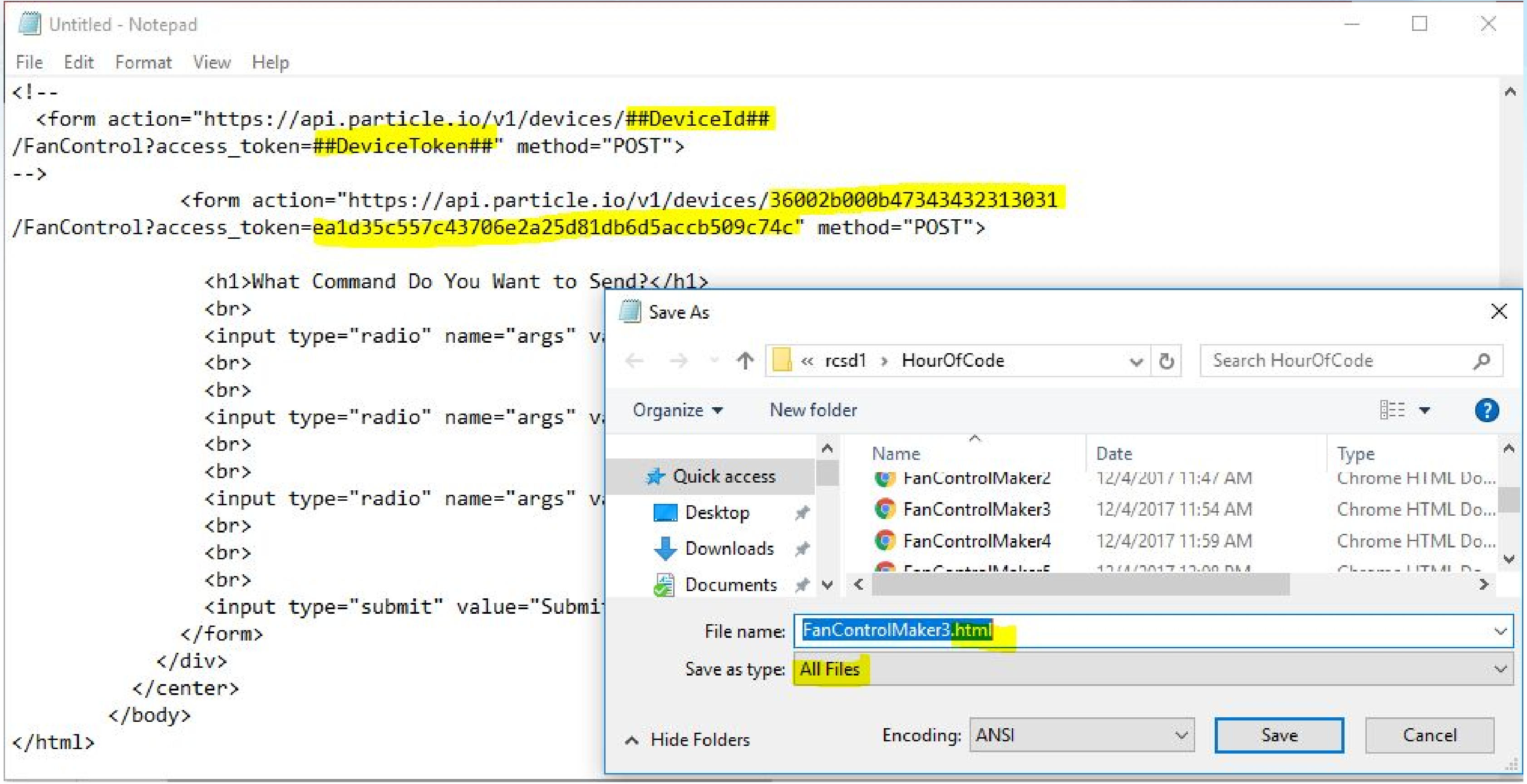
Access Token

ea1d35c557c43706e2a25d81db6d5accb509c74c

Cache

Some of data is cached to improve performance. If you encounter errors while using Build IDE it is recommended to clear the cache using button below.

