Embedded Project

Title:

Kitchen Ingredients System

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Section:

VI-B

Submitted To:

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Table of Contents

BOM Comparison

Sr. No.	Component Name	Specification/Details	Quantity	Estimated Cost (PKR)	Actual Cost (PKR)	Remarks
1	Arduino Uno	ATmega328P Microcontroller Board	1	700	**1050**	Used as main controller
2	Load Cell	40kg Load Cell	1	500	**450**	Weight measurement sensor
3	HX711 Amplifier	Analog to Digital Converter Module	1	350	**180**	Amplifies signal from Load Cell
4	16x2 LCD Display	Without I2C, parallel communication	1	500	**500**	Parallel interface used
5	Buzzer	5V Active Buzzer Module	1	80	**40**	Used for alert
6	Jumper Wires	Male-to-Male / Male-to-Female (Set)	1 set	120	**180**	Connections between modules
7	USB Cable	USB Type B for Arduino	1	100	**120**	For programming and power
8	Potentiometer (RV2)	10k Ohm for LCD contrast control	1	30	**30**	Contrast adjustment
9	Push Button	Calibration button	1	20	**20**	For taring/calibration
10	Resistors/Wires	Misc small components for connections	few	50	**30**	Basic electronics
	Total			**2450**	**2600**	

Arduino Code:

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(2, 3, 4, 5, 6, 7);
#define DT A0
#define SCK A1
#define sw 10
long sample=0;
```

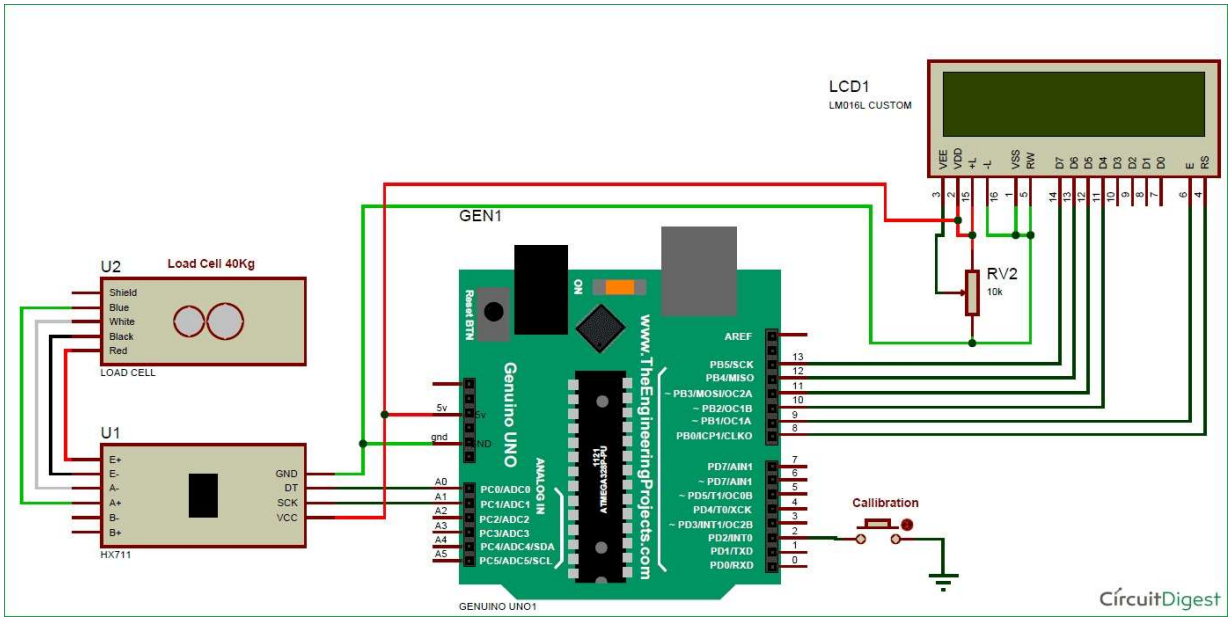
```
float val=0;
long count=0;
unsigned long readCount(void)
{
  unsigned long Count;
  unsigned char i;
  pinMode(DT, OUTPUT);
  digitalWrite(DT,HIGH);
  digitalWrite(SCK,LOW);
  Count=0;
  pinMode(DT, INPUT);
  while(digitalRead(DT));
  for (i=0;i<24;i++)
  {
    digitalWrite(SCK,HIGH);
    Count=Count<<1;
    digitalWrite(SCK,LOW);
    if(digitalRead(DT))
    Count++;
  }
  digitalWrite(SCK,HIGH);
  Count=Count^0x800000;
  digitalWrite(SCK,LOW);
  return(Count);
}
void setup()
{
  Serial.begin(9600);
  pinMode(SCK, OUTPUT);
  pinMode(sw, INPUT_PULLUP);
  pinMode(8,OUTPUT);
  lcd.begin(16, 2);
  lcd.print("    Weight ");
  lcd.setCursor(0,1);
  lcd.print(" Measurement ");
  delay(1000);
  lcd.clear();
  calibrate();
}
void loop()
{
  count= readCount();
  int w=(((count-sample)/val)-2*((count-sample)/val));
  Serial.print("weight:");
  Serial.print((int)w);
  Serial.println("g");
  lcd.setCursor(0,0);
  lcd.print("Weight           ");
  lcd.setCursor(0,1);
  lcd.print(w);
  lcd.print("g           ");
```

