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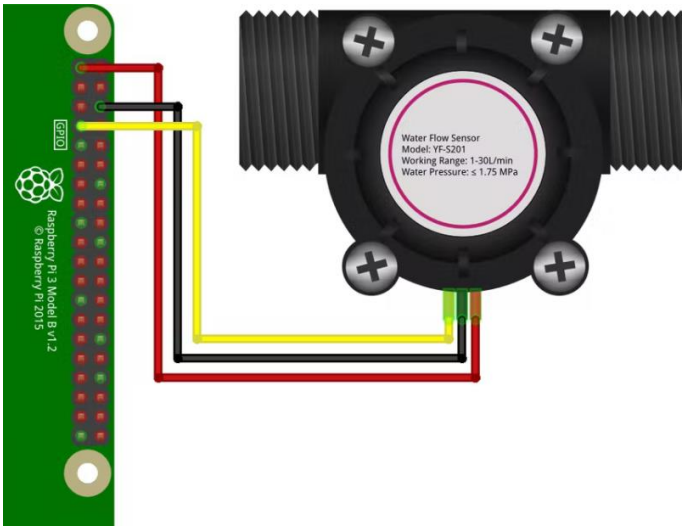
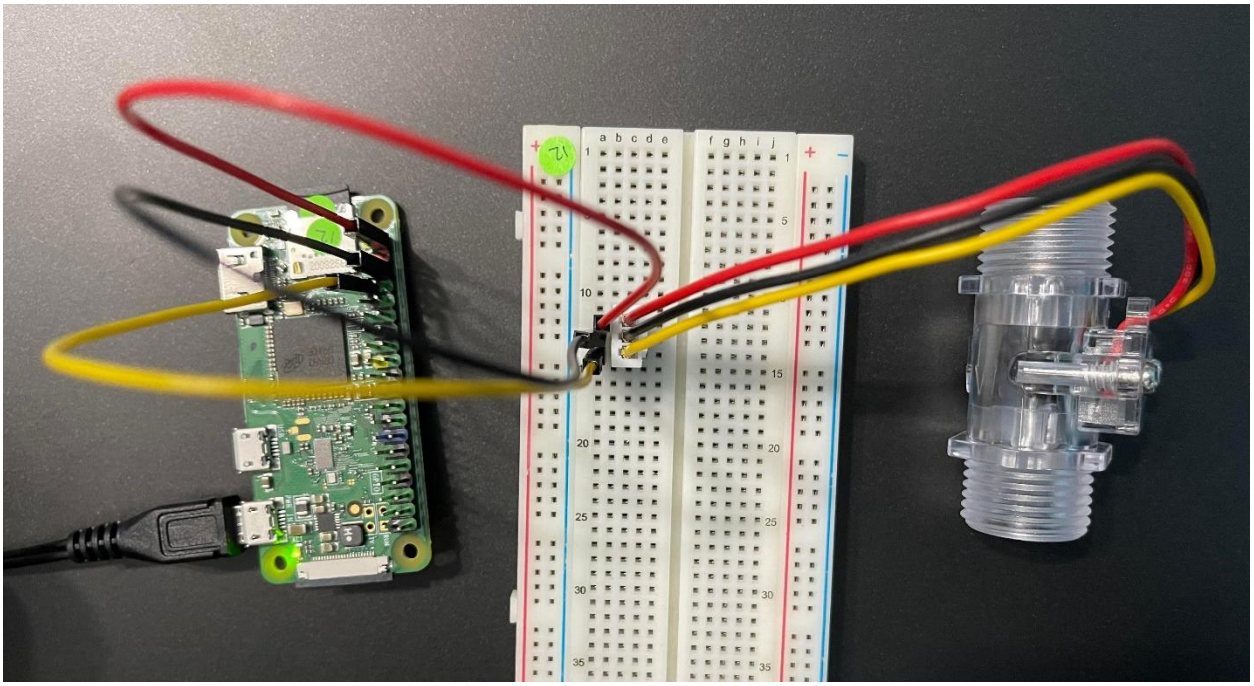
Water Flow Sensor

