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Arduino based Weighting Scale using Load Cell

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ABSTRACT

Embedded system is used in single task applications and it is important in process and control application such as temperature, pressure, flow, weight etc. This paper presents one such applications in which developed a model with objective of measurement and display weight. Electronic weighing machine uses load cell to measure the load or pressure produced by the load, here most load cells are follows the method of strain gauge, Which converts the pressure (force) into an electrical signal, these load cells have four strain gauges that are hooked up in a Wheatstone bridge formation. A load cell is a transducer that is used to create an electrical signal whose magnitude is directly proportional to the force being measured. HX711 is a precision 24-bit analog to-digital converter (ADC) designed for weigh scales and industrial control applications to interface directly with a bridge sensor. Arduino is a small microcontroller board with a USB plug to connect to the computer. Now a day precise measurement and storage of weight is one of the most important activities in industries. The measured weight is also displayed on an LCD screen.

Keywords : Arduino ATmega328, HX711, Weigh Machine.

I. INTRODUCTION

A load cell is a transducer that is used to create an electrical signal whose magnitude is directly proportional to the force being measured. The various types of load cells include hydraulic load cells, pneumatic load cells and strain gauge load cells.

The strain gauge measures the deformation/strain as a change in electrical resistance, which is a measure of the strain and hence the applied forces. A load cell usually consists of four strain gauges in a Wheatstone bridge configuration. The electrical signal output is typically in the order of a few millivolts and requires amplification by an instrumentation amplifier before it can be used. The output of the transducer can be scaled to calculate the force applied to the transducer. Sometimes a high resolution ADC, typically 24-bit, can be used directly.

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 cycles in application. Strain gauge load cells work on the principle that the strain gauge deforms/ stretches/contracts when the material of the load cells deforms appropriately. These values are extremely small and are relational to the stress and/or strain that the material load cell is undergoing at the time. The change in resistance of the strain gauge provides an electrical value change that is calibrated to the load placed on the load cell.

HARDWARE

Block diagram

The Block diagram of Load cell based Weighting Scale using Arduino is as shown in fig 1.

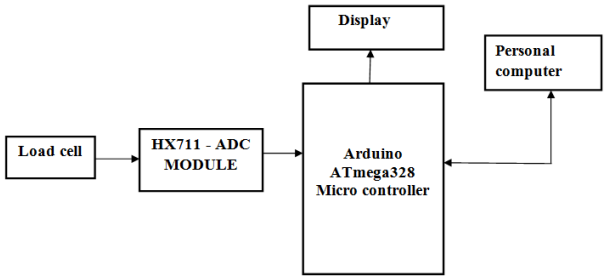

Figure 1 : Block diagram of Load cell based Weighting Scale using Arduino

1. Load Cell

A load cell is a transducer that is used to create an electrical signal whose magnitude is directly proportional to the force being measured. the strain gauge load cell, which is a mechanical element of which the force is being sensed by the deformation of a (or several) strain gauge(s) on the element.

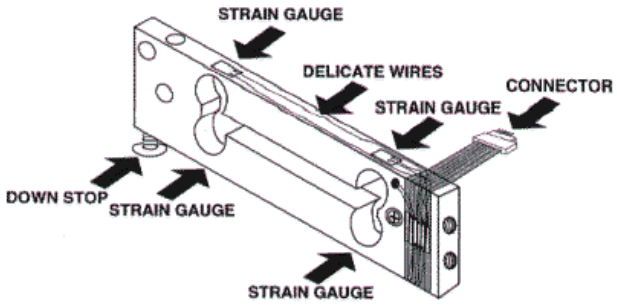

Figure 2 : Strain gauge load cell

In bar strain gauge load cells, the cell is set up in a "Z" formations so that torque is applied to the bar and the four strain gauges on the cell will measure the bending distortion, two measuring compression and two tension. When these four strain gauges are set up in a Wheatstone bridge formation, it is easy to accurately measure the small changes in resistance from the strain gauges.

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. A strain gauge is a device that measures electrical resistance changes in response to, and proportional of force applied to the device. The most common strain gauge is made up of very fine wire, or foil, set up in a grid pattern in such a way that there is a linear change in electrical resistance when strain is applied in one specific direction, most commonly found with a base resistance of 120Ω, 350Ω, and 1,000Ω.

Each strain gauge has a different sensitivity to strain, which is expressed quantitatively as the gauge factor (GF). The gauge factor is defined as the ratio of fractional change in electrical resistance to the fractional change in length (strain).The gauge factor for metallic strain gauges is typically around 2.

