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Calculating the Value of Coins Using Weight by Interfacing with Arduino

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ABSTRACT: Valuing the coins manually is the time taking process and there is no alternative for this problem in the existing world. There are many mechanisms in sorting a coin, but valuing a coin based on the weight is the most untouched mechanism, here in this concept, it is to integrate the load sensor and LCD module with Arduino uno using jumper wires. When a coin is placed on the load sensor it senses the weight of that particular coin and sends the electrical signal to Arduino uno. This microcontroller converts the input electrical signal to programmed output that shows the value of coin in rupees on the LCD module. This programming can be done for different coins as they exist in the banking system. This concept has a lot of potential that it can be used in banks and temples to value the coins within less time.

KEY WORDS: Load Sensor, Arduino Uno, LCD Module, Microcontroller

I. INTRODUCTION

Measuring the value of coins manually is a time taking process. Many domestic temples and small banks are still using a manual process to value the coins which might affect their time working hours. Valuing a large amount of coins within less time is a big task. Here in this project the main aim is to reduce the time while valuing the coins. There are many mechanisms in sorting the coins and the coins that are sorted according to their value will be further measured.

II. PRINCIPLE

Here in this paper, we measure the value of coins based on their weight and display their value in rupees according to their weight.
For example if a 1/- rupee coin weighs 5 grams then all coins in a bag are measured equivalent to the weight and display their value in rupees.

III. PROBLEM

There are many machines for valuing the notes but till date there is no machine that measures the value of coins accurately within less time. Small temples and small banks are still using manual methods to value the coins, and it is a time taking process so this problem can be solved by adopting this concept in temples and small banks.

IV. SOLUTION

When a 1 rupee coin of weight 5 grams is placed on a load cell it senses its weight and converts the weight of coin into its equivalent value and displays it on lcd screen, so we can measure the value of different coins in the same way that we measured 1 rupee coins. This can be continued for 2, 5, 10 rupee coins.

V. METHODOLOGY

A. Components used

- Arduino Uno

  Arduino is a microcontroller that takes input signals and converts it into equivalent output.The input signal can be a voltage signal and output signal can be a mechanical one.The boards feature serial communications interfaces,

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including Universal Serial Bus (USB) on some models, which are also used for loading programs. The microcontrollers can be programmed using the C and C++ programming languages, using a standard API which is also known as the Arduino language, inspired by the Processing language and used with a modified version of the Processing IDE. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) and a command line tool developed in Go.

FIG.1 ARDUINO UNO

- Load sensor

A load sensor (more commonly referred to as a "load cell") is an electronic device that converts tension and compression forces into a corresponding electrical signal. Load sensors are generally used to determine the weight of an object (as in household or industrial scales), but they are also used to quantify tension (such as in pulley cables and ropes). While designs and functions vary among load sensors, they all measure resistance and/or deformation within the sensor to determine the magnitude of tension and compression forces. The manufacturing, medical, grocery and automotive industries all benefit from load sensor technology. The two simplest load sensor designs are the hydraulic load sensor and the pneumatic load sensor. The hydraulic sensor uses liquid and the pneumatic sensor uses gas. When a tension or compression force is applied, the liquid or gas will expand or contract, generating an electrical signal that is directly proportional to the force applied. These sensors are often attached directly to gauges, and they are examples of pressure sensors. The most common type of load sensor is the strain gauge load sensor. A strain gauge consists of a flexible diaphragm and wire. When this load sensor experiences compression or tension, the electrical resistance within the strain gauge decreases or increases proportionally. Strain gauge load sensors are often arranged in Wheatstone bridge configurations (which are used to calculate an unknown resistance by using three known resistances).

Fig .2 load cell

- HX711 Load Cell Module

The SparkFun Load Cell Amplifier is a small breakout board for the HX711 IC that allows you to easily read load cells to measure weight. By connecting the amplifier to your microcontroller you will be able to read the changes in the resistance of the load cell, and with some calibration you'll be able to get very accurate weight measurements. This can be handy for creating your own industrial scale, process control or simple presence detection.

This version of the SparkFun Load Cell Amplifier features a few changes that you specifically asked for! We have separated the analog and digital supply, as well as added a 3.3uH inductor and a 0.1uF filter capacitor for digital supply. Need even more? Checkout the SparkFun Qwiic Scale. It has all the features of the HX711 but with additional library support, a true I2C interface, and no soldering required!