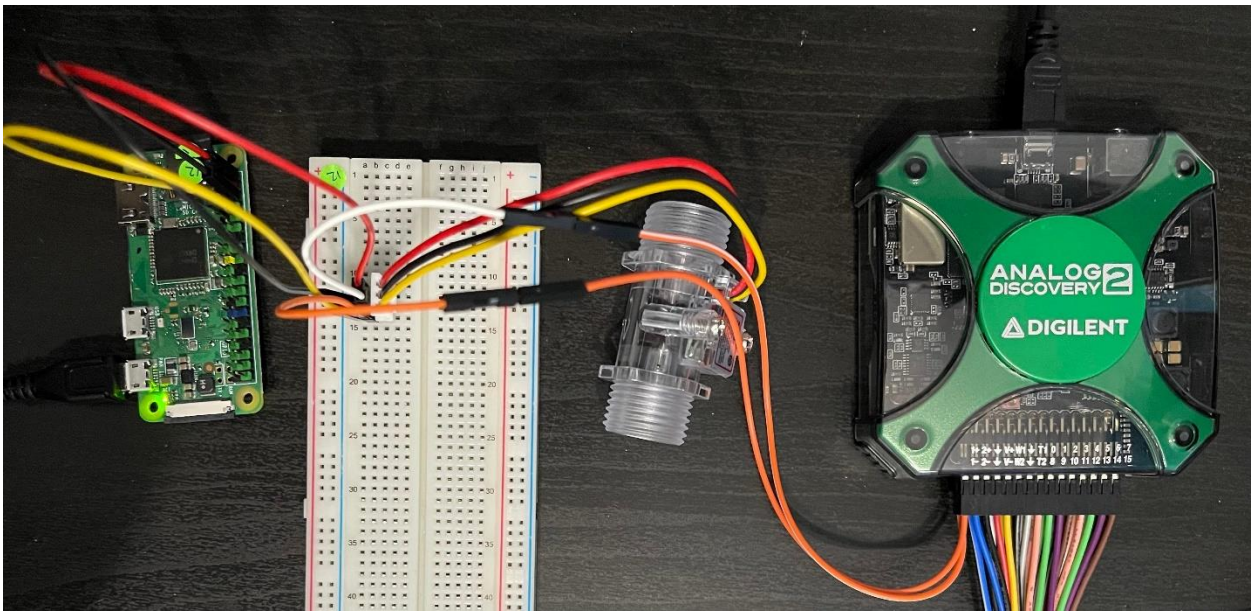
Section I

The water flow sensor has a 3-pin JST which has a red, black, and yellow wire. The red wire is for 5-15VDC, the black is for ground, and the yellow is for the hall effect pulse output. In the diagram below the red wire is connected to 5V on the pi, the black wire is connected to ground on the pi, and the yellow wire is connected to pin four.