```
if(w<100)
{
digitalWrite(8,HIGH);
lcd.setCursor(6,1);
  lcd.print("Low Stock");
delay(100);
}
if(w>100)
{
digitalWrite(8,LOW);
delay(100);
}
  if(digitalRead(sw)==0)
  {
    val=0;
    sample=0;
    w=0;
    count=0;
    calibrate();
  }
}
void calibrate()
{
    lcd.clear();
  lcd.print("Calibrating...");
  lcd.setCursor(0,1);
  lcd.print("Please Wait...");
  for(int i=0;i<100;i++)
  {
    count=readCount();
    sample+=count;
    Serial.println(count);
  }
  sample/=100;
  Serial.print("Avg:");
  Serial.println(sample);
  lcd.clear();
  lcd.print("Put 100g & wait");
  count=0;
  while(count<1000)
  {
    count=readCount();
    count=sample-count;
    Serial.println(count);
  }
  lcd.clear();
  lcd.print("Please Wait....");
  delay(2000);
  for(int i=0;i<100;i++)
  {
    count=readCount();
```

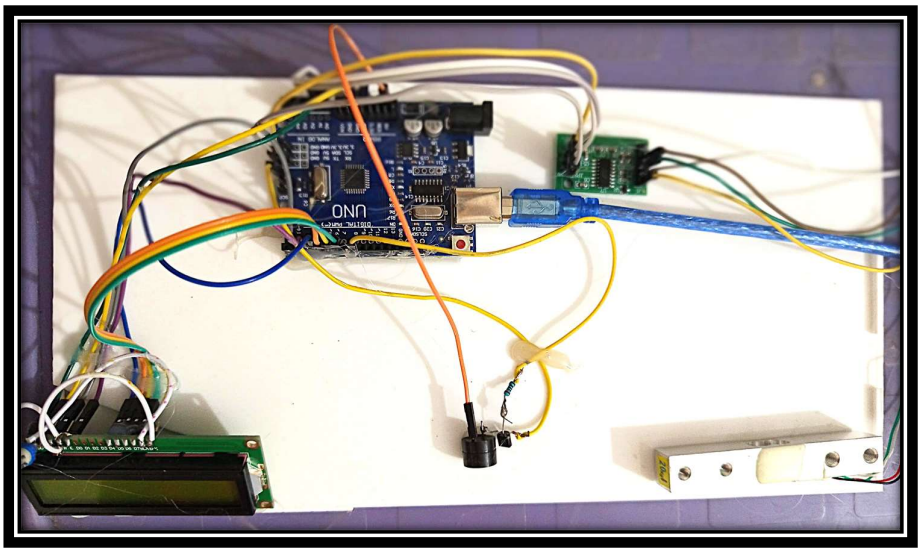
```
  val+=sample-count;
  Serial.println(sample-count);
 }
 val=val/100.0;
 val=val/100.0;      // put here your calibrating weight
 lcd.clear();
}
```

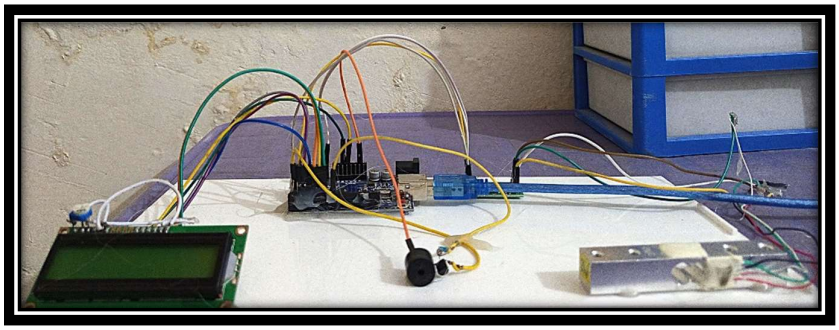
Hardware Connection:

Wiring Diagram(Fritzing Diagram)



Physical Hardware Setup





Member's Contribution:

1. **Iqra Shahzad**– Prepared the detailed report and created the initial Bill of Materials (BOM) sheet, outlining estimated costs and component specifications, helped to remove port error.
2. **Zainab** – Designed the project poster and was responsible for purchasing the required components from the market, participated in code logic.
3. **Urooj Fatima** – Developed the complete wiring diagram and handled the practical implementation of the project with project demonstration video, including hardware assembly and testing.

Project Demonstration Video:

https://drive.google.com/file/d/1Hat9LZs1pPW6q04xxU98MdBhpKb0NCE2/view?usp=sharing

Annexures:

Step-by-Step Connection Description

1. Power Supply Connections

- **Arduino UNO is powered via USB cable** from a PC or 5V USB adapter.
  - Supplies:
    - **5V regulated output** via 5V pin
    - **Ground reference** via GND pin
- **Jumper Wires Used:**
  - **Red jumper wires**: used to carry **5V power**
  - **Black jumper wires**: used to carry **GND (ground)** connections

2. Load Cell (U2) to HX711 (U1) Amplifier Module

Load Cell Wires (from Strain Gauge Sensor):

Wire Color	Signal Name	Connected To (on HX711)	Purpose
Red	Excitation+ (E+)	E+ terminal	Provides positive excitation voltage for the Wheatstone bridge
Black	Excitation– (E–)	E– terminal	Provides negative excitation voltage
White	Signal+ (A+)	A+ terminal	Analog output from bridge (positive input)
Green	Signal– (A–)	A– terminal	Analog output from bridge (negative input)
Shield	Optional Ground	(Not shown)	May be tied to GND to reduce noise

Jumper wires from HX711 screw terminals connect to these color-coded wires from the load cell using secure screw clamp terminals.

3. HX711 Module to Arduino UNO

HX711 Pin	Jumper Wire Color	Arduino UNO Pin	Description
VCC	Red	5V	Powers HX711 module
GND	Black	GND	Common ground
DT	Yellow	A1	Digital Data Output from HX711 to Arduino
SCK	Green	A0	Clock signal for synchronous communication

