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Heavy Load Scale Using Load Cell and Arduino

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ABSTRACT—

This paper presents a digital weighing system for heavy loads using an HX711 Load Cell module, Arduino Nano, and an LCD display. The system measures weights up to 200 kg with high accuracy, incorporating tare functionality for resetting weight measurements and overload detection to prevent excessive loading. The proposed system is cost-effective, scalable, and suitable for industrial applications such as warehouses and logistics.

Index Terms—Load Cell, HX711, Arduino Nano, Digital Weighing System, Overload Detection.

INTRODUCTION

Weight measurement is essential in industrial applications, logistics, and commercial sectors. Traditional mechanical weighing scales have limitations in precision and readability. The advancement of microcontroller-based systems allows for real-time digital weight measurement with enhanced accuracy and reliability. This project focuses on designing a costeffective, microcontroller-based heavy-load weighing system using a load cell and an Arduino Nano.

SYSTEM COMPONENTS AND METHODOLOGY

A. Hardware Components

The system comprises the following components:

- Arduino Nano: Microcontroller for processing weight data.
- HX711 Load Cell Amplifier Module: Converts analog signals from the load cell into digital values.
- Load Cell (200 kg capacity): Measures the applied weight.
- 16x2 LCD Display: Displays real-time weight readings. • Push Button (Tare Function): Resets the measurement.
- Power Supply (5V): Powers the circuit.

B. Working Principle

The system operates as follows:

1) The load cell deforms under weight, changing resistance.
2) The HX711 module amplifies and converts the signal to a digital value.
3) The Arduino Nano reads the signal and calculates the weight.
4) The LCD displays the weight in kilograms.
5) If the tare button is pressed, the weight is reset to zero.
6) If the weight exceeds 200 kg, an overload warning is displayed.

CIRCUIT DIAGRAM

The complete circuit of the digital weighing system is shown in Figure 1. The system consists of a load cell, HX711 amplifier, and Arduino Nano, interfaced with an LCD display for real-time weight measurement.

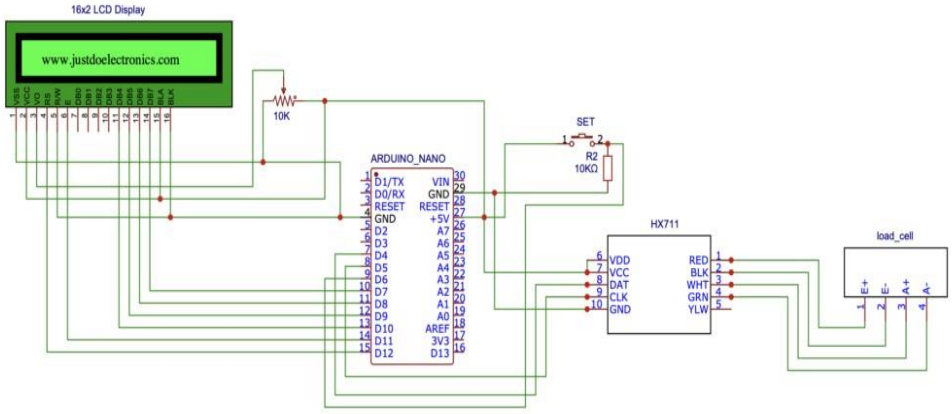

Fig. 1. Circuit Diagram of the Digital Weighing System

SOFTWARE IMPLEMENTATION

The software is written in C++ using the Arduino IDE. The program initializes the components, reads sensor data, and updates the display.

A. Arduino Code

```
#include <HX711_ADC.h>
#include <Wire.h>
#include <LiquidCrystal.h>

LiquidCrystal lcd(12, 11, 10, 9, 8, 7); HX711_ADC LoadCell(5, 4); int taree = 6;

void setup() {
    pinMode(taree, INPUT_PULLUP); LoadCell.begin();
   LoadCell.start(1000); LoadCell.setCalFactor(3.19); lcd.begin(16, 2); }

void loop() {
    LoadCell.update(); float weight = LoadCell.getData(); lcd.setCursor(1, 0); lcd.print("Weight: "); lcd.setCursor(1, 1); lcd.print(abs(weight
    / 1000), 2); lcd.print(" kg");

    if (weight >= 200000) {
        lcd.setCursor(0, 0); lcd.print(" Over Loaded "); delay(3000);
    }

    if (digitalRead(taree) == LOW) {
        lcd.setCursor(0, 1); lcd.print("Load Reset"); delay(1000); LoadCell.start(1000); lcd.clear();
    }
}
```

CALIBRATION AND TESTING

The system is calibrated using known weights. Table I shows the calibration values.

TABLE I

CALIBRATION DATA

Weight (kg)	Measured Voltage (mV)
6.83	3.7
9.26	4.5
13.21	4.6
23.00	4.7

Testing confirmed that the system provides accurate weight readings with an error margin of ±0.1 kg. The tare function and overload detection operate as expected.

