SwitchDoc Labs

Raspberry Pi, Arduino tutorials, scripts and projects

Reliable Projects 5: External WatchDog Timers for Raspberry Pi/Arduino Systems

Posted on November 23, 2014 by John Shovic

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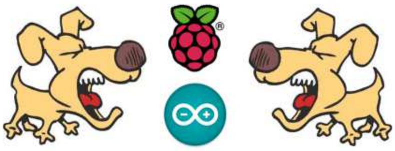


Summary: In Part 5 of this series I look at setting up an External WatchDog Timer with the Arduino and also with the Raspberry Pi. I use the SwitchDoc Labs Dual WatchDog Timer, which is a good choice for an External WatchDog Timer in many, *but not all*, systems. Finally, I look at a real world problem of RFI (Radio Frequency Interference), which really hits the Project Curacao Box.

Part 1 – Introduction

Part 2 – Using the Internal WatchDog Timer for the Raspberry Pi

Part 3 – Using the Internal WatchDog Timer for the Arduino

Part 4 – Internal Versus External WatchDog Timers

A solution to all of the potential problems and issues with the Internal WatchDog Timers discussed in the previous 4 parts of this series is to use an External WatchDog Timer. As I was exploring this set of problems with Project Curacao, I decided to build my own External WatchDog timer. Designing my own timer gives me a fixed set of parameters not dependent on other sofware processes (in the Raspberry Pi case) and which Arduino I am using (in the other case). And then there were the significant power system issues as Project Curacao is Solar and Wind Powered and has brownout issues (hey, it gets cloudy in the tropics too!).

The Code for “Patting The Dog” in Python and C

To “pat the dog” or trigger the External WatchDog Timer, you need to use the following code. Since the line has to be held in high impedance mode and then just taken to ground when you pat the dog, the code for the Arduino looks like this:

```
#define RESET_WATCHDOG1 9

void ResetWatchdog1()
{

     pinMode(RESET_WATCHDOG1, OUTPUT);
     delay(200);
     pinMode(RESET_WATCHDOG1, INPUT);
     Serial.println("Watchdog1 Reset");
}
```

And in Python for the Raspberry Pi, the code looks like this:

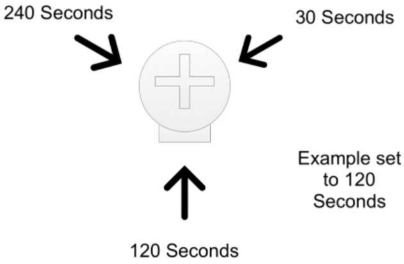
```
#define RESET_WATCHDOG1 18
def resetWatchDog():

        GPIO.setup(RESET_WATCHDOG1, GPIO.OUT)
        GPIO.output( RESET_WATCHDOG1, False)
        time.sleep(0.200)
        GPIO.setup(RESET_WATCHDOG1, GPIO.IN)
```

You put these functions in your code such that you pat the dog more often than *Wto*. *Wto* is defined as the maximum amount of time the WatchDog Timer can count before it needs to be reset (in other words, when it will reboot the computer if the computer goes away.

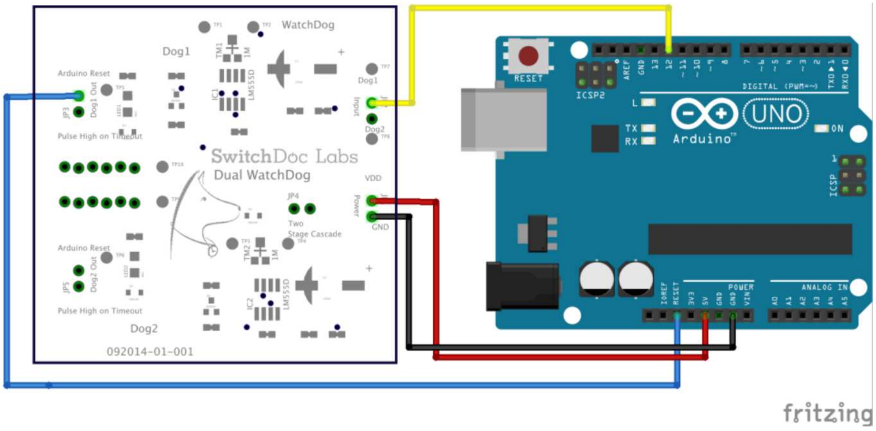
You can download the entire specification for the SwitchDoc Labs Dual WatchDog Timer here: DualWatchDog_101914-V1.3.