The **HX711** converts the small analog voltage difference from the load cell into digital data that the Arduino can read.

4. 16x2 LCD Display (Liquid Crystal Display)

Connected in **4-bit mode** using the **Hitachi HD44780** standard.

Power & Control Pins:

LCD Pin	Label	Connected To	Function
1	VSS	GND	Ground
2	VDD	5V	Power supply
3	VEE	Center of Potentiometer (RV2)	Controls LCD contrast
4	RS	Arduino Pin 6	Register Select: 0 = Command, 1 = Data

LCD Pin	Label	Connected To	Function
5	RW	GND	Always Write mode
6	E	Arduino Pin 7	Enable pin, triggers LCD to read data

Data Pins (used in 4-bit mode):

LCD Pin	Label	Connected To	Purpose
11	D4	Arduino Pin 8	Data bit 4
12	D5	Arduino Pin 9	Data bit 5
13	D6	Arduino Pin 10	Data bit 6
14	D7	Arduino Pin 11	Data bit 7

Backlight Pins:

LCD Pin	Label	Connected To	Purpose
15	LED+	5V (Red wire)	Backlight power
16	LED–	GND (Black wire)	Backlight ground

Jumper Wires:

- All LCD pins are connected with male-to-female jumper wires to Arduino headers.
- The LCD is in **write-only mode** (RW = GND).
- Only 4 data lines are used to save pins (4-bit mode).

5. Potentiometer (RV2)

Potentiometer Pin	Connected To
Left Terminal	5V
Right Terminal	GND
Middle Terminal	LCD Pin 3 (VEE)

Turning the knob adjusts voltage to LCD Pin 3, affecting display contrast.

6. Push Button (Calibration Button)

Button Pin	Connected To	Function
One side	Arduino Pin 2	Input pin used to trigger a calibration routine

Button Pin	Connected To	Function
Other side	GND	When pressed, completes circuit and sends LOW signal to Arduino

A **pull-up resistor** may be enabled in the code (pinMode(2, INPUT_PULLUP)) to detect button press accurately.

Overall Data Flow

1. **Load Cell** detects weight → sends small analog signal to HX711.
2. **HX711** amplifies and digitizes → sends to Arduino via A0 & A1.
3. **Arduino** reads weight data and formats display message.
4. **LCD** shows the weight in grams/kilograms.
5. **Button** can reset or calibrate the scale.
6. **Potentiometer** adjusts screen visibility.

Arduino Pin Usage:

Arduino Pin	Connected To	Purpose
A0	HX711 SCK	Clock signal for HX711
A1	HX711 DT	Data from HX711
2	Push Button	Detect press for calibration
6	LCD RS	Control signal
7	LCD Enable (E)	Trigger LCD data read
8	LCD D4	LCD data line
9	LCD D5	LCD data line
10	LCD D6	LCD data line
11	LCD D7	LCD data line
5V	HX711 VCC, LCD VDD, Potentiometer, LCD LED+	Power
GND	HX711 GND, LCD VSS, RW, Potentiometer, Button, LED–	Ground

References:

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[2] SparkFun Electronics, "Load Cell Amplifier HX711 Breakout Hookup Guide," *SparkFun Learn*. [Online]. Available: https://learn.sparkfun.com/tutorials/load-cell-amplifier-hx711-

breakout-hookup-guide/all
[3] Arduino Official, "LiquidCrystal - Arduino Reference," *Arduino.cc*. [Online]. Available: https://www.arduino.cc/en/Reference/LiquidCrystal
[4] Arduino Official, "Button - Arduino Example Tutorial," *Arduino.cc*. [Online]. Available: https://www.arduino.cc/en/Tutorial/Button
[5] Circuit Digest, "Interfacing HX711 Load Cell with Arduino," *CircuitDigest.com*. [Online]. Available: https://circuitdigest.com/microcontroller-projects/interfacing-hx711-load-cell-with-arduino