Lesson 28 Controlling Stepper Motor With Rotary Encoder

Introduction

In this lesson, you will learn how to control stepper motors using a rotary encoder. We will use the inexpensive and popular stepper motor that comes with its own control board: the 28BYJ-48 stepper motor with the ULN2003 board.

We will write some code to have the motor move in the direction that we turn the rotary encoder, and will also keep track of how many steps we have taken, so that we can have the motor move back to the starting position by pressing down on the rotary encoder switch.

Hardware Required

- ✓ 1 * RexQualis UNO R3
- ✓ 1 * 830 tie-points breadboard
- ✓ 1 * Rotary Encoder Module
- ✓ 1 * ULN2003 stepper motor driver module
- ✓ 1 * Stepper motor
- ✓ 1 * Power supply module
- ✓ 1 * 9V1A Adapter
- ✓ 12 * F-M Jumper Wires

Principle

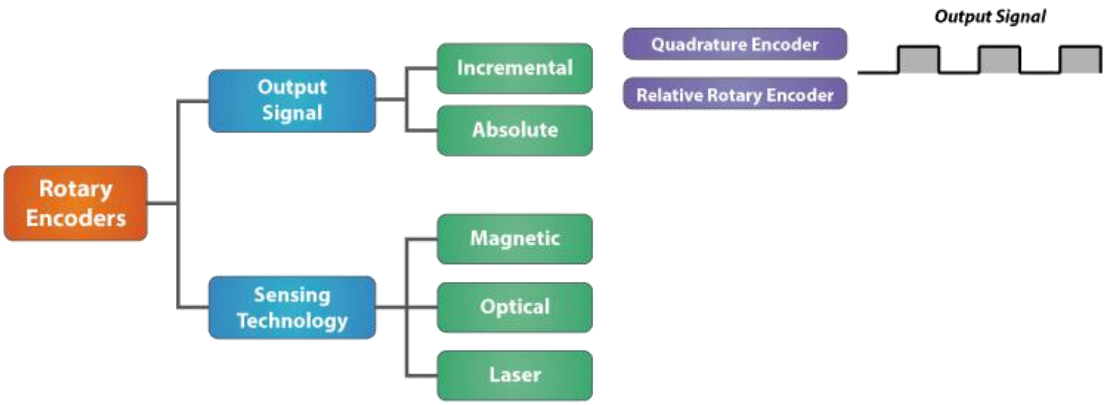
Rotary encoder

A rotary encoder is a type of position sensor which is used for determining the angular position of a rotating shaft. It generates an electrical signal, either analog or digital, according to the rotational movement.

There are many different types of rotary encoders which are classified by either Output Signal or Sensing Technology. The particular rotary encoder

that we will use in this tutorial is an incremental rotary encoder and it's the simplest position sensor to measure rotation.

This rotary encoder is also known as quadrature encoder or relative rotary encoder and its output is a series of square wave pulses.



