IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE)
e-ISSN: 2278-1676,p-ISSN: 2320-3331, Volume 14, Issue 4 Ser. I (Jul. – Aug. 2019), PP 32-37
www.iosrjournals.org

Manufacture of Electronic Weighing Machine Using Load Cell

Snehashis Das[1], Avijit Karmakar[2], Pikan Das[3], Biman Koley[4]
[1(]*Department of Electrical Engineering, Technique Polytechnic Institute, India)*
[2]*(Department of Electrical Engineering, Technique Polytechnic Institute, India)*
[3]*(Department of Electrical Engineering, Technique Polytechnic Institute, India)*
[4]*(Department of Electrical Engineering, Technique Polytechnic Institute, India)*
Corresponding Author; Snehashis Das

Abstract: *We have seen weighing machine at many shops, where machine displays the weight just by placing any item on the WEIGHING platform. The building of the weighing machine can be done by 7 segment LCD display using required DRIVER ICs, MICROCONTROLLER or by USING ARDUINO. Our project is to design weighing machine using ARDUINO & LOAD CELL, having capacity of measuring up to 20kgs. This limit can be further increased by using the load cell of higher capacity. In our project we have used HX711 IC& ARDUINO[1]. Here load cell acts as a transducer which transforms weight into Electrical Output. The basic unit of Load Cell is Strain Gauge which deforms when pressure is applied on it. Load cells are highly accurate transducers which provide the user with the information not generally obtainable by other technology due to commercial factors[2] Implementing arduino in weight measurement machine is easy and also economical. Initially one needs to calibrate this system for measuring the correct weight and after that the operation gives pretty accurate results.*

Date of Submission: 28-07-2019 Date of acceptance: 13-08-2019

I. Introduction

Nowadays to measure a perfect weight is a most vital requirement in the industries. It is very important to measure precisely and store of the measured value (weight). Nowadays the mechanical weighing machines are not used and are replaced by the electronic weighing machine as the electronic weighing machine has upper hand of higher accuracy& higher degree of reliability. Load cells are sensors that are used in the industry for variety of physical measurements[3]. Compared to the other weighing machine it has many advantages like- 1. Smaller in sizes than the others, 2.High speed response and rapid weighting, 3.good accuracy, 4.High dependability, 5.Online processing through computer, 6. Print out facility and parallel display can be attached. The Electronic weighing machine are manufactured by the combination of a transducer (load cell), a HX 711 module, an Arduino Uno and a LCD Display. The signals from the load cell are amplified and fed to the HX711 module and then to the Arduino Uno and then the LCD Display which is connected to the Arduino is then gives the output result, how much weight is calibrated and is given to the load cell.

II. . Importance Of The Project In The Present Technical Scenario

The electronic weighing machine helps us to show that the exact weight of a product by virtue of which one can ensure that how much weight is given. One can't ignore its need in an industry while talking about the importance of this machine.

Electronic weighing scale has become very popular and people consider it as one of the best ways to ensure that the production of goods and services happen in accurate manner. The Electronic WEIGHING machine helps in telling the exact weight so the one can ensure that how many numbers of products are produced.

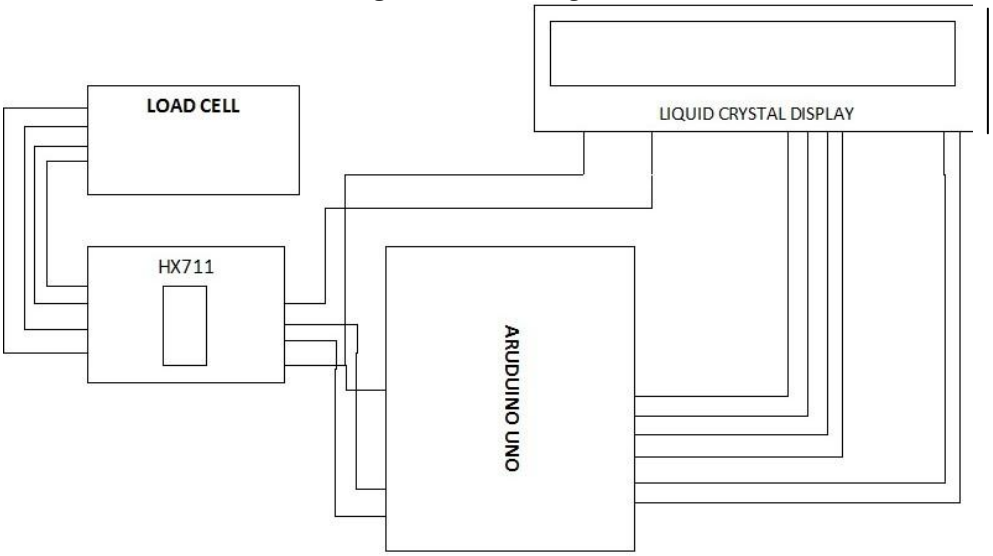
Telling the exact amount of production: While manufacturing products it actually become challenging to count the number of products manufactured, thus to ensure that one have the exact details of the products produced, one can ensure to get the exact numbers of the products. We can monitor the trend of usage of individual materials[3].

