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JSS Mahavidyapeetha

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Report on Event – 4

Topic : **Digital Weight Scale using Load Cell**

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CONTENT

1. INTRODUCTION

Weighing process is more accurate than radar or ultrasonic, flowmeters or level sensors for tank or silo inventory control. It is independent from material characteristics, tank shape, temperature foam or dust.

The basics of load cell technology is converting a load which is a force applied to any mass in the earth gravity field into an electrical signal. Most load cells have so called load cell sensors that convert a mechanical strain into a resistant change. load cell sensor is converted into resistant change and finally into a voltage output. That output is proportional to the applied mass. A scale load cell, or load cell sensor, is used in variety of industries in which precise measurements are needed. Load cells accurately measure the weight of tanks, vessels, hoppers or conveyors. Load cells are built to withstand the demands of a variety of rugged industrial applications.

The capacity of load cells can greatly vary. Some load cells are more appropriate for laboratory applications, while others are more appropriate for high-capacity batches or logistics applications. Load cells shall meet all globally-required approvals and standards. They include electronic load cells, analog load cells and hydraulic load cells that allow you to change your structure into a scale. Load cells are used in floor scales, belt weighers, weighing systems, pallet scales, checkweigher scales, load cell scales and conveyor scales. Loading cell technology from METTLER TOLEDO features robustness for harsh environments as well. These are typically used in tank scales, vessel weighing, silo scales and truck weighing.

2. OBJECTIVES

To measure the weight using load cell of particular range digitally with more accuracy.