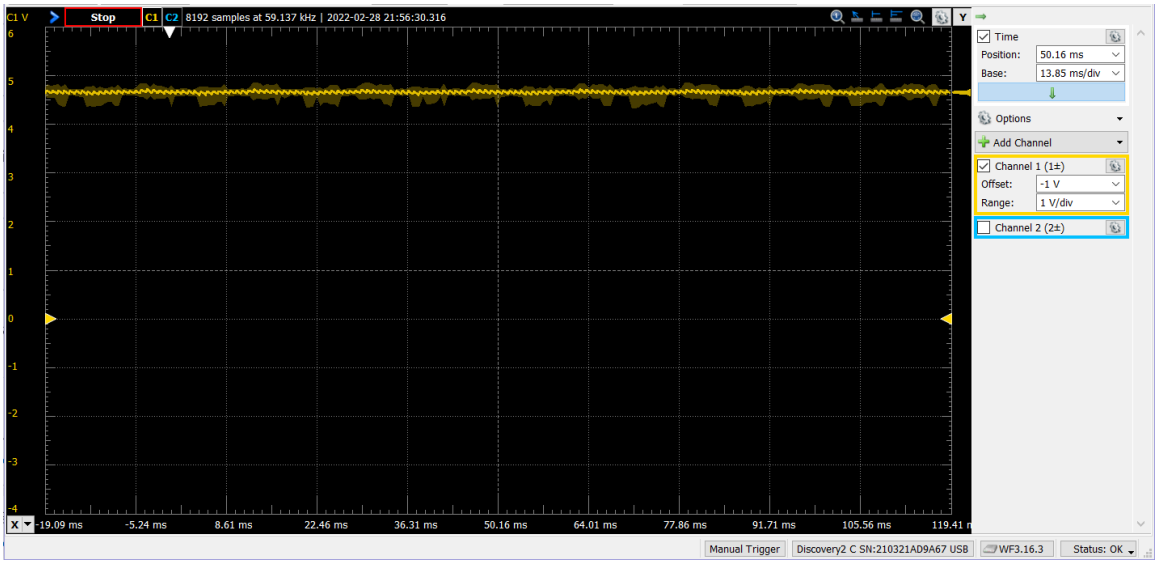




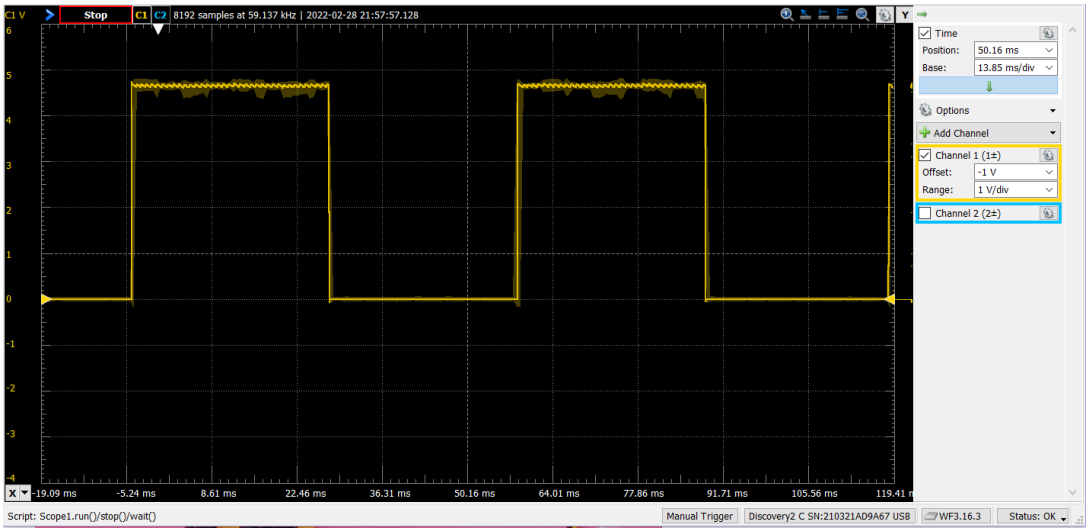
Using the Analog Discover 2 (AD2), the positive side of channel 1 is connect to the segment of the yellow wire and the negative side of channel 1 is connected to ground as shown below.



In the channel 1 scope display of the AD2, it shows a reading of 5V, as shown below.



In the channel 1 scope display of the AD2, when the turbine was spinning the reading cycled between 5V and 0V, as shown below.

