DESIGN AND MODIFICATION OF DUMP TRUCK TO AVOID ACCIDENTS DUE TO PROTRUDED RODS AND TO REDUCE MATERIAL THEFT

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Abstract - *Automobile industry is a growing industry which necessitates the importance of safety. This project focuses on the enhancement of safety in Heavy vehicles. One of the main threat in heavy vehicles is carrying a rod or other elements which is protruded beyond its loading area which will cause severe injury to the person who travelling back to the truck. The other problem is to reduce the theft of the loading material by the driver in the truck. To avoid the accidents due to protruded rods, the engine of the vehicle is made to crank only if the trailer door is completely closed. It is made possible by using proximity sensor near the door opening. The material theft is reduced by using Load cell in the loading area. The load cell value is continuously monitored by the truck owner. Hence by using the proximity sensor to detect the opening of Back door, we can reduce accident rate and by use of Load cell continuous monitor is done and hence control the theft.*

Keywords: Proximity Sensor, Load cell, Amplifier, Alarm buzzer, Arduino UNO.

1. INTRODUCTION

The present works focus on prevention of damage of roads and prevent vehicle damage. Roads now-a-days play a very important role in every part of world. The value lies in providing safe and convenient travel for the users. As the device is working in the loading process, it can ensure to prevent vehicle overloading; in the process of driving, the drivers don't have to worry about being fined due to overload syndrome; ensure the personal safety of driving. At the same time the system is designed to save the national highway maintenance fees and to ensure the safety of people's lives and property.

Overloading a Vehicle will pose the following risks: Different vehicles have different maximum weights for which they are designed .Hence if this maximum weight exceeds than it is difficult to stop the vehicle and thus the vehicle becomes less stable .Effectiveness to stop the vehicle decreases due to overheating of breaks which will result in harder breaking mechanism as the vehicle is heavier. The parts of the vehicle are of great concern and overloading will incur major loss or reduction in their effective usage and will decrease the efficiency of the vehicles. As the

overloading is illegal the insurance covered by it becomes invalid. Overloaded vehicles produce higher kinetic energy, resulting in greater impact forces and damages to other vehicles or to the infrastructure. The other common problems on National highways is overloading of trucks beyond the specified height and length limits. In 2014 these two causes have resulted in 36,543 deaths.

1.1.   ARDUINO UNO

ARDUINO UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of ARDUINO Software (IDE) 1.0. The Uno board and version 1.0 of ARDUINO Software (IDE) were the reference versions of ARDUINO, now evolved to newer releases. The Uno board is the first in a series of USB ARDUINO boards, and the reference model for the ARDUINO platform; for an extensive list of current, past or outdated boards see the ARDUINO index of boards.
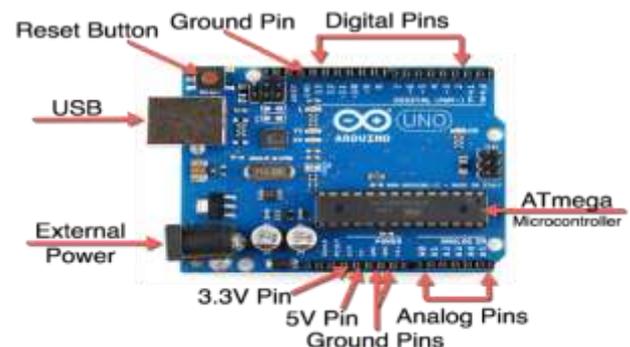
(Figure 1.1)

1.1.1 POWER USB

Arduino board can be powered by using the USB cable from your computer. All you need to do is connect the USB cable to the USB connection.

1.1.2 POWER (BARREL JACK)

Arduino boards can be powered directly from the AC mains power supply by connecting it to the Barrel Jack (2).

1.1.3 VOLTAGE REGULATOR

The function of the voltage regulator is to control the voltage given to the Arduino board and stabilize the DC voltages used by the processor and other elements.

1.1.4 CRYSTAL OSCILLATOR

The crystal oscillator helps Arduino in dealing with time issues. How does Arduino calculate time? The answer is, by using the crystal oscillator. The number printed on top of the Arduino crystal is 16.000Hertz. It tells us that the frequency is 16,000,000 Hertz or 16 MHz.

1.1.5 ARDUINO RESET

You can reset your Arduino board, i.e., start your program from the beginning. You can reset the UNO board in two ways. First, by using the reset button (17) on the board. Second, you can connect an external reset button to the Arduino pin labelled RESET (5).