3. BLOCK DIAGRAM

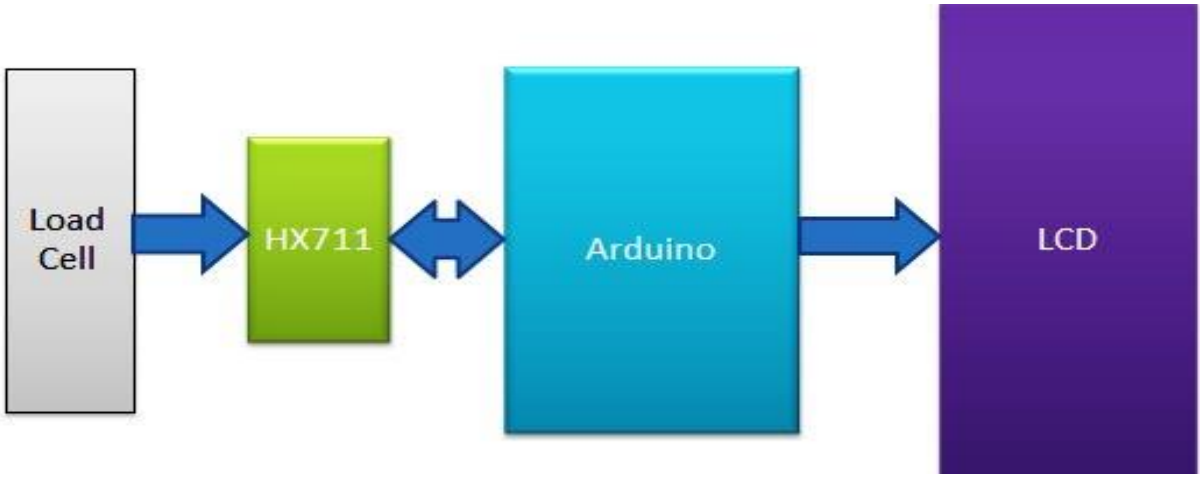

Fig.3.1

4. PIN DIAGRAM

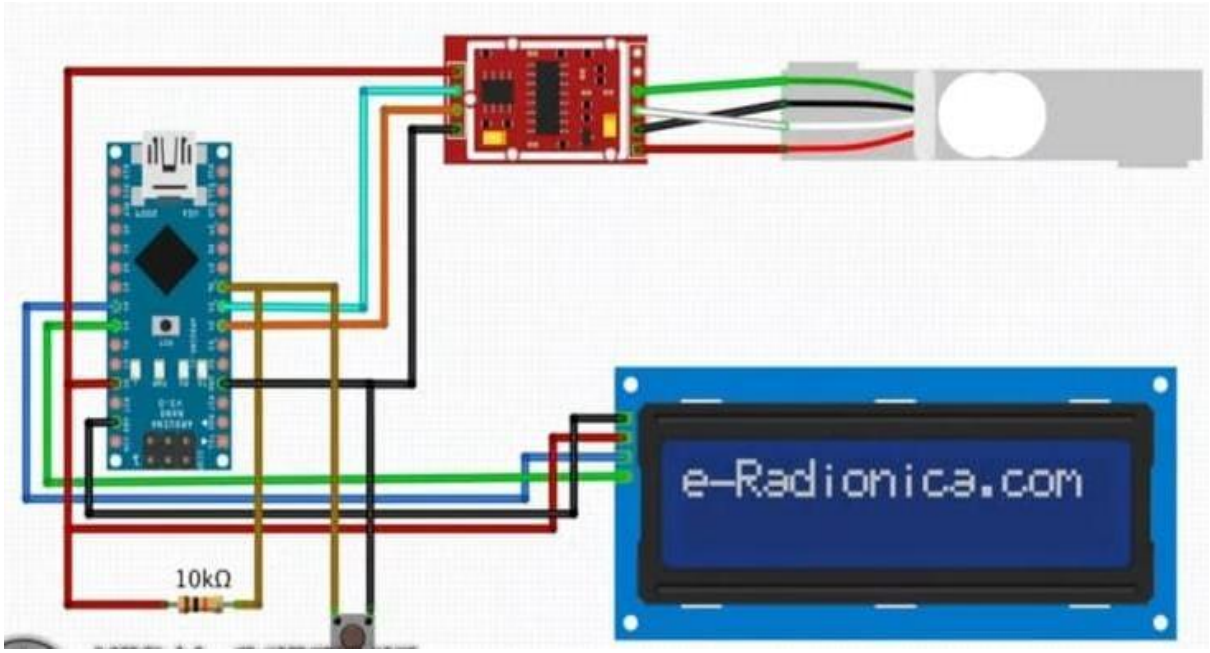

Fig.4.1

5. CIRCUIT DIAGRAM

6. COMPONENTS REQUIRED

- Load cell (20kg)
- HX711 Load cell Amplifier Module
- Display- 16x2 LCD I2c converter
- Ardiuno Nano
- Connecting wires
- USB cable
- Breadboard

6.1. Load Cell

• The load cell is a transducer that transforms force or pressure into electrical output. The magnitude of this electrical output is directly proportional to the force being applied.

• Load cells have a strain gauge, which deforms when pressure is applied to it. And then strain gauge generates an electrical signal on deformation as its effective resistance changes on deformation. A load cell usually consists of four strain gauges in a Wheatstone bridge configuration.

• Load cell comes in various ranges like 5kg, 10kg, 100kg and more, here we have used Load cell, which can weigh up to 20kg. 1. Load Cell .

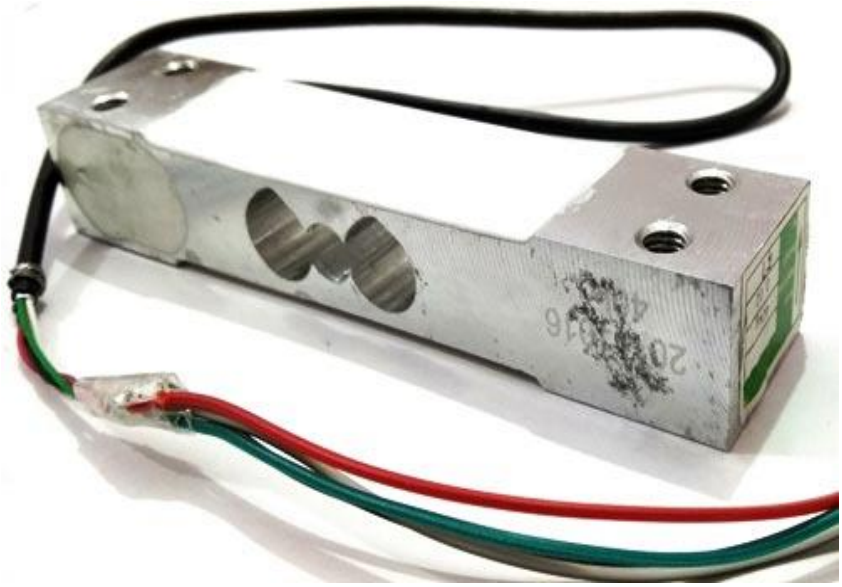

Fig.6.1

6.2. HX711 Weighing Sensor Module

- HX711 module is used to get measureable data out from a load cell and strain gauge.
- HX711 acts as an amplifier which amplifies the electrical signals generated by the Load cell which are in few millivolts to the required rage for the further applicatin.
- **HX711 Weighing Sensor Module** has HX711 chip, which is a 24 high precision Analog to digital converter. This converts analog electrical signal outpt of the load cell to digital signals.
- HX711 has two analog input channels and we can get gain up to128 by programming these channels.
- The load cell is connected with the HX711 Load cell Amplifier using four wires. These four wires are Red, Black, White, and Green/Blue.