Setting Wto on the SwitchDoc External WatchDog Timer



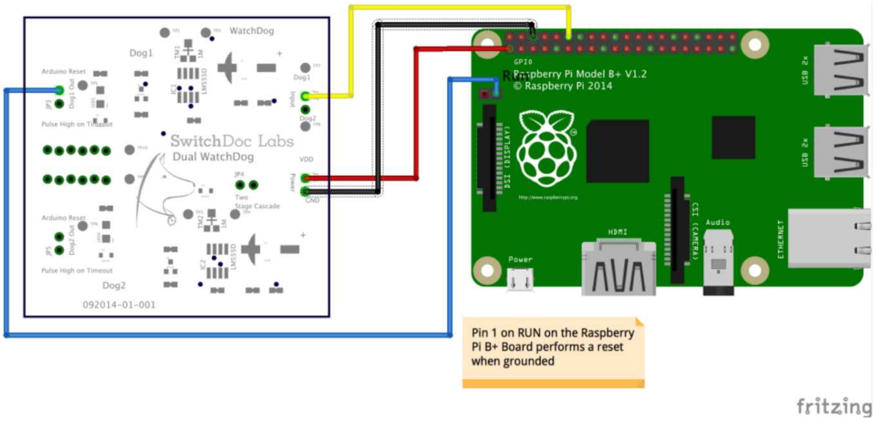
You can adjust *Wto* from about 220 seconds to 30 seconds.

Using an External WatchDog Timer with the Arduino



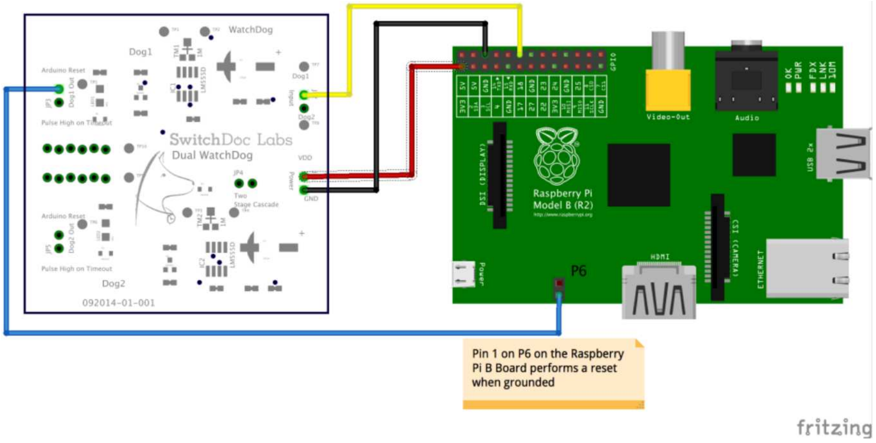
Dual WatchDog and Arduino

Using an External WatchDog Timer with the Raspberry Pi



Pin 1 on RUN on the Raspberry Pi B+ Board performs a reset when grounded

Dual WatchDog with Raspberry Pi B+



Pin 1 on P6 on the Raspberry Pi B Board performs a reset when grounded

Dual WatchDog with Raspberry Pi B (and A)