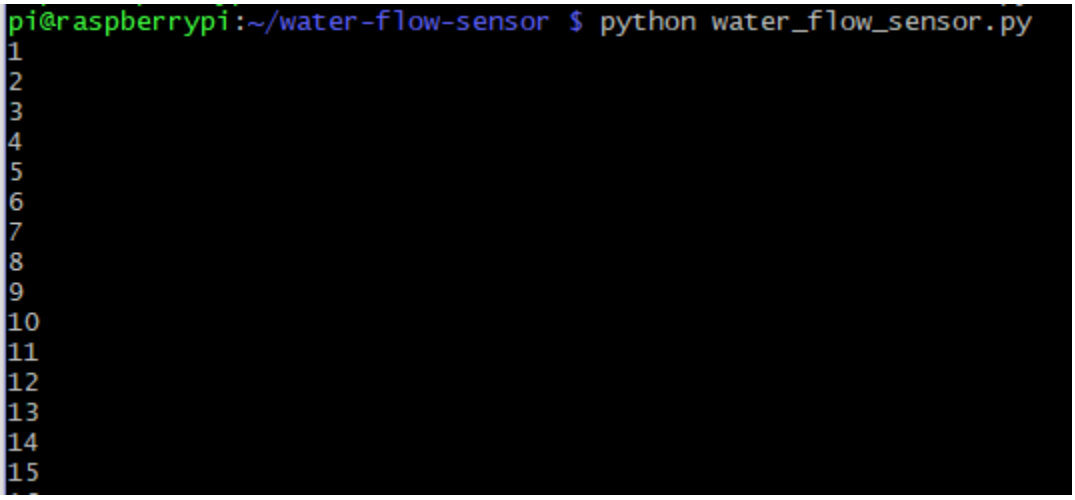


Section II

```python
# Part: Water Flow Sensor

import RPi.GPIO as GPIO
import time
import sys

global pin
global count

pin = 4
count = 0

def setup_water_flow_sensor():
    global pin
    GPIO.setmode(GPIO.BCM)
    GPIO.setup(pin, GPIO.IN, pull_up_down = GPIO.PUD_DOWN)

def flow_count(pin):
    global count
    if not GPIO.input(pin):
        count += 1
    print(count)

def detect_water_flow_sensor():
    GPIO.add_event_detect(pin, GPIO.FALLING, callback = flow_count)

setup_water_flow_sensor()
detect_water_flow_sensor()

try:
    while True:
        time.sleep(1)

except KeyboardInterrupt:
    GPIO.cleanup()
    sys.exit()

```

The necessary imports are made. Then global variable for the pin number and the count are created. The function setup_water_flow_sensor() sets up the pin and sets it up to GPIO/BCM pin four and sets it to pull down. The flow_count() updates the global count variable every time a falling edge is detecting so that the number of times the turbine spins is being kept track of. The detect_water_flow_sensor() detects the falling edge. The setup function is called and then the detect function is called. The try except runs the code continuously until a keyboard interruption is detected, where if it is detected then the pins are cleared and exits the system.

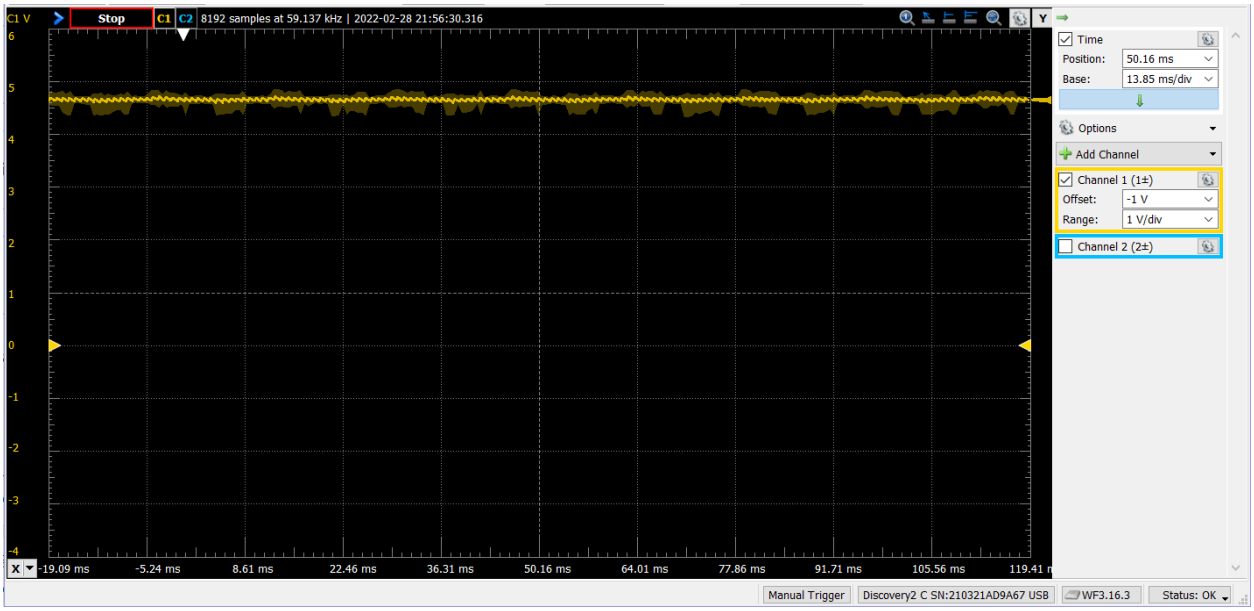
When the script is run the following is displayed on the terminal. Every time the turbine is spun, the count is printed which is being incremented.