- RED Wire is connected to E+
- BLACK Wire is connected to E-
- WHITE Wire is connected to A-
- GREEN Wire is connected to A

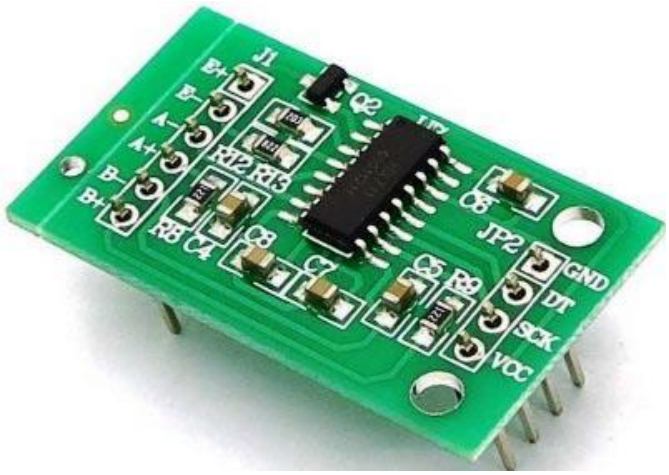

Fig.6.2

6.3. 16x2 LCD I2c converter:

This is I2C interface 16x2 LCD display module is a high-quality 2 line 16 character LCD module which displays negative white characters on blue background with on-board contrast control adjustment, backlight and I2C communication interface
The real significance advantages of this I2C Serial LCD module will simplify the circuit connection, save some I/O pins on Arduino board .Compatible with Arduino Board or other controller board with I2C bus.
Specifications:-

- Display Type: Negative white on Blue backlight.
- I2C Address:0x38-0x3F (0x3F default)
- Supply voltage: 5V
- Interface: I2C to 4bits LCD data and control lines.
- Contrast Adjustment: built-in Potentiometer.
- Backlight Control: Firmware or jumper wire.
- Board Size: 80x36 mm. 16x2 LCD I2c converter
- Power consumption 0.075W

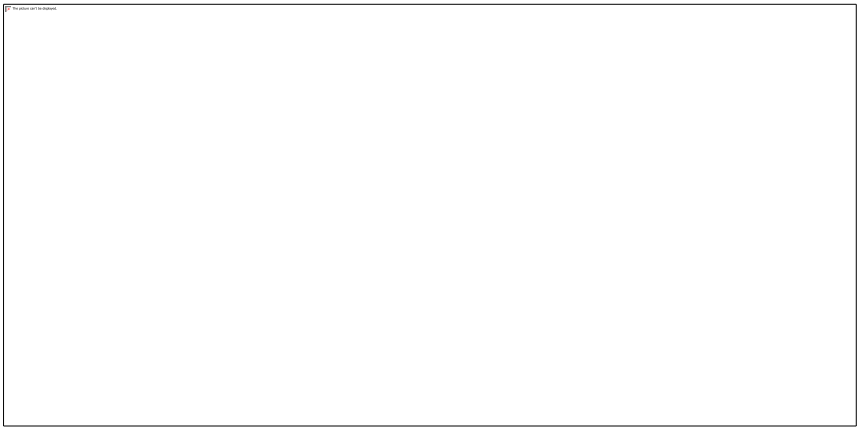

Fig.6.3

6.4. Arduino Nano

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3. x).