Front-end Coding - Web Form



```
<!--
  <form action="https://api.particle.io/v1/devices/##DeviceId##
/FanControl?access_token=##DeviceToken##" method="POST">
-->
              <form action="https://api.particle.io/v1/devices/36002b000b47343432313031
/FanControl?access_token=ea1d35c557c43706e2a25d81db6d5accb509c74c" method="POST">

                <h1>What Command Do You Want to Send?</h1>
                <br>
                <input type="radio" name="args" v
                <br>
                <br>
                <input type="radio" name="args" v
                <br>
                <br>
                <input type="radio" name="args" v
                <br>
                <br>
                <br>
                <input type="submit" value="Submi
              </form>
            </div>
          </center>
        </body>
</html>
```

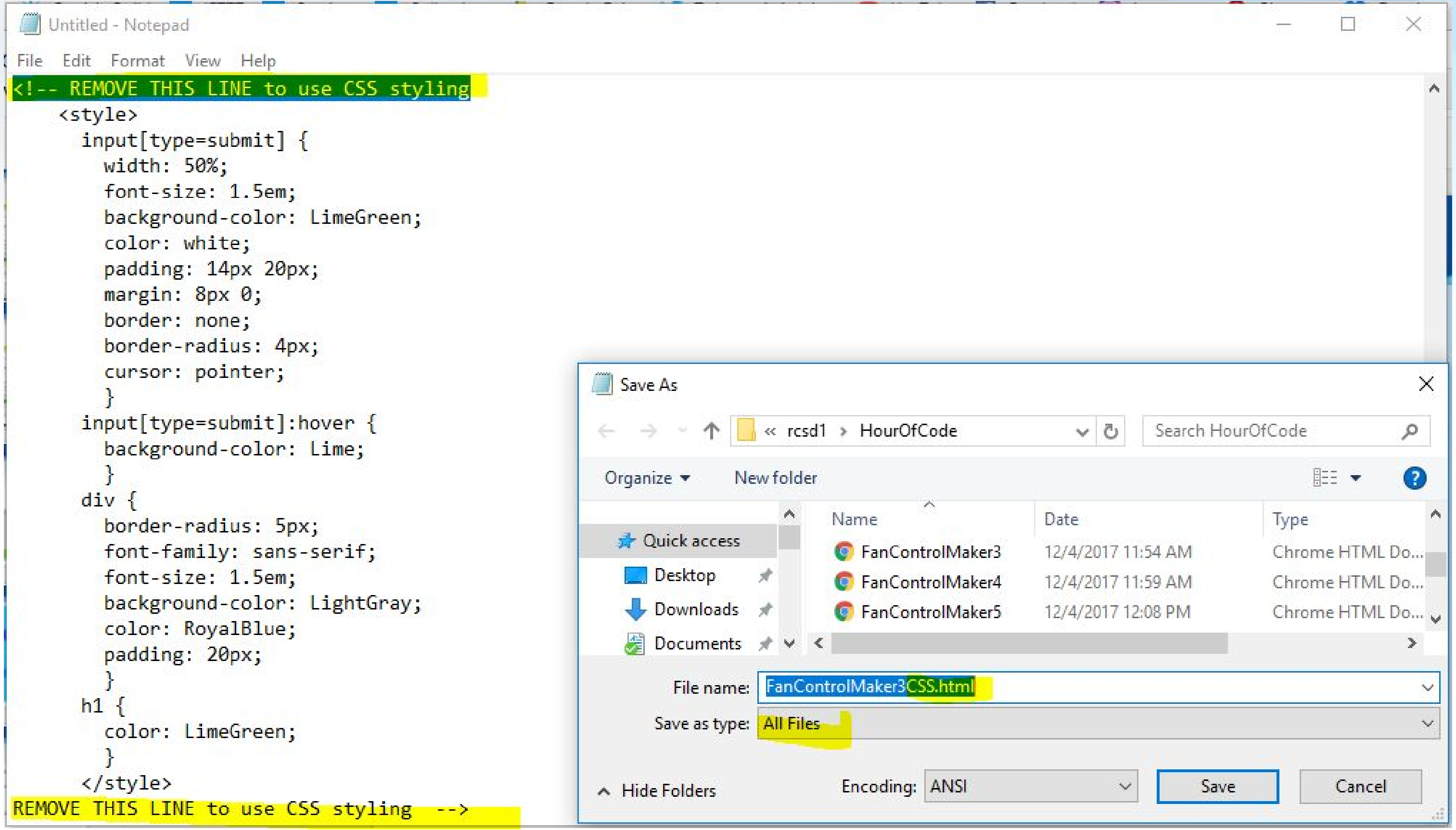
Name	Date	Type
FanControlMaker2	12/4/2017 11:47 AM	Chrome HTML Do...
FanControlMaker3	12/4/2017 11:54 AM	Chrome HTML Do...
FanControlMaker4	12/4/2017 11:59 AM	Chrome HTML Do...
FanControlMaker5	12/4/2017 12:00 PM	Chrome HTML Do...