SIMULATION AND EXPERIMENTAL RESULTS

The system was simulated using Proteus, and the expected voltage responses were verified under different loads. The final hardware implementation was tested, and the real-time readings were recorded.

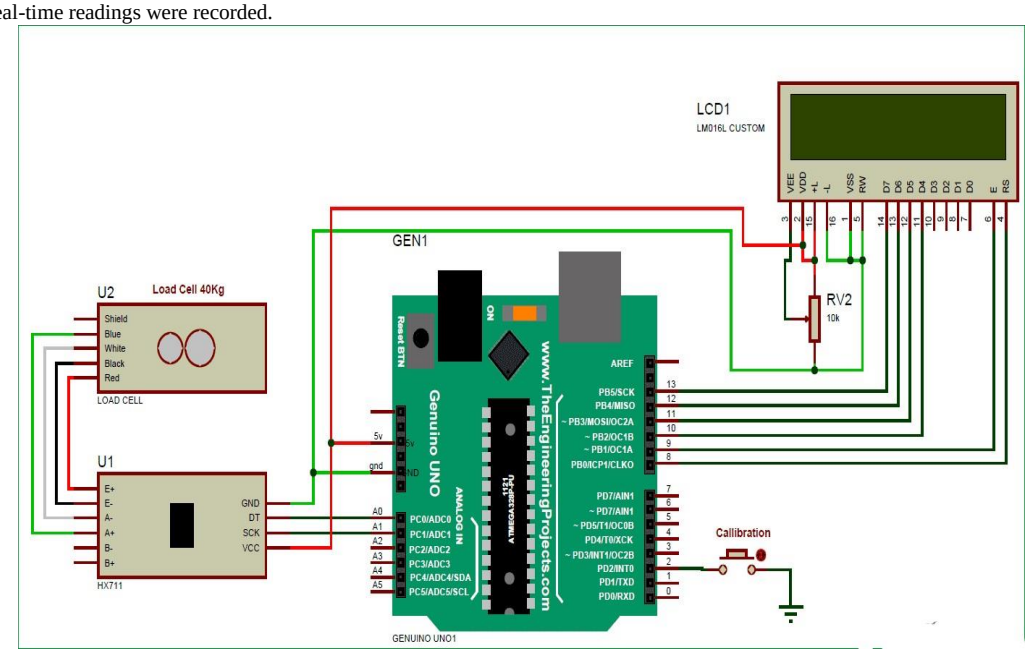

Fig. 2. Simulation Results of the Weighing System

The test results confirmed that the system provided accurate weight readings within an error margin of ±0.1 kg. The system

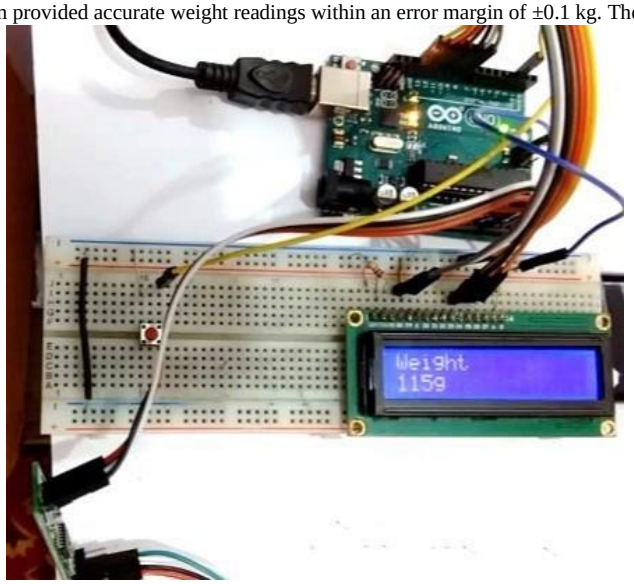

Fig. 3. Hardware Testing Results

was stable under various loading conditions, and the tare function effectively reset the measurements.

APPLICATIONS AND FUTURE ENHANCEMENTS

A. Applications

- Industrial weight measurement in warehouses and logistics.
- Retail and commercial weighing solutions.
- Agricultural weight measurement.

B. Future Enhancements

- Wireless data transmission via Bluetooth or WiFi.
- Higher load capacity for industrial applications.
- Mobile app integration for remote weight monitoring.

VIII. CONCLUSION

This project successfully implements a heavy-load digital weighing system using a load cell, HX711 module, and Arduino Nano. The system provides real-time, accurate weight measurements with tare functionality and overload protection. Future enhancements can expand its capabilities for industrial and commercial applications.

REFERENCES

[1] HX711 Load Cell Amplifier Datasheet.
[2] Arduino Nano Technical Documentation.
[3] IEEE Papers on Digital Weighing Systems.