Microcontroller	ATmega328P – 8-bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage for Vin pin	7-12V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (2 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
PWM output	6
POWER CONSUMPTION	19 mA
PCB SIZE	18 x 45 mm
WEIGHT	7 g
PRODUCT CODE	A000005

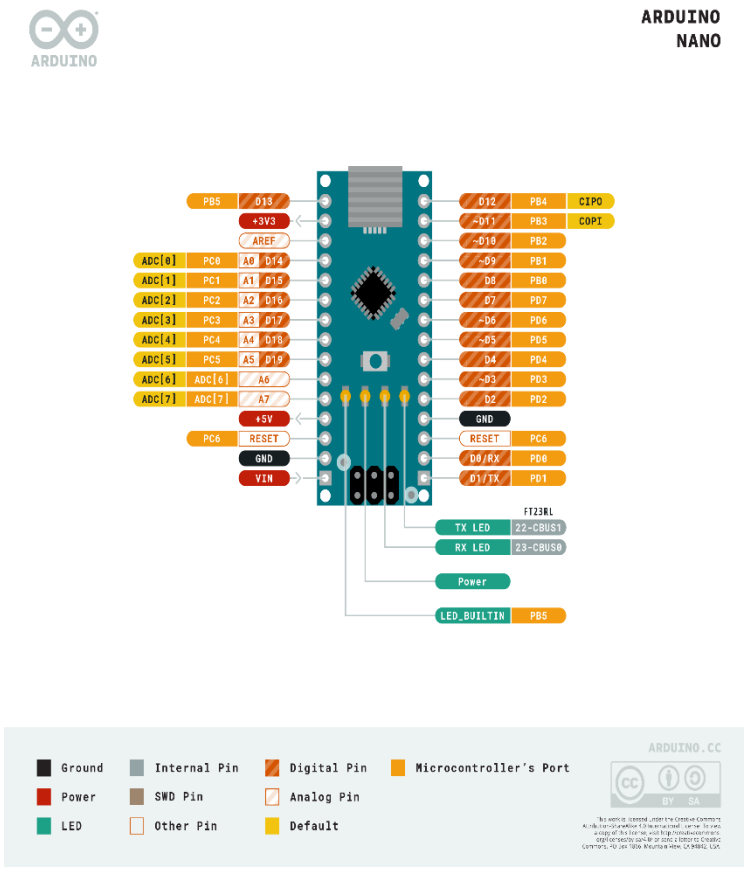
ARDUINO
ARDUINO
NANO
PB5 D13
+3V3
AREF
ADC[0] PC0 A0 D14
ADC[1] PC1 A1 D15
ADC[2] PC2 A2 D16
ADC[3] PC3 A3 D17
ADC[4] PC4 A4 D18
ADC[5] PC5 A5 D19
ADC[6] ADC[6] A6
ADC[7] ADC[7] A7
+5V
PC6 RESET
GND
VIN
D12 PB4 CIPO
~D11 PB3 COPI
~D10 PB2
~D9 PB1
D8 PB0
D7 PD7
~D6 PD6
~D5 PD5
D4 PD4
~D3 PD3
D2 PD2
GND
RESET PC6
D0/RX PD0
D1/TX PD1
FT23RL
TX LED 22-CBUS1
RX LED 23-CBUS0
Power
LED_BUILTIN PB5
Ground
Power
LED
Internal Pin
SWD Pin
Other Pin
Digital Pin
Analog Pin
Default
Microcontroller's Port
ARDUINO.CC
BY SA

Fig.6.4

7. Working principle

- Working principle of this digital scale using load cell is converting a load or force into an electronic signal using transducer.
- This electronic signal can be voltage, current or frequency change depending on the type of the load cell and the circuit used.
- Connections are made as shown in the circuit.
- Initially, weight is placed on platform mounted above the load cell , which records the force/pressure exerted by weight.
- The recorded weight applied which will be in terms of change in resistance is converted to an analog signal i.e., current in mV by the strain gauges present in load cell. This output current is the function of weight applied.
- So the low electric output of Load cells is amplified by HX711 module and converts into digital signal.
- This amplified & digitally converted signal is fed into the Arduino to derive the weight measurement.
- Arduino is fed with predefined program for receiving , analysing the digital output from HX711 module will represent the data in required format on LCD(g).
- Calibration has to be done using standard weight like 100g or 200g and by adjusting calibration factor in code according to the standard weight.
- The maximum range of weight measurement also depends upon the designing of the instrument along with the maximum range of the load cell.

8. Results

Objects	Actual weight In grams	Measured weight In grams	Error in %	Image of reading
Mobile phone	208	210.2	0.96	
Water bottle	80	77.9	2.69	
Metallic box	78	81.2	2.02