Radio Frequency Interference – A Real World Problem

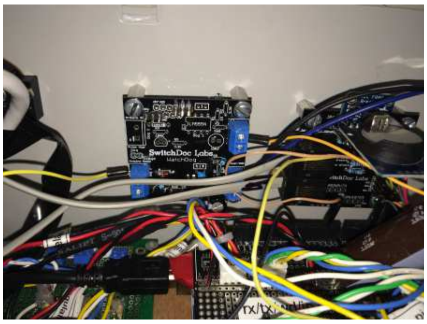
The significant problem I discovered with RFI (Radio Frequency Interference) was when the Amateur Radio folks powered up their worldwide radio contest in October and November on 28MHz. My box is connected to a radio tower in Curacao. And connected to a 15 meter line which just happens to be about 3 wavelengths of 28MHz, making a very good antenna. Things looked good up until the radio contest!

The wavelength of 28MHz radio waves is about 5 meters. I had a 15 meter line. Not a bad antenna for receiving 28MHz signals. Assuming that it is about 12 meters effective I have a nice 1/2 wavelength (2.5 wavelengths actually) staring at the input to the Arduino. And the WeatherRack (seen in the distance below) is connected directly to the tower where the 28MHz signal is being transmitted. Could be an issue, for sure. I have a question into the Radio Gods about what kind of voltages could I expect. One God (Geoff) replied, saying up to 2V. That is pretty close to 2.5 Volts which will start triggering things.

New Solar Panels on Top of the Project Curacao Box – WeatherRack in Background

The second God (Jeff) indicated that it could be all the way up to 3V and that there the contest last weekend was not just on 28 MHz. It was an all-band contest, on the 160, 80, 40, 20, 15, and 10 meter bands. During daylight hours on the contest weekend, transmitting will have been on 10m (28.3 – 29.0 MHz), 15m (21.2 – 21.4), and 20m (14.15 – 14.3 MHz). During nighttime hours on the contest weekend, transmitting will have been on 160m (~1.8 – 1.9 MHz), 80m (~3.6 – 3.9 MHz), 40m (~7.05 – 7.25 MHz) and 20m (~14.15 – 14.3 MHz).

Lots of little signals running around my box with the big new wire (antenna) connected.



SwitchDoc Dual WatchDog Board Installed in Project Curacao

Yet another reason to use an External WatchDog Timer because the RFI was putting the Arduino in a state that required a power reset.

Conclusion

WatchDog Timers can improve the reliability of your Arduino and Raspberry Pi projects.   Internal WatchDogs have limitations in both the Arduino and Raspberry Pi but can still improve your project reliability. For those issues (such as Brownouts, power loss, coding errors and RFI) that aren't handled well by the Internal WatchDog Timers, a better solution is to use an External WatchDog Timer.

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About John Shovic

Dr. John C. Shovic is currently Managing Partner of SwitchDoc Labs, LLC and Chief Technical Officer of InstiComm, LLC, a company specializing in mobile medical software solutions for health practitioners. He has worked in industry for over thirty years and has founded multiple companies: Advance Hardware Architectures, TriGeo Network Security, Blue Water Technologies, InstiComm, LLC, and bankCDA. He has also served as a Professor of Computer Science at Eastern Washington University, Washington State University and the University of Idaho. Dr. Shovic has given over [illegible] invited talks and has published over 35 papers on a variety of topics on HIPAA, GLB, computer security, computer forensics, embedded systems and others.

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Constantin *says:*

December 8, 2014 at 23:40

Hi,

A 555 wouldn't work as well ?

Reply

ohn Shovic *says:*

ecember 9, 2014 at 11:05

This is a Dual 555 based board. The 555 is rock solid for this kind of application if you pay attention to the inputs and outputs. It has some interface tricks to allow you to stage two timers together to produce a pulse (for a relay for example) and can reset both a Raspberry Pi and an Arduino. Take a look at the product brief on http://www.switchdoc.com/dual-watchdog-timer/ to see the whole theory of operation.

It also is designed to allow the power to the WatchDog timers to be shut off if the voltage is too low. The new SunAir Solar Controller board takes advantage of this feature, so the Watchdog won't keep trying to boot the computer until the voltage is sufficient to run the computer.

John

Reply

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