DIGITAL SCALE

Trần Gia Thịnh, Lê Minh Khôi, Đỗ Đức Hoàng, Huỳnh Bảo Thanh

# 1 Introduction

Weight accuracy plays an important role in not only industries but also in daily life such as in trading food or materials. Therefore, an instrument which is able to obtain precise and accurate goods, is highly required in companies and local sellers. In this project, we will try to construct a digital scale from sensor load cell 1 kg and module amplifier Hx711, then display the result in the optimal accuracy way.

# 2 Method

## 2.1 Hardware construction

In the hardware section, we use the list of components consisting of arduino nano, Hx711 module, load cell 1 kg, LCD and a frame set.

|  |
| --- |
| *Figure 1: LCD* |

|  |
| --- |
| *Figure 2: Load cell 1kg and Hx711 module* |

|  |
| --- |
| *Figure 3: Arduino Nano* |

|  |
| --- |
| *Figure 4: Frame set* |

## 2.2 Programming

After fully wiring the hardware section, we added the code below to the arduino module.

| #include <Q2HX711.h>  //LCD config  #include <Wire.h>  #include <LiquidCrystal\_I2C.h>  LiquidCrystal\_I2C lcd(0x27,16,2); //sometimes the LCD adress is not 0x3f. Change to 0x27 if it doesn't work.    //Pins  const byte hx711\_data\_pin = 3; //Data pin from HX711  const byte hx711\_clock\_pin = 2; //Clock pin from HX711  int tare\_button = 8; //tare button  Q2HX711 hx711(hx711\_data\_pin, hx711\_clock\_pin); // prep hx711    //Variables  long y1 = 181.0; // Grams  long x1 = 8649505;  long x0 = 8454100;  // x0, x1  //8454770, 9373578  //8454100, 8649505 (most accurate)    float avg\_size = 10.0; // amount of averages for each mass measurement  float tare = 0;  bool tare\_pushed = false;  //////////////////////////////////////////////////////////    void setup() {   Serial.begin(9600); // prepare serial port   PCICR |= (1 << PCIE0); //enable PCMSK0 scan   PCMSK0 |= (1 << PCINT0); //Set pin D8 trigger an interrupt on state change.   pinMode(tare\_button, INPUT\_PULLUP);     lcd.init(); //Init the LCD   lcd.backlight(); //Activate backlight     delay(1000); // allow load cell and hx711 to settle  }    void loop() {   // averaging reading   long reading = 0;   for (int jj=0;jj<int(avg\_size);jj++)   {   reading+=hx711.read();   }   reading/=long(avg\_size);     // calculating mass based on calibration and linear fit   float ratio\_1 = (float) (reading-x0);   float ratio\_2 = (float) (x1-x0);   float ratio = ratio\_1/ratio\_2;   float mass = y1\*ratio;     if(tare\_pushed)   {   tare = mass;   tare\_pushed = false;   Serial.print("TARE");   Serial.print(".");   lcd.setCursor(0,0);   lcd.print(" Tare ");   lcd.setCursor(0,1);   lcd.print(" . ");   delay(300);   Serial.print(".");   lcd.setCursor(0,0);   lcd.print(" Tare ");   lcd.setCursor(0,1);   lcd.print(" .. ");   delay(300);   Serial.println(".");   lcd.setCursor(0,0);   lcd.print(" Tare ");   lcd.setCursor(0,1);   lcd.print(" ... ");   delay(300);   }   if (mass - tare < 1.0) mass = tare;     // Display value   Serial.print(mass - tare);   Serial.println(" g");   lcd.clear();   lcd.setCursor(0,0);   lcd.print(" SCALE! ");   lcd.setCursor(0,1);   lcd.print(mass - tare);   lcd.print(" g");  }//End of void loop      //interruption to detect buttons  ISR(PCINT0\_vect)  {   if (!(PINB & B00000001))   {   tare\_pushed = true; //tare button was pushed   }  } |
| --- |

## 2.3 Calibrate

To ensure the scale work correctly, we calibrate by following steps:

Step 1: Use a precise scale to weigh a calibration object. Take note of this weight in grams.

Step 2: Add obtained number into line 14 in Coding section.

Step 3: Upload the code to the Arduino. Then open the Serial Monitor, put the weight onto the plate and record the second numbers on screen.

Step 4: Put the second numbers above into x1 and x0 variables at line 15, 16 respectively.

After this, the scale has been calibrated and the user can use it as normal.

# 3 Result

When all tasks mentioned have been done, we tested the scale with two different objects: a canned food and a pack of coffee. We performed multiple measurements for each object, then the received results were approximately similar to the information on the packaging although there is a difference in error about 0.01 in some of the measurements.

# 4 Discussion

During the time we operated the experiment, when we relocated the scale to another position, it sometimes resulted with lower accuracy. This phenomenon might come from the individualities of the components and the poor connection quality of common electronic wires. By fixing the connection wires, we made the inaccuracies minimized. In addition, we did try to put the objects in the several contacts of the plate and the results were unchanged.

# 5 Conclusion

To sum up, we succeeded in designing and constructing a usable electronic scale, which is able to produce relative accuracy measurements. For further work, there are considerable ideas to improve and develop: integrating the scale to an IOT system, combining all the components into one embedded circuit,...