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Arduino based Vehicle Overload Detection and Prevention System

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Abstract - *The present work focuses on the prevention of vehicle damage due to the overloading of the vehicle. Problems that arise due to overloading of the vehicle are Truck Instability, Braking Default, Damage To The Infrastructure, Economic Impact, Suspension system, Steering trouble, Fuel economy. New technologies are being developed for more efficient overload screening and enforcement. Weigh-in-Motion (WIM) technologies allow vehicles to be weighed in the traffic flow, without any disruption to operations, but these are just measuring the weight of the vehicle but not considering the overload and improper loading of the vehicle Much progress has been made recently to improve and implement WIM systems, which can contribute to the safer and more efficient operation of vehicles. The main thing we are innovating in this field is that as soon as the vehicle is overloaded, there will be an intimation to the driver with a display and buzzer to draw the attention of the driver and to inform him about the overloaded condition and then the ignition will get cut off after some delay and hence in any circumstances the user can not start his vehicle unless he reduces the load on the vehicle.*

Key Words: Overload, Suspension system, Ignition.

1. INTRODUCTION

Overloaded vehicles pose serious threats to road transport operations, with increased risks for road users, deterioration of road safety, severe impacts on the durability of infrastructure (pavements and bridges), and fair competition between transport modes and operators. To overcome this problems this paper introduces a new technology to decrease the problems which are being faced by overloaded vehicles. This technology consists of a load sensor which is placed under the vehicle and permissible weight is being checked with the actual load and sends the output to the arduino microcontroller, if the load is in given limit, then it gives input(power) to vehicle for ignition

2. HARDWARE COMPONENTS

Load Cell: A load cell is a type of transducer, specifically a force transducer. It converts a force such as tension, compression, pressure, or torque into an electrical signal that can be measured and standardised. As the force applied to the load cell increases, the electrical signal changes proportionally. The most common types of load cells used are hydraulic, pneumatic, and strain gauge.

Fig 1: Load cell

HX711 ADC : HX711 is a 24 high precision A/D converter (Analog to digital converter). HX711 has two analog input channels and we can get gain up to128 by programming these channels. So HX711 module amplifies the low electric output of Load cells and then this amplified & digitally converted signal is fed into the Arduino to derive the weight.

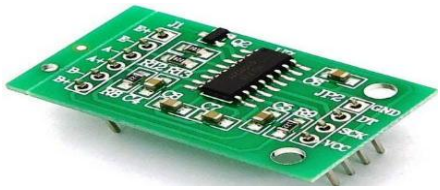


Fig 2: HX711 ADC

Arduino Uno : The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced with various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts

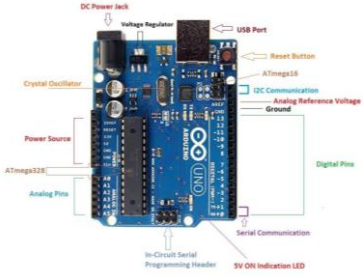


Fig 3: Arduino UNO

DC Motor : A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of the current in its field windings.

Fig 4: DC Motor

Liquid Crystal Display : A liquid-crystal display (LCD) is a flat-panel display or another electronically modulated optical device that uses the light-modulating properties of liquid crystals. It consists of 16 input ,output pins.

Fig 5: LCD Display

Buzzer: It is an electrical device, similar to a bell, that makes a buzzing noise and is used for signalling.

Fig 6: Buzzer

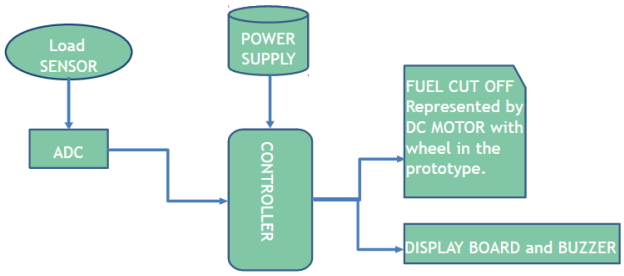
3. SOFTWARE DESCRIPTION

The software which we use here is Arduino IDE.

The main features we need to know about it are:

- **Code area:** This is where you will type all your code
- **Verify:** This allows you to compile your code to code the Arduino understands. Any mistakes you have made in the syntax of your code will be shown in the info panel
- **Upload:** This does the same as verify but will then send your code to your Arduino if the code is verified successfully
- **Info panel:** This will show any errors during compiling or uploading code to your Arduino
- **Serial Monitor:** This will open a window that allows you to send text to and from an Arduino.

4. BLOCK DIAGRAM



5. WORKING

First, we have to calibrate this system for measuring the correct weight. When user will power it up then the system will automatically start calibrating and if the user wants to calibrate it manually then press the reset button. In this work, we have used Arduino to control the whole process. Load cell senses the weight and supplies an electrical analogue 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 calculates the output of HX711 and converts that into the weight values in grams and shows it on LCD. If the weight limit is permissible then Arduino sends the signal to on the fuel, if not fuel cut off is done. The calibration will be done every time the Arduino Uno is reset, Hence enabling it for the application in different conditions. The buzzer is interfaced to give a sound notification to draw the driver's attention and here, With the usage of DC motor, we represent the fuel cut off, which will happen in real-time applications.

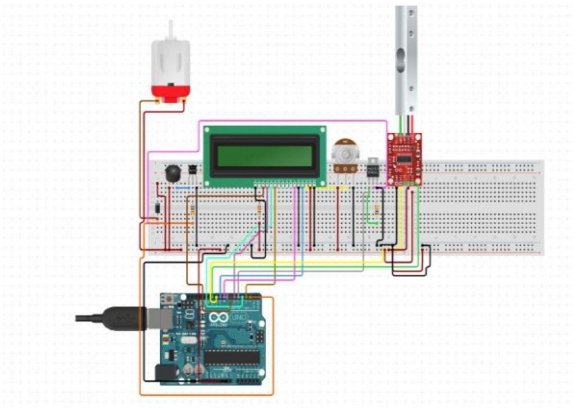


Fig 7: Circuit Diagram

Connections for this project are easy and schematic is given above. Load cell is connected with HX711 Load cell Amplifier using four wires. These four wires are Red, Black, White and Green/Blue. There may be slight variation in colours of wires from module to module. Below the connection details and diagram:

- RED Wire is connected to E+
- BLACK Wire is connected to E-
- WHITE Wire is connected to A-
- GREEN Wire is connected to A+

16x2 LCD pins RS, EN, d4, d5, d6, and d7 are connected with pin number 8, 9, 10, 11, 12 and 13 of Arduino respectively. HX711 Module's DT and SCK pins are directly connected with Arduino's pin A0 and A1.
DC Motor and buzzer are connected to Digital Pin D2 and D3 of Arduino UNO.

6. ADVANTAGES

- Truck stability on uphills and downhills increases.
- Braking can be adjusted as per loading conditions.
- Suspension system life increases.
- Fuel economy increases.
- Human Life

7. CONCLUSION

This paper mainly focuses to reduce the accidents which takes place due to the overload of vehicles and trucks. By interfacing load cell and microcontroller with the vehicle, we can control the ignition of the vehicle. Most vehicle manufacturers nowadays offer a relatively low-cost onboard weighing solution based on APT sensors. In addition, the sensor industry solutions based on the strain gauge sensor technology seem to offer an attractive prospect.

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