Easy to use: the WEIGHING scale is very easy to use and it actually makes it possible for one to know the amount of the production which happens on a regular basis. Alone has required to do is to put the products on it to know about the weight of the product items.

Increases work efficiency: The other best thing about using a WEIGHING scale for industry use is that if increases the work efficiency and It also helps the workers a lot as they can do their job at a much more fine manner.

III. Block Diagram

Figure 1: Block Diagram

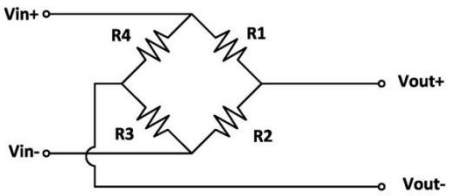


IV. Component Details

LOAD CELL: A load cell is a transducer that is used to create an electrical signal whose magnitude is directly proportional to the force. The load cell that we will use in this project is a strain gauge.

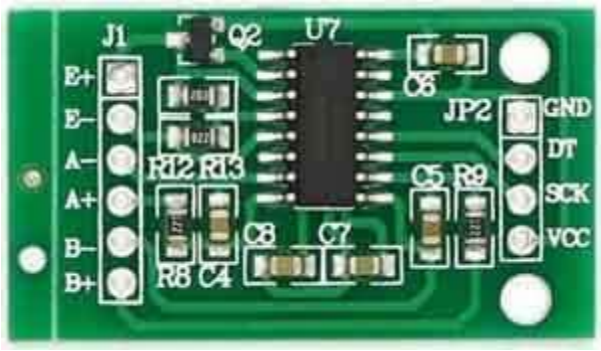
The strain gage-based load cells has the characteristics of Highly precise and linear measurements, Little influence due to temperature changes, Small size compared with other types of load cells, Long operating life due to lack of moving parts or any parts that generate friction, Ease in production due to small number of components, Excellent fatigue characteristics[4]. Strain gauge load cells are the most common in industry. These load cells are particularly stiff, have very good resonance values, and tend to have long life. Strain gauge load cells work on the principle that the strain gauge (a planar resistor) deforms when the material of the load cells deforms appropriately. Deformation of the strain gauge changes its electrical resistance, by an amount that is proportional to the strain. The change in resistance of the strain gauge provides an electrical value change that is calibrated to the load placed on the load cell. A load cell usually consists of four strain gauges in a Wheatstone bridge configuration which is shown below:

Figure 2: Bridge configuration of load cell



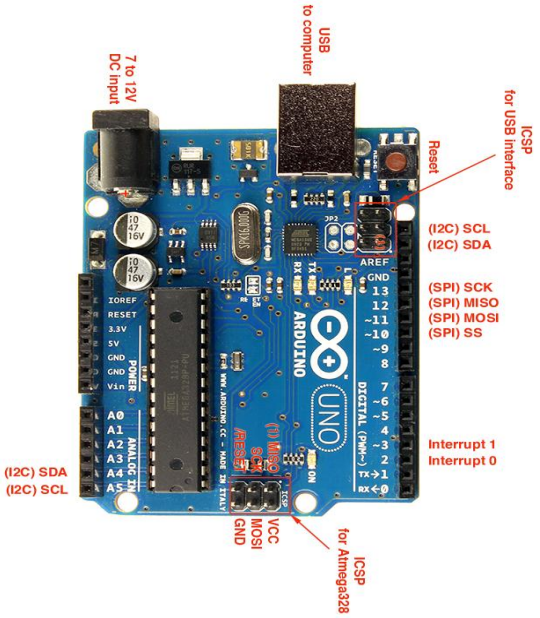
HX711 MODULE: As the load cell will give the output in micro volts and ARDUINO is not capable of reading these values therefore amplification is required. The best solution is to use HX711 amplifier which is a 24-bit analog to digital amplifier and gives best output from a load cell. The HX711 amplifier consists of 10 pins the image of which is shown below:

Figure 3: IC HX711



ARDUINO UNO: The arduino board [2] is a freely available open source development microcontroller capable to cope up with a variety of communication protocols that is a must to be usable for any kind of IoT device[6]. An Arduino board historically consists of an an Atmel 8, 16 or 32 bit AVR microcontroller (although since 2015 other makes microcontroller have been used) with completely components that fascinate programming and incorporation into other circuits. The C-based simple program code for the Arduino is referred to as a sketch. Collection of sketches for specific functionalities is referred to as libraries[4].

Figure 4: Arduino UNO Board

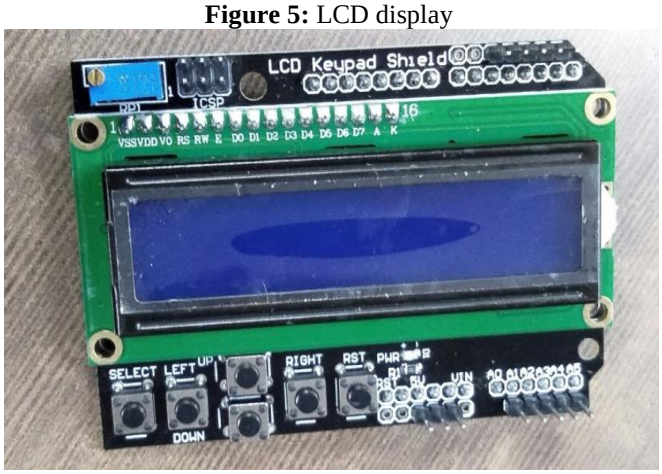


LIQUID CRYSTAL DISPLAY: LCD (Liquid Crystal Display) screen is an electronic display module and finds a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments[5]. In the LCD the each character displayed in 5x7 pixel matrix. This LCD has two registers, namely, command and data. LCD display is an electronic display module and find a wide range of application. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segment display and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable: have no limitation of displaying special & even custom characters (unlike in seven segments), animation and so on.

The command resistor stores the command instruction given to the LCD, A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen setting it and controlling display. The data of the character to be displayed on the LCD.

Here in our project this LCD will display the value of the measured weight.

Figure 5: LCD display



V. Working Principle

Working of this **Arduino Weight Measurement project** is easy. Before going into details, first we have to **calibrate this system** for measuring correct weight. When user will power it up then system will automatically start calibrating. And if user wants to calibrate it manually then press the push button.

For calibration, wait for LCD indication for putting 100 gram over the load cell as shown in below picture. When LCD will show "put 100g" then put the 100g weight over the load cell and wait. After some seconds calibration process will be finished. After calibration user may put any weight (max 40kg) over the load cell and can get the value over LCD in grams.

In this project, we have used **Arduino** to control whole the process. **Load cell** senses the weight and supplies a electrical analog voltage to **HX711 Load Amplifier Module**. HX711 is a 24bit ADC, which amplifies and digitally converts the Load cell output. Then this amplified value is fed to the Arduino. Now Arduino calculate the output of HX711 and converts that into the weight values in grams and show it on LCD. A **push button** is used for calibrating the system.

VI. Result

The results that were obtained under testing and in comparison to standard weight were:

Table 1: Result of measured standard known weights

Sl. No.	Standard weight (gm)	Measured weight (gm)	Deviation (gm)	Deviation Percentage
1	5.000	5.000	0.000	0.00%
2	25.000	25.000	0.000	0.00%
3	30.000	30.000	0.000	0.00%
4	50.000	50.001	0.001	0.20%
5	75.000	75.001	0.001	0.13%
6	100.000	100.001	0.001	0.10%
7	250.000	250.000	0.000	0.00%
8	500.000	500.002	0.002	0.04%
9	750.000	750.002	0.002	0.03%
10	1000.000	1000.002	0.002	0.02%

