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Rotary Encoder

Overview

An incremental rotary encoder (also called a *shaft* encoder) converts angular motion of a shaft to a series of digital pulses that can be counted to determine how many times (and in what direction) a shaft has been rotated. Combined with control logic, rotary encoders can be used to measure turning speed, distance, and position. Rotary encoders are used in industrial controls, robotics, computer mice and trackballs, and other applications that require precise but unlimited rotation.

Experimental Materials

```
Raspberry Pi          x1
Breadboard            x1
Rotary encoder        x1
Dupont jumper wires
```

Experimental Procedure

1. If you have not done so already, prepare your development system by installing the Python interpreter, RPi.GPIO library, and wiringPi library as described in READ_ME_FIRST.TXT.

2. Install the rotary encoder on your breadboard and use Dupont jumper wires to connect in to your Raspberry Pi as illustrated in the Wiring Diagram below.

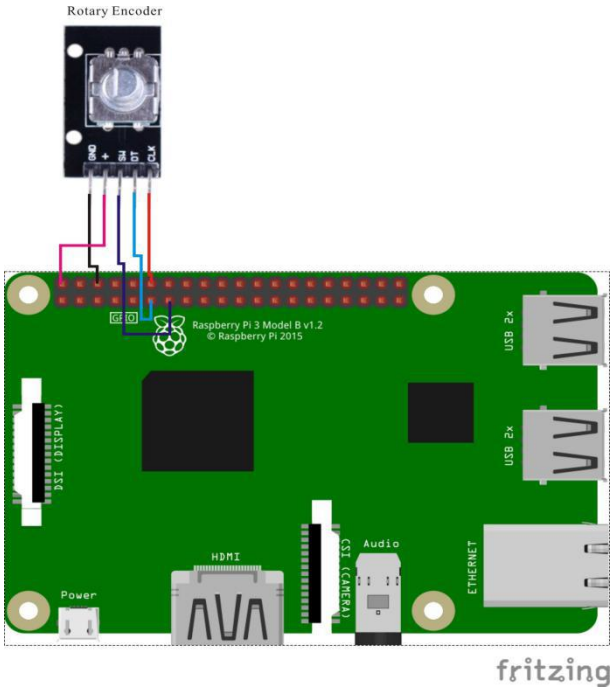
3. Execute the sample code stored in this experiment's subfolder.
   If using C, compile and execute the C code:
   ```
   cd Code/C
   gcc rotaryEncoder.c -o rotaryEncoder.out -lwiringPi
   ./rotaryEncoder.out
   ```

If using Python, launch the Python script:

```
cd Code/Python
python rotaryEncoder.py
```

4. Make experimental observations. As you turn the rotating shaft on the sensor in one direction, a counter displayed on Raspberry Pi command line interface increases. As you turn the shaft in the other direction, the counter decreases. You can zero the counter by pressing the small button on the sensor.

Wiring Diagram



Rotary-Encoder pin position:

"DT" ↔ Raspberry Pi pin 11

"CLK" ↔ Raspberry Pi pin 12

"SW" ↔ Raspberry Pi pin 13

"+" ↔ Raspberry Pi +5V

"-" ↔ Raspberry Pi GND

Sample Code

Python Code

```
#!/usr/bin/env python
import RPi.GPIO as GPIO
import time

RoAPin = 11
RoBPin = 12
BtnPin = 13

globalCounter = 0
flag = 0
Last_RoB_Status = 0
Current_RoB_Status = 0

def setup():
    GPIO.setmode(GPIO.BOARD)
    GPIO.setup(RoAPin, GPIO.IN)
    GPIO.setup(RoBPin, GPIO.IN)
    GPIO.setup(BtnPin, GPIO.IN, pull_up_down=GPIO.PUD_UP)
    GPIO.add_event_detect(BtnPin, GPIO.FALLING, callback=btnISR)

def rotaryDeal():
    global flag
    global Last_RoB_Status
    global Current_RoB_Status
    global globalCounter
    Last_RoB_Status = GPIO.input(RoBPin)
    while(not GPIO.input(RoAPin)):
        Current_RoB_Status = GPIO.input(RoBPin)
        flag = 1
    if flag == 1:
        flag = 0
        if (Last_RoB_Status == 0) and (Current_RoB_Status == 1):
            globalCounter = globalCounter - 1
        if (Last_RoB_Status == 1) and (Current_RoB_Status == 0):
            globalCounter = globalCounter + 1

def btnISR(channel):
    global globalCounter
    globalCounter = 0
```

```
def loop():
    global globalCounter
    tmp = 0    # Rotary Temperary

    while True:
        rotaryDeal()
        if tmp != globalCounter:
            print 'globalCounter = %d' % globalCounter
            tmp = globalCounter

def destroy():
    GPIO.cleanup()

if __name__ == '__main__':
    setup()
    try:
        loop()
    except KeyboardInterrupt:
        destroy()
```

C Code

```
#include <stdio.h>
#include <string.h>
#include <errno.h>
#include <stdlib.h>
#include <wiringPi.h>

#define  SWPin     2
#define  RoAPin    0
#define  RoBPin    1

static volatile int globalCounter = 0 ;

unsigned char flag;
unsigned char Last_RoB_Status;
unsigned char Current_RoB_Status;

void btnISR(void)
{
    globalCounter = 0;
}
```

```
void rotaryDeal(void)
{
    Last_RoB_Status = digitalRead(RoBPin);

    while(!digitalRead(RoAPin))
    {
        Current_RoB_Status = digitalRead(RoBPin);
        flag = 1;
    }

    if(flag == 1){
        flag = 0;
        if((Last_RoB_Status == 0)&&(Current_RoB_Status == 1)){
            globalCounter ++;
        }
        if((Last_RoB_Status == 1)&&(Current_RoB_Status == 0)){
            globalCounter --;
        }
    }
}

int main(void)
{
    int temp =0;
    if(wiringPiSetup() < 0)
    {
        fprintf(stderr,          "Unable          to          setup
wiringPi:%s\n",strerror(errno));
        return 1;
    }

    pinMode(SWPin, INPUT);
    pinMode(RoAPin, INPUT);
    pinMode(RoBPin, INPUT);

    pullUpDnControl(SWPin, PUD_UP);

    if(wiringPiISR(SWPin, INT_EDGE_FALLING, &btnISR) < 0)
    {
        fprintf(stderr, "Unable to init ISR\n",strerror(errno));
        return 1;
    }
```

```
    while(1)
    {
        rotaryDeal();
        if(temp != globalCounter)
        {
            printf("%d\n", globalCounter);
            temp = globalCounter;
        }
    }

    return 0;
}
```