1.1.6 Pins (3.3, 5, GND, Vin)

- 3.3V (6) – Supply 3.3 output volt

- 5V (7) – Supply 5 output volt

- Most of the components used with Arduino board works fine with 3.3 volt and 5 volt.

- GND (8)(Ground) – There are several GND pins on the Arduino, any of which can be used to ground your circuit.

- Vin (9) – This pin also can be used to power the Arduino board from an external power source, like AC mains power supply.

1.1.7 ANALOG PINS

The Arduino UNO board has six analog input pins A0 through A5. These pins can read the signal from an analog sensor like the humidity sensor or temperature sensor and convert it into a digital value that can be read by the microprocessor.

1.1.8 Main microcontroller

Each Arduino board has its own microcontroller (11). You can assume it as the brain of your board. The main IC (integrated circuit) on the Arduino is slightly different from board to board. The microcontrollers are usually of the ATMEL Company. You must know what IC your board has before loading up a new program from the Arduino IDE. This information is available on the top of the IC. For more details about the IC construction and functions, you can refer to the data sheet.

1.1.10 ICSP pin

Mostly, ICSP (12) is an AVR, a tiny programming header for the Arduino consisting of MOSI, MISO, SCK, RESET, VCC, and GND. It is often referred to as an SPI (Serial Peripheral Interface), which could be considered as an "expansion" of the output. Actually, you are slaving the output device to the master of the SPI bus.

1.1.11 Power LED indicator

This LED should light up when you plug your Arduino into a power source to indicate that your board is powered up correctly. If this light does not turn on, then there is something wrong with the connection.

1.1.12 TX and RX LEDS

On your board, you will find two labels: TX (transmit) and RX (receive). They appear in two places on the Arduino UNO board. First, at the digital pins 0 and 1, to indicate the pins responsible for serial communication. Second, the TX and RX led (13). The TX led flashes with different speed while sending the serial data. The speed of flashing depends on the baud rate used by the board. RX flashes during the receiving process.

1.1.13 Digital I/O

The Arduino UNO board has 14 digital I/O pins (15) (of which 6 provide PWM (Pulse Width Modulation) output. These pins can be configured to work as input digital pins to read logic values (0 or 1) or as digital output pins to drive different modules like LEDs, relays, etc. The pins labelled can be used to generate PWM.

1.1.14 AREF

AREF stands for Analog Reference. It is sometimes, used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

1.2 LOAD CELL

A load cell is a sensor or a transducer that converts a load or force acting on it into an electronic signal. This electronic signal can be a voltage change, current change or frequency change depending on the type of load cell and circuitry used. There are many different kinds of load cells. We offer resistive load cells and capacitive load cells.

Resistive load cells work on the principle of piezo-resistivity. When a load/force/stress is applied to the sensor, it changes its resistance. This change in resistance leads to a change in output voltage when a input voltage is applied.

Capacitive load cell work on the principle of change of capacitance which is the ability of a system to hold a certain amount of charge when a voltage is applied to it. For common parallel plate capacitors, the capacitance is directly proportional to the amount of overlap of the plates and the dielectric between the plates and inversely proportional to the gap between the plates.
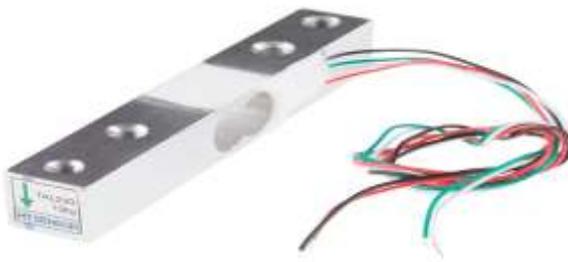
(Figure 1.2 i)

HX711 LOADCELL AMPLIFIER

- We've all used a scale to determine the weight of something at some point in our lives.

- Using a Load Cell or Weight sensor you can add this capability to your Arduino projects.

- In this project we will see how to connect, calibrate and display the weight on a small OLED display, and by using a rotary encoder we will be able to change the units from: grams, kg or pounds.