Code interpretation

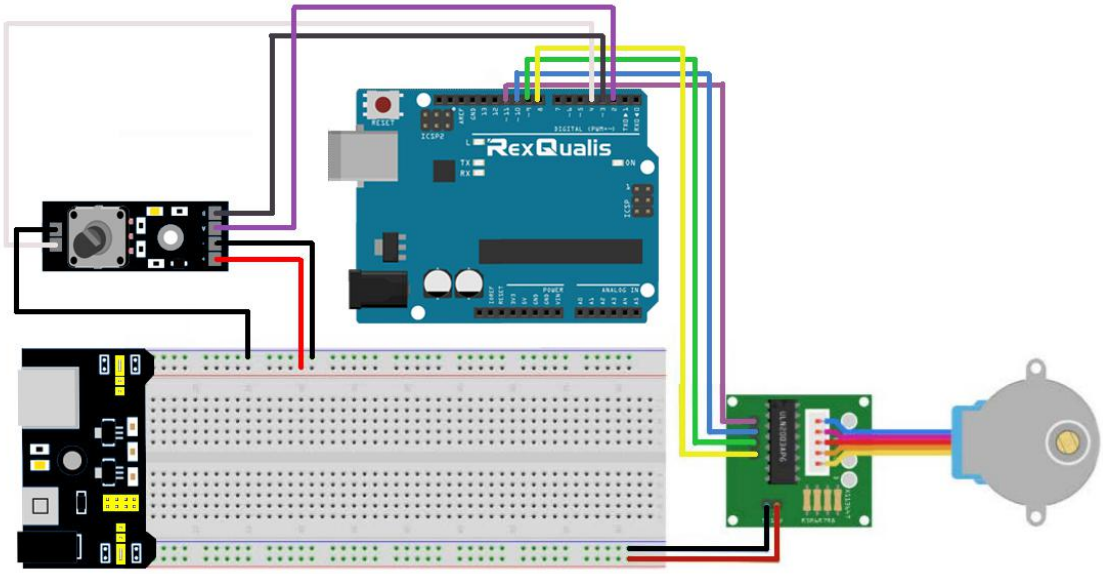
```
#include <Stepper.h>

#define STEPS  32

// Number of steps for one revolution of Internal shaft

// 2048 steps for one revolution of External shaft


volatile boolean TurnDetected;      // need volatile for Interrupts

volatile boolean rotationdirection;  // CW or CCW rotation

const int PinCLK=2;    // Generating interrupts using CLK signal

const int PinDT=3;     // Reading DT signal

const int PinSW=4;     // Reading Push Button switch

int RotaryPosition=0;  // To store Stepper Motor Position

int PrevPosition;      // Previous Rotary position Value to check
accuracy

int StepsToTake;       // How much to move Stepper

// Setup of proper sequencing for Motor Driver Pins

// In1, In2, In3, In4 in the sequence 1-3-2-4
```

```
Stepper small_stepper(STEPS, 8, 10, 9, 11);
// Interrupt routine runs if CLK goes from HIGH to LOW
void isr ()  {
  delay(4);  // delay for Debouncing
  if (digitalRead(PinCLK))
    rotationdirection= digitalRead(PinDT);
  else
    rotationdirection= !digitalRead(PinDT);
  TurnDetected = true;
}
void setup ()  {
pinMode(PinCLK,INPUT);
pinMode(PinDT,INPUT);
pinMode(PinSW,INPUT);
digitalWrite(PinSW, HIGH); // Pull-Up resistor for switch
attachInterrupt (0,isr,FALLING); // interrupt 0 always connected to
pin 2 on Arduino UNO
}
void loop ()  {
  small_stepper.setSpeed(700); //Max seems to be 700
  if (!(digitalRead(PinSW))) {    // check if button is pressed
    if (RotaryPosition == 0) {   // check if button was already
pressed
    } else {
        small_stepper.step(-(RotaryPosition*50));
        RotaryPosition=0; // Reset position to ZERO
      }
```