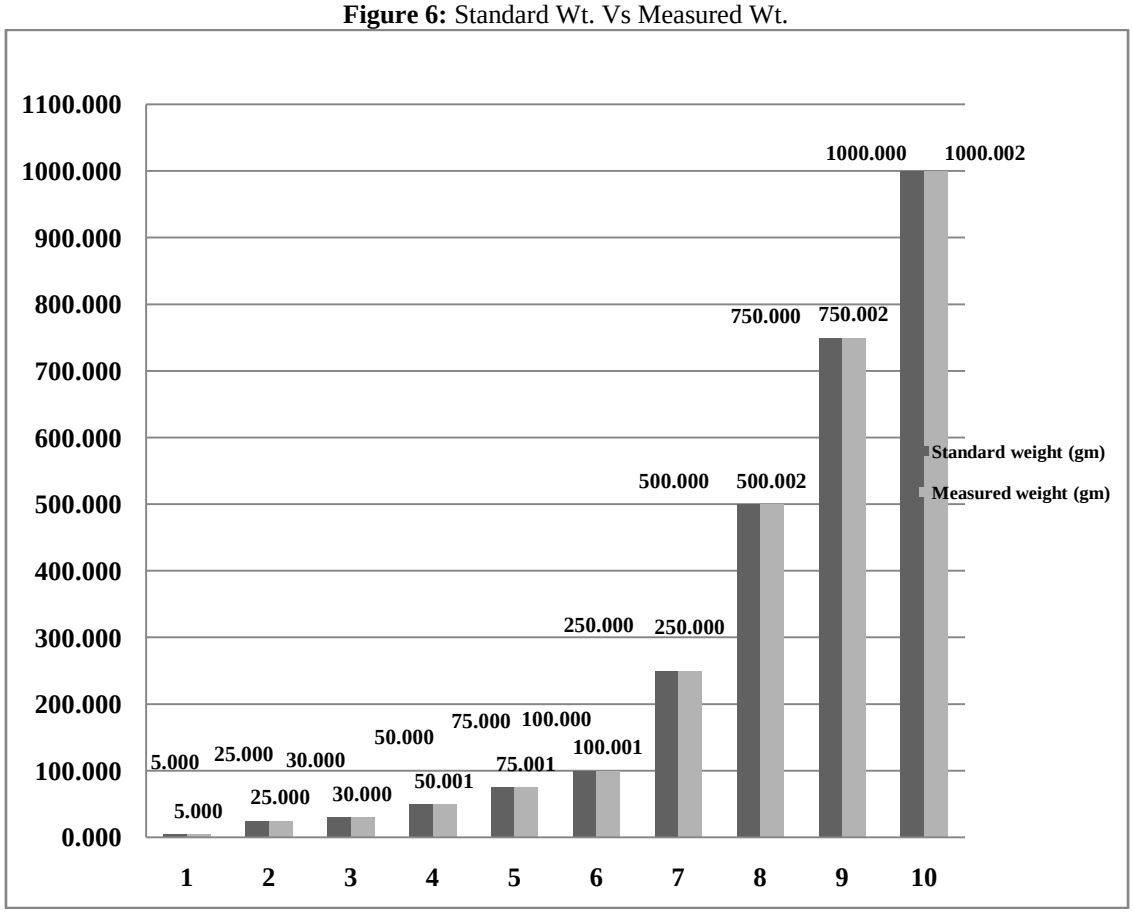
The results depict that the deviation obtained are of negligible limit. For ten consecutive values taken, the average value of deviation resulted is-

$$\textbf{Average Deviation} = \frac{\sum(\textbf{Individual deviations for standard weights})}{\textbf{Total number of weights taken}}$$

Or, Average Deviation = (0.00%+0.00%+0.00%+0.20%+0.13%+0.10%+0.00%+0.04%+0.03%+0.02%)/10 = 0.05%

The graphical representation is shown below:

Figure 6: Standard Wt. Vs Measured Wt.



VII. Application

A WEIGHING machine is a device to measure weight or mass. This WEIGHING machine also known as mass scales, weight scales, mass balance, Weight balance.

An exact scale is critical for manufacturer the industries use this-

- Food industries
- Vegetable markets
- Grocery shops
- Sweets shops
- Gold shop
- Almost in every shops and many industries

A WEIGHING machine is an essential component to manufacturing the weight of our body and measuring the progress of a growing child.