File name: FanControlMaker3.html

Save as type: All Files

Encoding: ANSI

Front-end Coding - Web Form CSS Styling



```
<!-- REMOVE THIS LINE to use CSS styling
  <style>
   input[type=submit] {
    width: 50%;
    font-size: 1.5em;
    background-color: LimeGreen;
    color: white;
    padding: 14px 20px;
    margin: 8px 0;
    border: none;
    border-radius: 4px;
    cursor: pointer;
    }
   input[type=submit]:hover {
    background-color: Lime;
    }
   div {
    border-radius: 5px;
    font-family: sans-serif;
    font-size: 1.5em;
    background-color: LightGray;
    color: RoyalBlue;
    padding: 20px;
    }
   h1 {
    color: LimeGreen;
    }
   </style>
REMOVE THIS LINE to use CSS styling  -->
```

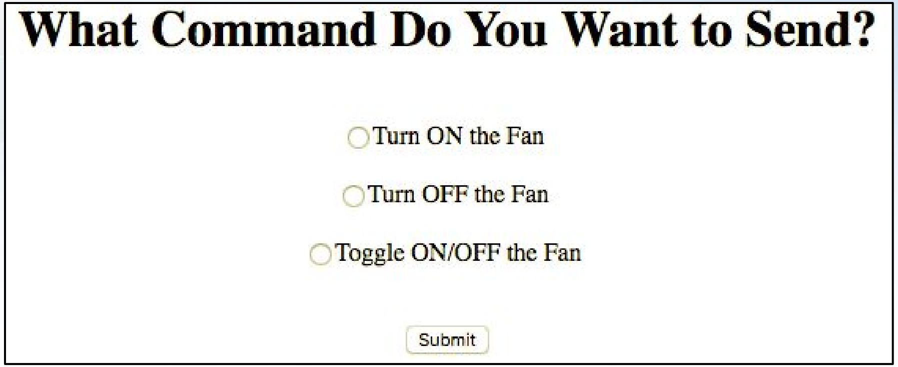
Name	Date	Type
FanControlMaker3	12/4/2017 11:54 AM	Chrome HTML Do...
FanControlMaker4	12/4/2017 11:59 AM	Chrome HTML Do...
FanControlMaker5	12/4/2017 12:08 PM	Chrome HTML Do...

File name: FanControlMaker3CSS.html

Save as type: All Files

Encoding: ANSI

Front-end Coding - With/Without CSS Styling

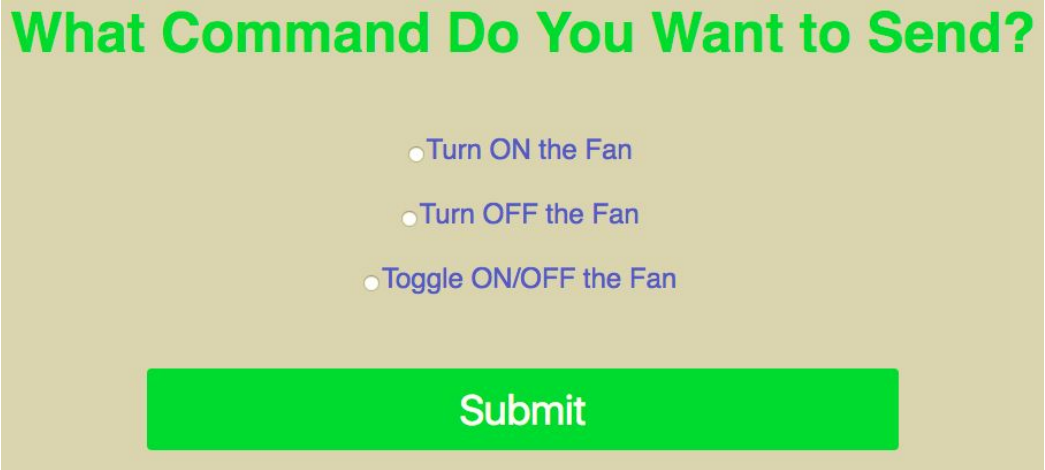


What Command Do You Want to Send?