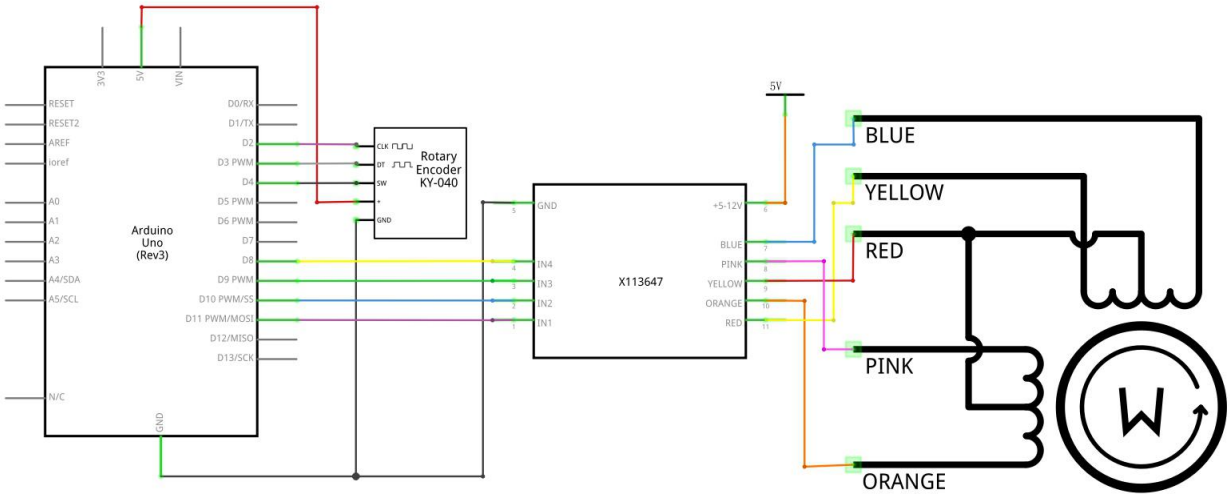
```
    }
  // Runs if rotation was detected
  if (TurnDetected)  {
    PrevPosition = RotaryPosition; // Save previous position in variable
    if (rotationdirection) {
      RotaryPosition=RotaryPosition-1;} // decrase Position by 1
    else {
      RotaryPosition=RotaryPosition+1;} // increase Position by 1
    TurnDetected = false;  // do NOT repeat IF loop until new rotation detected
    // Which direction to move Stepper motor
    if ((PrevPosition + 1) == RotaryPosition) { // Move motor CW
      StepsToTake=50;
      small_stepper.step(StepsToTake);
    }
    if ((RotaryPosition + 1) == PrevPosition) { // Move motor CCW
      StepsToTake=-50;
      small_stepper.step(StepsToTake);
    }
  }
    digitalWrite(8, LOW);
    digitalWrite(9, LOW);
    digitalWrite(10, LOW);
    digitalWrite(11, LOW);
}
```