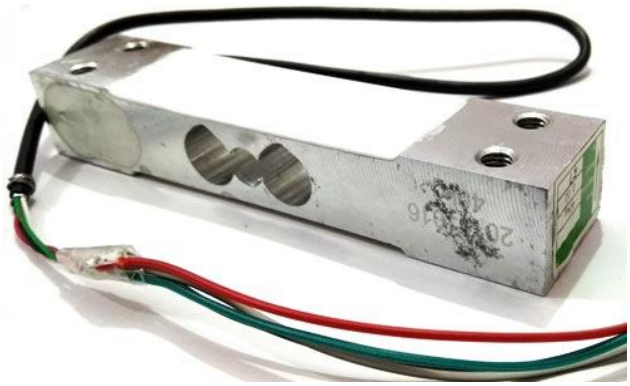

Figure 3 :load cell

2. Weight Sensor Module HX711

Weight Sensor Module is based on HX711, which is a precision 24-bit analog-to-digital convertor designed for weight scale and industrial control applications to interface directly with a bridge sensor. HX711 has a few basic function, which also contains high integration, fast response, immunity, and other features. The chip lowers the cost of the electronic scale, at the same time, improving the performance and reliability. This module uses 24 high precision A/D converter chip hx711. It is a specially designed for the high precision electronic scale design with two analog input channel the internal integration of 128

times the programmable gain amplifier. The input circuit can be configured to provide a bridge type pressure bridge (such as pressure weighing sensor mode)is of high precision low cost is an ideal sampling front-end module.

Figure 4 : Weight Sensor Module HX711

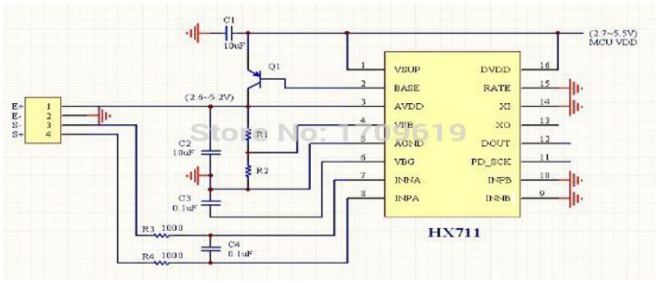

Figure 5 : Weight Sensor Module SCH

3. Arduino-ATmega 328 Microcontroller

The Arduino Uno is an open-source microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs) and 6 analog input. It contains everything needed to support the microcontroller, and it can be simply connected to a computer with a Universal Serial Bus (USB) cable to get started.

The Arduino Uno can be programmed with the Arduino Integrated Development Environment (IDE). 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. The Arduino can be programmed upto 32 KB memory. Arduino can function autonomously without being connected to a computer, or alternatively programmed to respond mainly to commands sent from the computer via various software interfaces or to the data acquired from the input channels. The Arduino UNO based on ATMega-328 Microcontroller

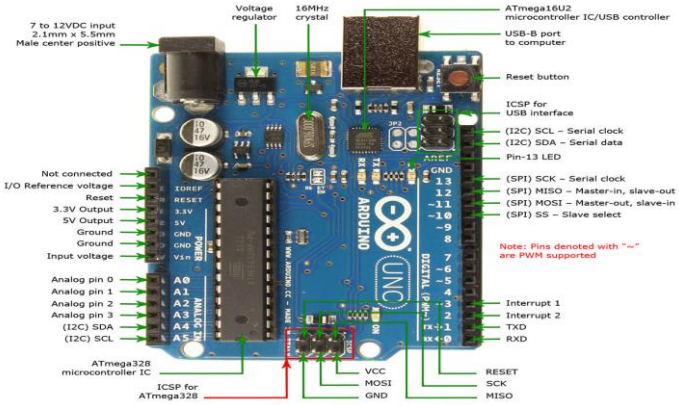

Figure 6 : Arduino UNO Based on ATMega-328 Microcontroller

Arduino Arduino raises an alert only when raining with a certain threshold is detected, within a pre-defined time interval. This extra feature helps in reducing false alarm counts to some extent. The present work is for switching an acoustic sounder as a rain alarm and sending text message to a specified person. The analog output read from the sensor module is transferred to personal computer through serial port via Arduino.

Connect the electronic scale HX711 output to Analog pin 2 of the Arduino, view the analog output through the serial monitor, and note the average value being displayed. Apply the different weight to the scale, and note the corresponding serial monitor value. the result also shown in lcd display. The LCD display is used for indication purpose. The weight of each job is indicated by the LCD display. +5 v DC power supply is required for 16x2 alphanumeric LCD is interfaced to the Arduino Microcontroller. the table 1 shows the Analog output across load cell with the weights.

Table 1: Analog output across load cell with reference to applied weights

S.NO	Weight (Kg)	Analog output by load cell (mV)
1	1	2.1279 mV
2	2	2.257 mV
3	10	21.79 mV
4	20	43.56mV
5	30	62.38mV

II. REFERENCES

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