○ Turn ON the Fan

○ Turn OFF the Fan

○ Toggle ON/OFF the Fan



What Command Do You Want to Send?

○ Turn ON the Fan

○ Turn OFF the Fan

○ Toggle ON/OFF the Fan

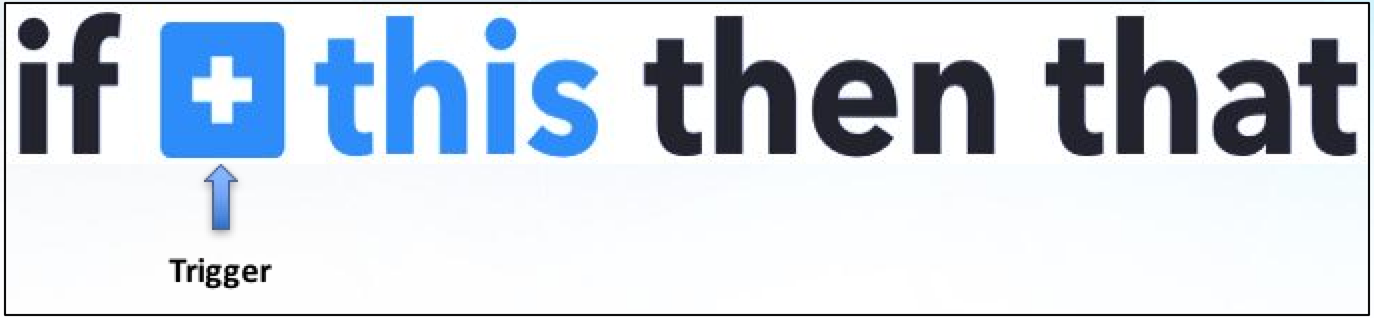
IFTTT (If This Then That)

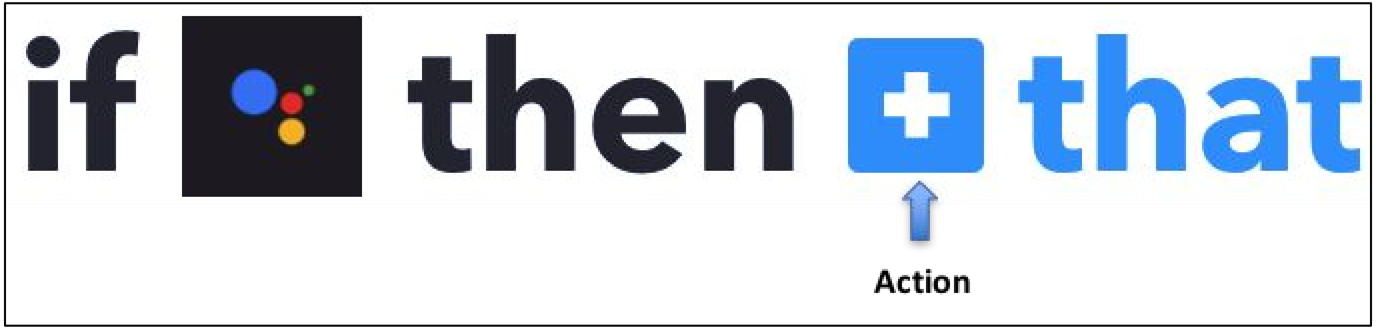
Source

Why IFTTT?

- Aggregator of heterogeneous web accessible applications and devices (multi-vendor)
- Connects hardware and software services
- Controls things automagically
- Pushes data when needed reinforce routine

IFTTT Applets: Triggers and Actions





References

- GitHub - Share your code with others
  - https://github.com/
- Particle Photon - Datasheet
  - https://docs.particle.io/datasheets/photon-(wifi)/photon-datasheet/
- Particle Photon Kit - Ask for one for Christmas
  - https://store.particle.io/products/photon-kit
- IFTTT - Connect your smart apps and devices
  - http://www.ifttt.com/
- Fritzing - Design and Build a Circuit Board
  - https://madeby.google.com/home
- Web Forms / CSS Styling
  - https://www.w3schools.com/html/html_forms.asp
  - https://www.w3schools.com/css/default.asp