Chemists often deal with chemical equipments that call at a specific amount at substances and different connect rations of solution.

VIII. Cost Estimation

COST BEFORE BUYING THE COMPONENTS

NAME	QUANTITY	RATING	PRICE
LOAD CELL	1	40 KG 11 YEARS LIFE	525
HX711 LOAD CELL AMPLIFIER MODULE	1	DC BATTERY, 4WIRE	355
ARDUINO UNO	1	5V, 7-12V I/P O/P	599
LCD DISPLAY	1	16X2	596
PUSH BUTTON SWITCHES	1	2PIN TACKLE SWITCH	10
CONNECTING WIRES	-	-	100
USB CABLE	1	1.5 CM	150
BREAD BOARD	1	5.5X17X1 CM3	150
NUT BOLTS, BOX	-	-	150
SCREW, FRAME	-	-	150
		TOTAL	2785

CAUSE OF CHANGING COST ESTIMATION

The cost is reduced as the rate of components that are used in our project was found to be much lower than pre-consideration. When we bought the components we have seen the cost is much lesser. The actual cost of this project is given below –

NAME	QUANTITY	RATING	PRICE
LOAD CELL	1	40 KG 11 YEARS LIFE	475
HX711 LOAD CELL AMPLIFIER MODULE	1	5V, 7-12V IP OP	100
ARDUINO UNO	1	5V, 7-12V I/O O/P	330
LCD DISPLAY	1	16X2	120
PUSH BUTTON SWITCHES	1	2PIN TACKLE SWITCH	10
CONNECTING WIRES	-	-	100
USB CABLE	1	1.5CM	30
BREAD BOARD	1	5.5X17X1	30
NUT BOLTS, BOX	-	-	50
SCREW, FRAME	-	-	80
		TOTAL	1325

IX. Conclusion

In this project, we will be developing a WEIGHING machine with its obvious feature of measuring weight with accuracy & precision. The designed machine will be simple to use and economical. Its target customers will be the one whose weighing range will be up to 20 kilograms.

Though proper practical nuisances, detailed further study thereafter and required modifications are yet to be faced and overcome, the initial designs are ready. In the static weighing systems conventional filtering method employed have limitation in improving the accuracy and in throughput rate. In this case, an alternative technique has been explored to find a solution. It will enable high measurement accuracy and good throughput rate of article weighing[7]. If financial aids suffice, weight of even higher dimensions can be measured efficiently. The key points of the product are:

- Allowable error in the minimum range
- Portability of the product
- Bright and consistent display
- Minimum fluctuations
- Zero interference

Reference

[1]. Akindele Ayoola E.; Awodeyi Afolabi I., Development of an Electronic Weighing Indicator for Digital Measurement, International Research Journal of Engineering and Technology (IRJET), Volume: 05 Issue: 09 | Sep 2018

[2]. Aravind R , Arun Kumar E., Load Cell based Fuel Level Measurement using Arduino Uno Microcontroller, International Journal of Advance Research and Development(IJARND), Volume3, Issue3

[3]. Vipul Phulphagar , Dr. Rupesh Jaiswal, Arduino Controlled Weight Monitoring With Dashboard Analysis, International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 5 Issue XI November 2017

[4]. N. Anju Latha, B. Rama Murthy, Arduino based Weighting Scale using Load Cell, IJSRST, Volume 3 | Issue 6 2017

[5]. A.Avinashkumar , U.Singaravelan, Digital fuel level indicator in two-wheeler along with distance to zero indicator, IOSR-JMCE, Volume 11, Issue 2 Ver. III (Mar- Apr. 2014), PP 80-84

[6] Dinkar R Patnaik Patnaikuni, A Comparative Study of Arduino, Raspberry Pi and ESP8266 as IoT Development, International Journal of Advanced Research in Computer Science, Volume 8, No. 5, May-June 2017

[7] Dr. Pradeep B. Dahikar, Mr. Kamlesh S. Patle, Design of an Embedded Platform for Digital Weighing System to Enhance Measuring Capabilities, International Journal of Innovative Research in Computer and Communication Engineering, Vol. 1, Issue 8, October 2013

Snehashis Das " Manufacture of Electronic Weighing Machine Using Load Cell" IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE) 14.4 (2019): 32-37.