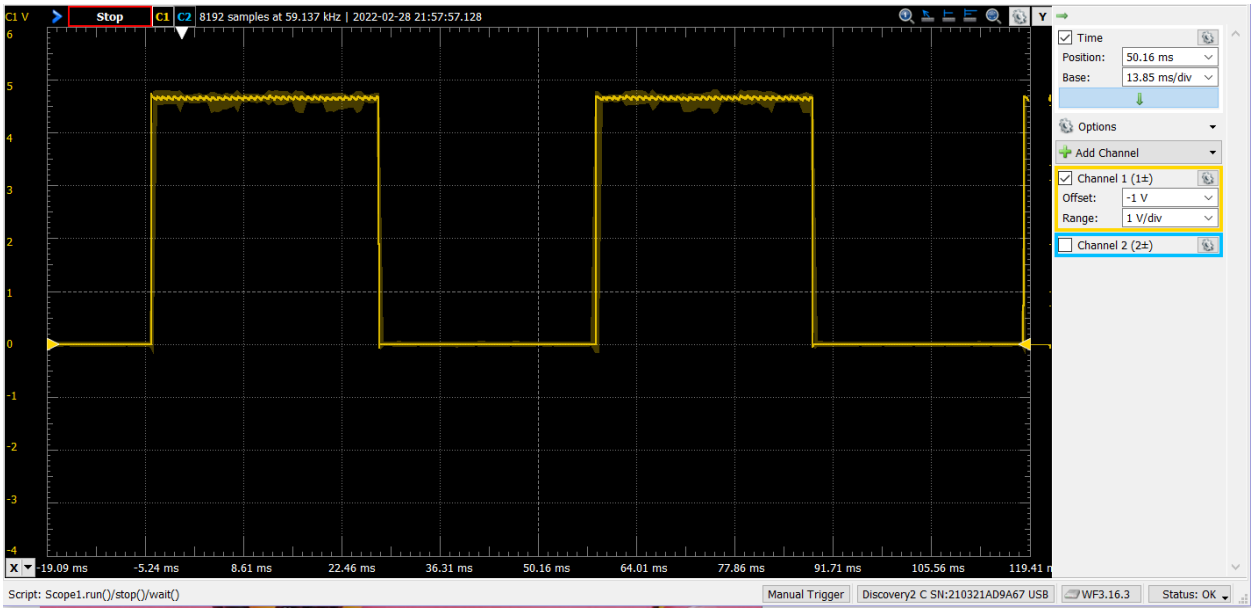


Section III

The water flow sensor uses a hall effect sensor to detect the turbine's movements. The hall effect sensor detects the density of the magnetic field around the device. This is a great way to detect the turbine movements without the circuit directly coming in contact with the water. The output is at 5V but when the magnetic flux density exceeds a certain defined limit then the circuit is triggered and represents one revolution of the turbine.

The first image from the AD2 shows channel 1 when there is no movement in the turbine. The second image from the AD2 shows channel 1 when the turbine is spinning. It is noticed that at every revolution the voltage drops to 0V from 5V. The toggle between 5V and 0V shows each revolution of the turbine.


C1 V
Stop
C1 C2 8192 samples at 59.137 kHz | 2022-02-28 21:56:30.316
6
5
4
3
2
1
0
-1
-2
-3
-4
X
-19.09 ms
-5.24 ms
8.61 ms
22.46 ms
36.31 ms
50.16 ms
64.01 ms
77.86 ms
91.71 ms
105.56 ms
119.41 m
Y
Time
Position: 50.16 ms
Base: 13.85 ms/div
Options
Add Channel
Channel 1 (1±)
Offset: -1 V
Range: 1 V/div
Channel 2 (2±)
Manual Trigger
Discovery2 C SN:210321AD9A67 USB
WF3.16.3
Status: OK


C1 V
Stop
C1 C2 8192 samples at 59.137 kHz | 2022-02-28 21:57:57.128
6
5
4
3
2
1
0
-1
-2
-3
-4
X
-19.09 ms
-5.24 ms
8.61 ms
22.46 ms
36.31 ms
50.16 ms
64.01 ms
77.86 ms
91.71 ms
105.56 ms
119.41 m
Y
Time
Position: 50.16 ms
Base: 13.85 ms/div
Options
Add Channel
Channel 1 (1±)
Offset: -1 V
Range: 1 V/div
Channel 2 (2±)
Script: Scope1.run()/stop()/wait()
Manual Trigger
Discovery2 C SN:210321AD9A67 USB
WF3.16.3
Status: OK