The HX711 uses a two-wire interface (Clock and Data) for communication. Any microcontroller's GPIO pins should work, and numerous libraries have been written, making it easy to read data from the HX711. Check the

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hookup guide below for more information.

Load cells use a four-wire Wheatstone bridge configuration to connect to the HX711. These are commonly colored RED, BLK, WHT, GRN and YLW. Each color corresponds to the conventional color coding of load cells:

- Red (Excitation or VCC)
- Black (Excitation- or GND)
- White (Amplifier-, Signal- or Output-)
- Green (A+, S+ or O+)
- Yellow (Shield)

The YLW pin acts as an optional input that are not hooked up to the strain gauge but is utilized to ground and shield against outside EMI (electromagnetic interference). Please keep in mind that some load cells might have slight variations in color coding.

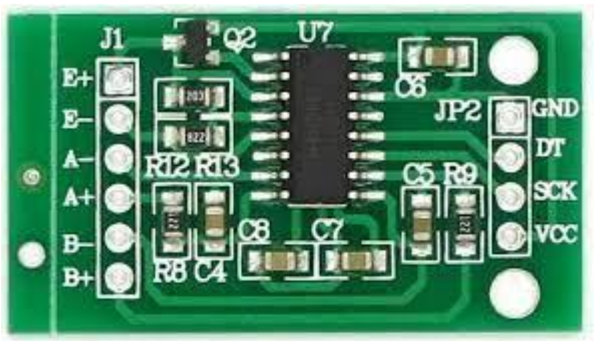

Fig. 3 Load cell module HX711

- LCD module 16*2

  An LCD is an electronic display module that uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in DIYs and circuits. The 16×2 translates to a display of 16 characters per line in 2 such lines.

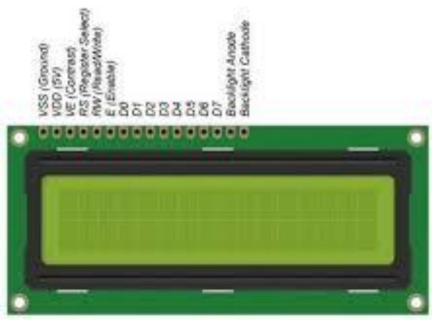

Fig.4 16*2 LCD Module

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- Coins

Table1. Weights of Indian coins

Denomination	Metal Weight Shape Size	Obverse	Reverse
Ten Rupees	Bimetallic Cupro-Nickel in Center Aluminium Bronze in outer ring 7.71 gm Circular 27 mm		
Five Rupees	Nickel Brass 6 gm Circular 23 mm		
Two Rupees	Ferritic Stainless Steel 4.85 gm Circular 25 mm		
Rupee One	Ferritic Stainless Steel 3.79 gm Circular 22 mm		

B.Applications

- temples
- small banks
- RTC bus depots (ticket collection)
- retail stores
- super marts
- railways stations (tickets collection)

C.Circuit diagram

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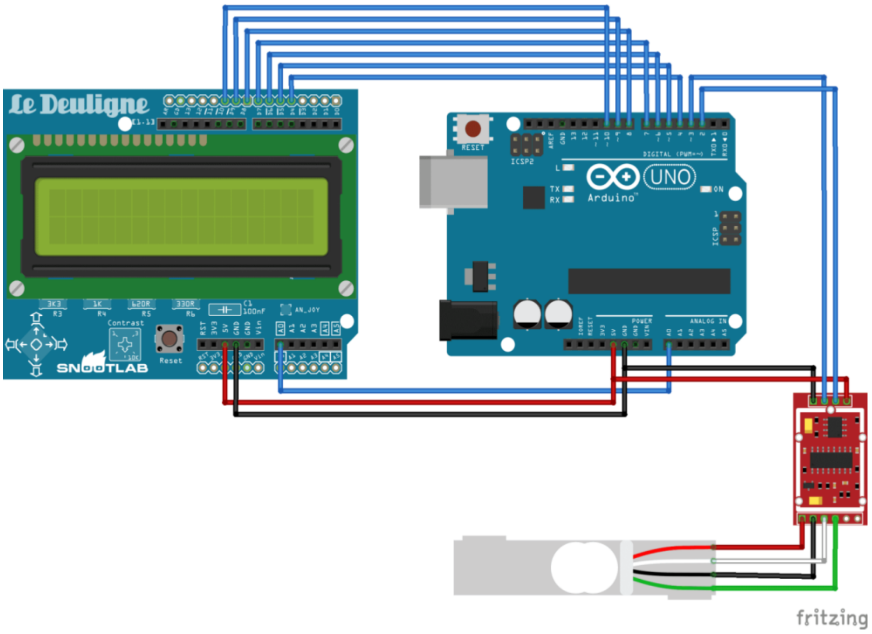

