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REVIEW ON DIGITAL WEIGHING INDICATOR

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ABSTRACT:-
This paper presents the development of an electronic weighing indicator for digital measurement. The objectives of the system were to read weight measured in the conventional analog form to digital form, achieve high precision in measurement and calibration. This components used for this research are Load Cell, Hx711 Load Cell amplifier, Arduino Uno Microcontroller, and an LCD module. In this research, a 40kg load cell is used. The load cell sends output signals of the mechanical weights measured to the Hx711 module which amplifies and sends the output to the Arduino microcontroller. The microcontroller calibrates the output signal with the aid of the load cell amplifier module before sending the signal which is already converted to digital form to the LCD module for display. The system developed has proved that a digital electronic weighing system can be low cost, miniaturized, detached and can take accurate readings devoid of errors.

1. INTRODUCTION:-

The demand for digital scales is on the rise for businesses involved in measuring items because it provides accurate and precise measurement of the weight of objects [2]. The digital scale gives a high accuracy and efficiency in measuring the weight of items and this brings satisfaction to the manufacturer/seller and buyer. Sensing devices such as load cells are used in analog scales.
These scales they do not use digital processors and are read in an analog way. These analog scales use a rotating pointer that rotates. The disadvantage of the analog weighing indicator is the high performance consumption because the actuators are electromechanical in nature. The drive works with high current, low a distinction which is due to the fact that there are slight differences in the weight of different objects which are not easy to detect and the efficiency of the analog scale is low due to the rotating indicator which is constantly shaking or moves. A digital scale has been developed that is used to measure weights from 0 kg to 40 kg which is very accurate [1]. The developed electronic digital weight indicator utilizes the following; Arduino Uno microcontroller, 40kg load cell, HX711 load cell amplifier module and 16x2 LCD.

2. LITERATURE REVIEW:-

A load cell was used to measure the weight of objects according to [1], the load cells functioned as sensors. Under load the load column was compressed while its length changed. The column acted as a primary converter because the applied force was converted to a change in length. The change in length was not directly measured under stress the gage attached to the load column compressed. While the load column acted as the primary transducer, the strain gauge acted as a secondary transducer as it recorded the displacement of the support column. While the strain gauge was compressed, its length varying depending on the magnitude of the force acting on the upper part force meter. The resistance of the strain gauge changed as its length changed. The change in resistance was measured in terms of output voltage change and could be amplified using a differential amplifier. When the voltage became negative, the inverter was positive, therefore the load sensor gave a voltage level that was equivalent weight used.

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[2] Discussed the development of a load cell based on a static weighing system, which focused on the use of digital filtering techniques that were used to remove low frequency noise during measurements from a static weighing system. This design had high resolution measurements. The PGA was also included in the analog-to-digital converter associated with high resolution; this eliminated the need for signal conditioning circuitry. The analog-to-digital converter was directly connected to the precision sensor and was accessible to the microcontroller, which improved the measurement. This designed system had accurate and highly accurate output.
[3] Presented the design of an efficient and low-cost microcontroller-based scale. A strain gauge/resistance strain gauge was used to measure weight. The pressure was converted to different voltage levels. The voltage levels in this design were converted to digital data in a PIC16F690 microcontroller. This digital data was then displayed on a 16*2 liquid crystal display. The goal of this design was to provide scope for low cost and highly accurate user-friendly features, all of which were achieved.
[4] Described the design and implementation of a digital electronic weighing system that is high-resolution, portable, and inexpensive. The proposed system could be used in the laboratory, for commercial and domestic purposes. This system has miniaturized circuits that use a microcontroller. It consists of an 8-bit 8051 a microcontroller that had a memory module to store data from an analog-to-digital converter. A program was designed to interface a serial 10-bit ADC to an 8-bit microcontroller, achieving high resolution without compromising range. The developed weighing system displayed the weight placed on the single-point load cell on the LCD, reads and measures. The weights measured on this system range between 0-19 kg.
[5] Got an analog scale and converted it to a digital scale. This was achieved by using a spring extension in the analog scale, which was converted by a voltage divider circuit (converter) to a voltage. The output of the converter (voltage divider) was fed to the microcontroller that was responsible for it converting analog voltage to its digital equivalent using an analog-to-digital converter built into the microcontroller. The microcontroller was programmed to simultaneously display the weight and the corresponding measured weight on the LCD. The values of the manufactured weighing system were compared with the data of the standard weighing system. The result showed an average deviation of 1.44 kg between the readings of the adjusted scale and the analog scale that served as a control. A simple moment product correlation coefficient was used to compare the two readings and the result obtained showed that there was an almost perfect correlation 0.9998 between values on both scales.

3. MATERIALS AND METHOD:-

The materials used in the development of this design are listed as follows:

- An Arduino Uno microcontroller
- A 40kg Load cell
- An HX711 Load cell Amplifier Module
- A 16x2 LCD

The architecture and Program flowchart of the system is shown in figure 1 and figure 2 below.