- We will be using the HX711 ADC converter board to amplify the signal received from the weight sensor. This amplifier enables the Arduino to detect the changes in resistance from the load cell.
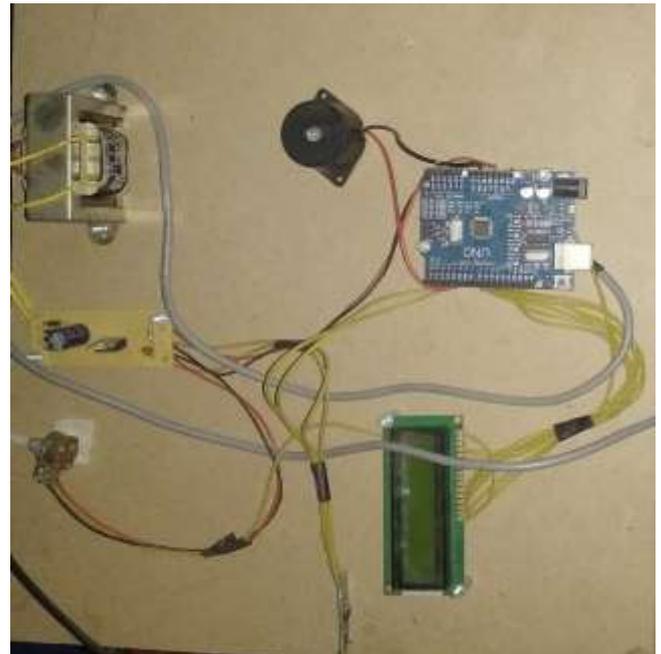
(Figure 1.2 ii)

1.3 PROXIMITY SENSOR

A sensor that can be used for detecting the presence of objects surrounding it without having any physical contact is termed as a proximity sensor. This can be done using the electromagnetic field or electromagnetic radiation beam in which the field or return signal changes in the event of the presence of any object in its surrounding. This object sensed by the proximity sensor is termed as a target.

(Figure 1.3 i)

Thus, if we discuss about different types of targets such as plastic target, metal target, and so on requires different types of proximity sensors such as capacitive proximity sensor or photoelectric proximity sensor, inductive proximity sensor, magnetic proximity sensor and so on. The range in which the proximity sensor is able to detect an object is termed as nominal

range. Unlike the other sensors, proximity sensors can last for long life and have very high reliability as there are no mechanical parts as well as no physical contact exists between the sensor and sensed object.

Let us discuss about the inductive proximity sensor circuit which is most frequently used in many applications. The proximity sensor circuit diagram is shown in the above figure which consists of different blocks such as oscillator block, electrical induction coil, power supply, voltage regulator, etc.

2. LITERATURE REVIEW

Mohamed Rehan Karim and Et.al in their study have highlighted the magnitude of the problem of vehicle overloading. Apart from the impact on pavement damage and carbon emission, vehicle overloading would lead to more hazardous road environment because of the limitation in vehicle dynamics and braking performance of the vehicle to cope with the higher demands for the excess pay loads.

Kilavo Hassan and Et.al done overview on passengers overload in public buses has been a problem in various countries. The current situation for controlling overloading passengers in public buses needs to be improved. There is a need to device a new system which can overcome all this difficulties as the technology is growing we need to utilize it for the development of our country.

Akindele Ayoola .E et al discussed on load cell development based on a static weighing system which focused on the use of digital filtering techniques which was used to remove low frequency noise during measurement from the static weighing system. This design had a high resolution measurement. A PGA was also included in the analog to digital converter coupled with the high resolution.

Awodeyi Afolabi .I et al presented the design of an efficient and inexpensive microcontroller based weighing scale. The load cell/resistive strain gauge was used to measure weight. Pressure was converted into various voltage levels. The voltage levels in this design were converted into digital data in the PIC16F690 microcontroller.

Matthews Victor O et al described the design and implementation of a digital electronic weighing system which is high resolution, portable and low cost. The designed system could be used in laboratory, for commercial and domestic purposes. This system has miniaturized circuits which made use of a microcontroller. It is made up of an 8 bit 8051 microcontroller which had a memory module for storing data from analog to digital converter.

Alashiri Olaitan A et al got analogue weighing machine and converted it to a digital weighing machine. This was achieved using the spring extension in the analog weighing machine was converted by a voltage divider circuit (transducer) into voltage. The transducer (voltage divider) output was fed to the microcontroller which was responsible for converting analog voltages to its digital equivalent using the analog-digital converter embedded into the microcontroller.

Idowu Oriyomi .K et al developed an automatic digital weighing system that operated with solar energy. The advantages of this system are the implementation of efficient energy, miniaturized parts, great accuracy and efficiency, low cost. The system operates on AC and DC supply. This system developed measures weights ranging from 0-40kg.