Fig.5. Circuit diagram

D.Programming code for calibration of HX711

```
 *  HX711 Calibration
 Setup your scale and start the sketch WITHOUT a weight on the scale
 Once readings are displayed place the weight on the scale
 Press +/- or a/z to adjust the calibration_factor until the output readings match the known weight
*/

#include "HX711.h"
#define DOUT  4
#define CLK   5
HX711 scale(DOUT, CLK);

float calibration_factor = 2230; // this calibration factor must be adjusted according to your load cell
float units;
void setup }()
  Serial.begin(9600);
  Serial.println("HX711 calibration sketch");
  Serial.println("Remove all weight from scale");
  Serial.println("After readings begin, place known weight on scale");
  Serial.println("Press + or a to increase calibration factor");
  Serial.println("Press - or z to decrease calibration factor");

   scale.set_scale(calibration_factor); //Adjust to this calibration factor
  scale.tare();  //Reset the scale to 0

  long zero_factor = scale.read_average(); //Get a baseline reading
  Serial.print("Zero factor: "); //This can be used to remove the need to tare the scale. Useful in permanent scale projects.
  Serial.println(zero_factor);
{

void loop}()
```

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Vol. 9, Issue 6, June 2022

```
 Serial.print("Reading");
 units = scale.get_units(), 5;
 if (units < 0)
}
  units = 0.00;
 {
  Serial.print("Weight: ");
 Serial.print(units);
 Serial.print(" grams");
 Serial.print(" calibration_factor: ");
 Serial.print(calibration_factor);
 Serial.println();
  if (units==10)
   lcd.setCursor(12,0);
   lcd.print("currency=rs.1");
  else if (units==20)
   lcd.setCursor(12,0);
   lcd.print("currency=rs.2");
  else if (units==30)
   lcd.setCursor(12,0);
   lcd.print("currency=rs.5");
  else if (units==40)
   lcd.setCursor(12,0);
   lcd.print("currency=rs.10");
```

F..Programming code for valuing coins

```
 Digital valuing Scale with Load Cell
#include "HX711.h"  //You must have this library in your arduino library folder
#include <LiquidCrystal.h>
LiquidCrystal lcd(12, 11, 10, 9, 8, 7);
#define DOUT  4
#define CLK  5
HX711 scale(DOUT, CLK);

float calibration_factor = 2230; // this calibration factor is adjusted according to my load cell
float units;
float currency;

void setup() {
 lcd.begin(16,2);
 Serial.begin(9600);
 Serial.println("Press T to tare");
scale.set_scale(calibration_factor); //Adjust to this calibration factor
 scale.tare();
}

void loop() {

 units = scale.get_units(), 5;
 if (units < 0)
 {
  units = 0.00;
 }
 lcd.setCursor(0,0);
```

ISSN: 2350-0328
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Vol. 9, Issue 6, June 2022

```
lcd.print("Weight: ");
lcd.setCursor(4,0);
lcd.print(units,5); //displays the weight in 4 decimal places only for calibration
lcd.setCursor(8,0);
lcd.print("grams");
  if (units==10)
    lcd.setCursor(12,0);
    lcd.print("currency=rs.1");
  else if (units==20)
    lcd.setCursor(12,0);
    lcd.print("currency=rs.2");
   else if (units==30)
    lcd.setCursor(12,0);
    lcd.print("currency=rs.5");
   else if (units==40)
    lcd.setCursor(12,0);
    lcd.print("currency=rs.10");
    if(Serial.available())
{
  char temp = Serial.read();
  if(temp == 't' || temp == 'T')
    scale.tare();  //Reset the scale to zero
}
```

VI. RESULTS AND DISCUSSION

The time taken in valuing the coins is decreased, productivity and accuracy is increased. It has a lot of potential in problem solving and has a great market value because of its cost effectiveness.

VII. CONCLUSION

The demand for valuing the coins in future is high and any person can afford it because of its absolute low cost. This concept has a lot of potential that it can be used in banks and temples to value the coins within less time.

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