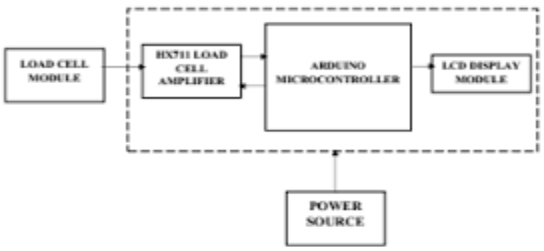

Fig: 1 system architecture

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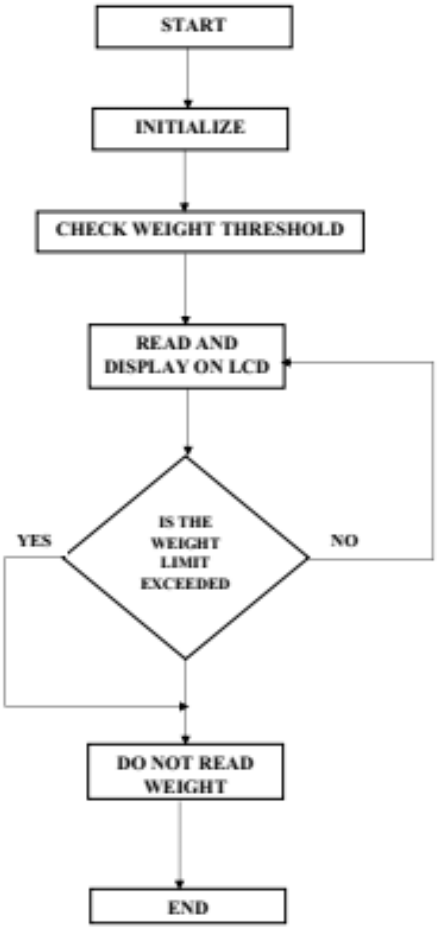

Fig: 2 System flowchart for developed system

4. SYSTEM ANALYSIS:-

A cheap electronic Digital weighing indicator for digital measurement was developed which was designed for a maximum weight of 40kg. The components acquired for the development of this project are an Arduino Uno microcontroller, a 40kg load cell, an Hx711 load cell amplifier module and a 16x2 LCD Module. Figure 3 shows the circuit diagram of the developed system.

Arduino Uno

The ArduinoUno was used control Centre for the project. The Arduino was programmed in Arduino c++. All activities for the developed system are carried out in the Arduino Uno. These activities include the activities carried out by the load cell, Hx711 load cell amplifier and the display on the 16x2 LCD.

Load cell

The load cell which is also known as a transducer converts mechanical energy (weight) to an electrical output. The magnitude of the electrical output is directly proportion to applied force. The strain Gauge in the Load cells deforms when pressure is applied on it. Strain gauge generates electrical signal during deformation because its effective resistance changes during deformation. The load cell weighs up to 40kg of load. The load cell is shown in figure 4 below.

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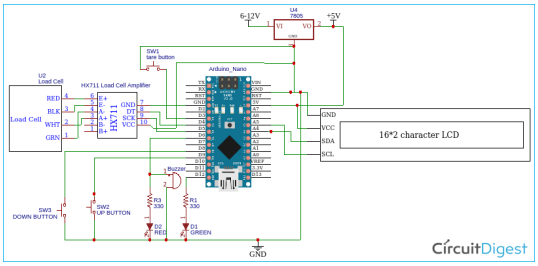

Fig: 3: Circuit diagram for the developed system

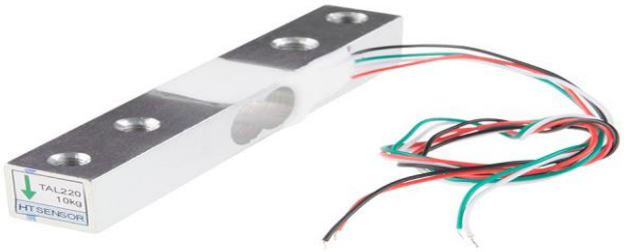

Fig: 4 Diagram of load cell

Hx711 Load Cell amplifier Module

Hx711 Load cell amplifier module is a 24 high precision analog to digital converter which amplifies low electric output from the load cells, amplifies and converts the low electric output of the load cell gotten from the mechanical energy (weight) and converts it to a digital form. The digital form is transmitted into the Arduino Uno to generate the weight. When the load cell amplifier is connected to the microcontroller, changes in the resistance of the load cell will be read by the microcontroller with some calibrations. This causes very accurate weight measurements. The diagram for the load cell amplifier module used is shown in figure 5 below.

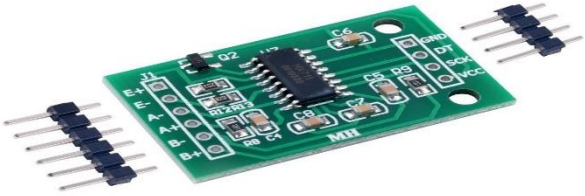

Fig: 5 Diagram of the Hx711 Load Cell amplifier Module

LCD DISPLAY

The LCD display is an electronic display module used to display the output of the scale result of the developed system.

5. RESULT

A prototype for the Electronic Weighing Indicator was physically constructed. All parts worked as designed. The components of the working system are the Arduino Uno, a 40kg Load cell, a HX711

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Load cell Amplifier Module and a 16x2 LCD module. The diagram of the constructed working prototype.

6. CONCLUSION:-

An Electronic Weighing Indicator system was developed for digital measurement and the functions of the components were explained in the course of this paper. This system was built to read weight measurement digital form. The system developed consisted of a 40kg load cell which read mechanical energy (weight) between 0 to 40kg. The load cell amplifier module reads the output from the load cell and converts the data from analog to digital form which is then fed to the microcontroller. The microcontroller processes the data, apart from coordinating the activities of the entire system. The processed data is the sent from the microcontroller to the LCD module which is displayed for the user to read.

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