Experimental Procedures

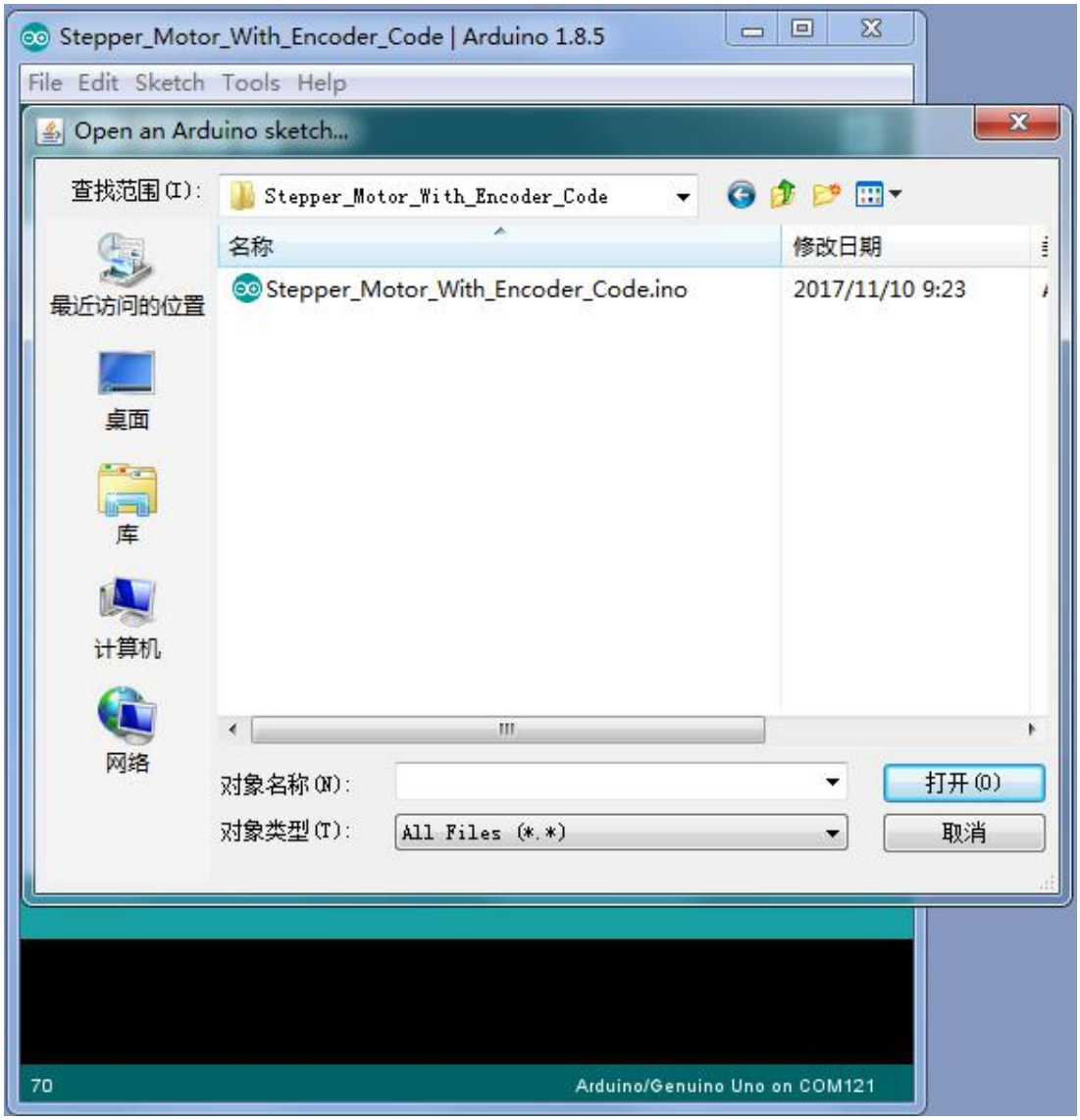
Step 1:Build the circuit



Schematic Diagram

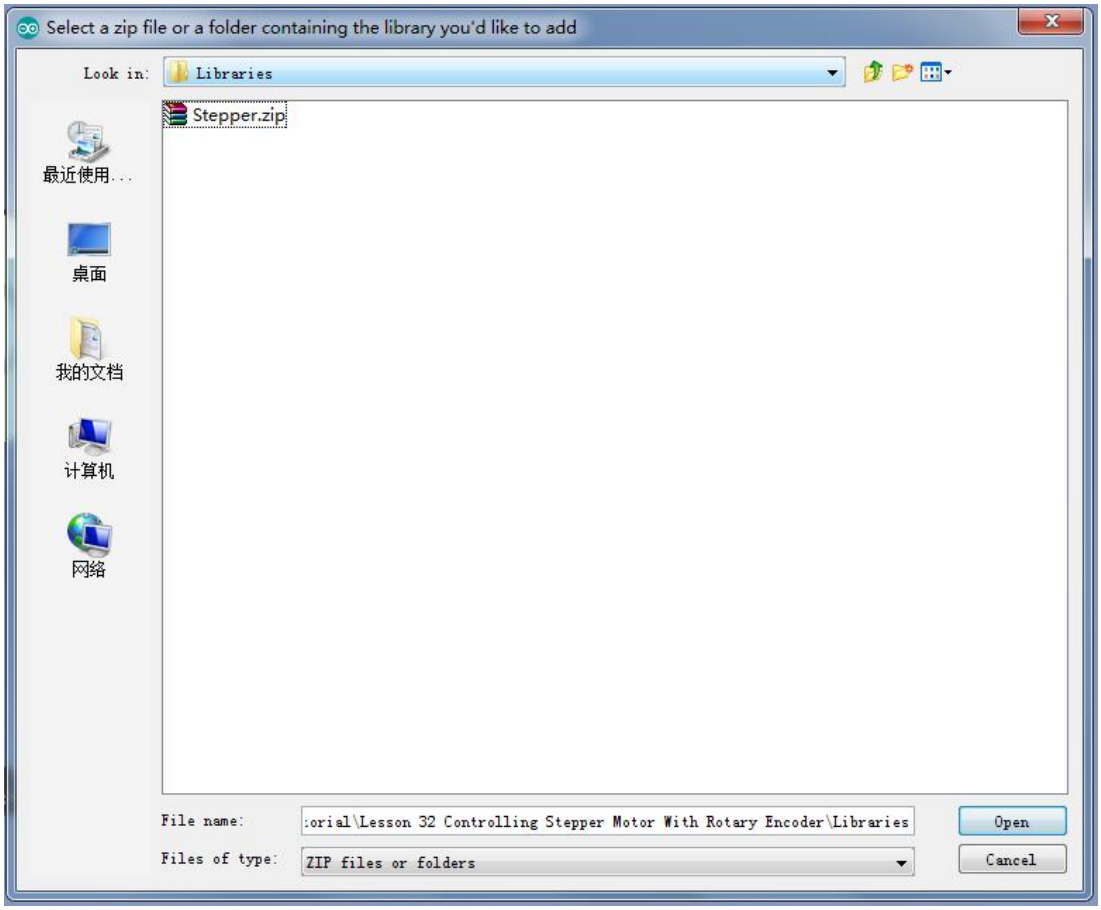


Step 2: Open the code:Stepper_Motor_With_Encoder_Code



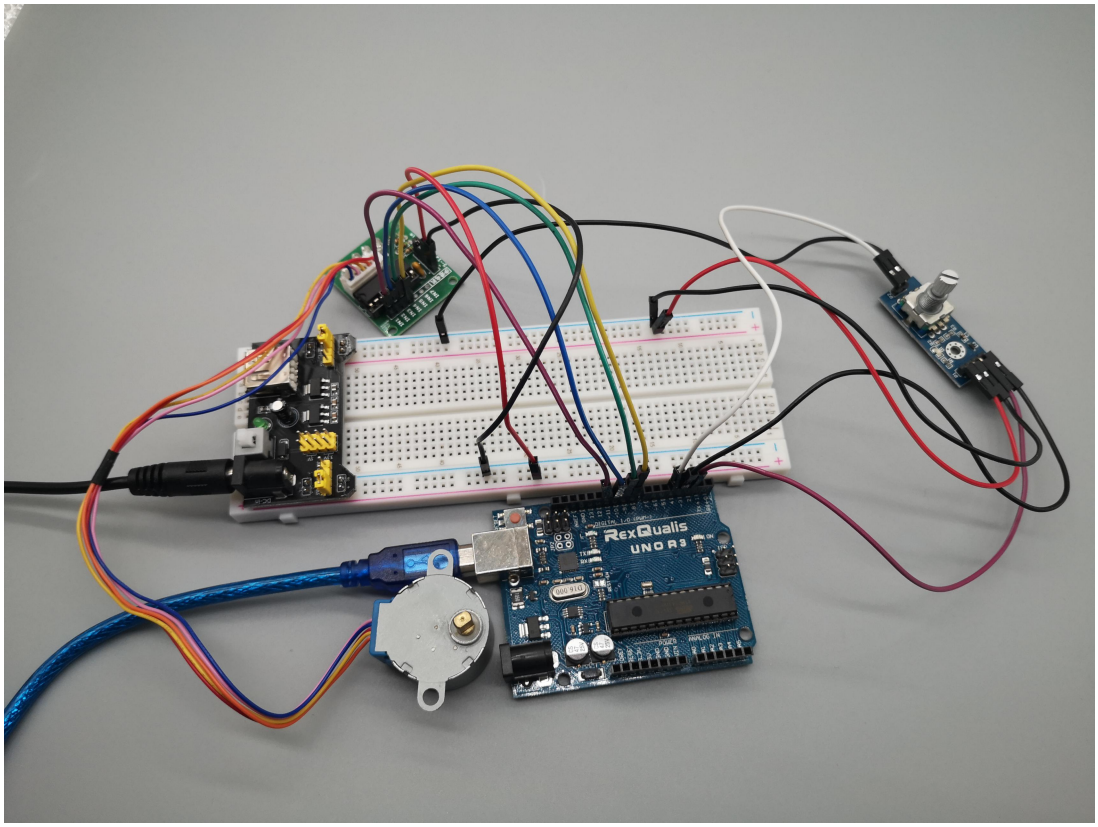
Step 3: Attach Arduino UNO R3 board to your computer via USB cable and check that the 'Board Type' and 'Serial Port' are set correctly.

Step 4: Load the Library:Stepper



Step 5:Upload the code to the RexQualis UNO R3 board.

Then,you can see that when you turn the Rotary Encoder, the Stepper motor will follow.



If it isn’t working, make sure you have assembled the circuit correctly, verified and uploaded the code to your board. For how to upload the code and install the library, check Lesson 0 Preface.