Olaloye Folarin J et al developed a hybrid digital weighing scale which is energy efficient and can be used for weight measurements. The system detects minute weights placed over it, accurately reads and measures it kilograms and displays it on the LCD module. The system developed converted pressure into appropriate voltage levels. The voltage level was filtered and converted into digital data in the microcontroller which was displayed on a LCD.

Chandrasekhar et al ,1994Liquid crystals (LCs) are a state of matter that have properties between those of a conventional liquid and those of a solid crystal For instance, an LC may flow like a liquid, but its molecules may be oriented in a crystal-like way. There are many different types of LC phases, which can be distinguished by their different optical properties.

Ralf Joost, Ralf Salomon et al have proposed Advantages of FPGA-Based Multiprocessor Systems in Industrial Applications. Today, industrial production machines must be highly flexible in order to competitively account for dynamic and unforeseen changes in the product demands.

Durga Prasad, N.V.P.R. , Lakshminarayana T, Narasimham J.R.K, Verman T.M., KrishnamRaju C.S.R et al have proposed "Automatic Control and Management of Electrostatic Precipitator". The efficient operation of an electrostatic precipitator (ESP) in practice depends upon many variables, such as charging method, particle size, gas flow, temperature, dust resistivity, etc.

3. WORKING PRINCIPLE

A load cell is made by using an elastic member (with very highly repeatable deflection pattern) to which a number of strain gauges are attached.

In this particular load cell shown in above figure, there are a total of four strain gauges that are bonded to the upper and lower surfaces of the load cell.

When the load is applied to the body of a resistive load cell as shown above, the elastic member, deflects as shown and creates a strain at those locations due to the stress applied. As a result, two of the strain gauges are in compression, whereas the other two are in tension as shown in below animation.
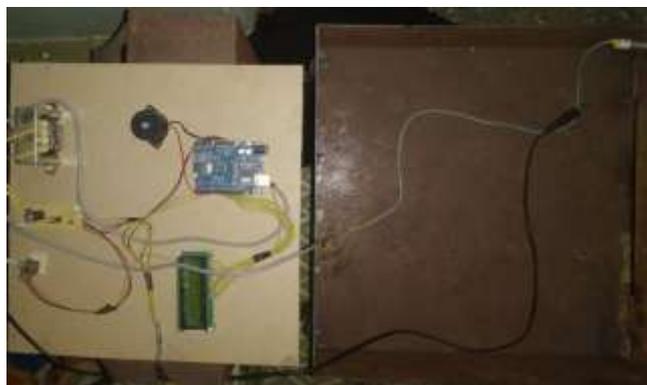
(Figure 3)

4. BLOCK DIAGRAM OF LOAD CELL
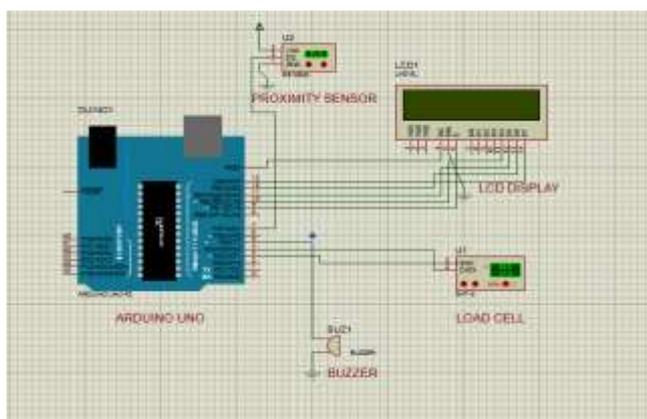
(Figure 4)

5. ADVANTAGES

- Low cost
- Easy implementation
- Low power consumption
- Accurate

5.1 DISADVANTAGES

- The accuracy may vary while the vehicle is in motion.

6. CONCLUSION

This paper proposed a practical method of accurately and easily performing digital compensation for the creep error in a load cell. The method employs as a compensation function a weighted composite function that consists of a first-order lag response and a linear function. It also proposed a creep occurrence model that re produces the amount of creep error that varies according to the loading history, and a compensation algorithm corresponding to that model. They can be used to realize accurate compensation and are also of less computational complexity and require fewer parameters to be stored, and thus are suitable for being implemented on integrated circuit boards where processing capacity and memory size can be limited. In this paper the effectiveness of the method was verified by processing the resultant output that were obtained from a load cell generating positive creep error and another one generating negative creep error on a computer. The method proved to be capable of compensating for various creep errors generated under the loading conditions of a normal load, repetitive load and unloading and ramp input loading, with high accuracy, and had its effectiveness verified.

7. REFRENCES

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