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HMV LOAD SPECULATOR

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Abstract
Heavy Motor Vehicles are used for the purpose of transferring Heavy weight product from one place to another place. HMV owners or HMV drivers are faking the weight levels while calibrating the product weight in that vehicle without the knowledge of Product Company. This crisis arises because the weight of the product is measured in the weight bridge which is away from the owner's sight. So, to overcome this faking system HMV load detector is screwed to the vehicle itself. The main purpose of this product is to avoid the fake load report, transport for measuring load can be avoided, the measurement of load is done at the straight view of the owner and we have also planned to place the overload buzzer in the both sides of the vehicle as well as GSM module has installed with the vehicle to monitor the load levels during weight loading and unloading. So, traffic police can easily find the overloading of vehicle and they can easily trace it. So, we can also avoid the accidents due to overloaded vehicles by this HMV Load detector product.

Index terms: HMV, Load detector, Fake load, Overload

1. Introduction
FAKE load report is a major problem for the company who need to transfer their product by the rent HMV vehicle or a contract vehicle. As the transport industry production and the continuous development of commerce and trade, the vehicle dynamic weighing technology as an effective management tool for overloading, has been widely used. It has playing an increasingly important role and achieved very good results[1]. In modern society, heavy traffic including congestion can be observed all over the world, which makes traffic volume and speed important for traffic management [2]. The owner of the vehicle or the drivers are cheating the company with a fake loaded report by loading weights other than the original goods. So this is the major issue for both the transferring company and transferred company of product. To overcome this issues we have planned to fit the HMV Load Detector in the vehicles. This product completely avoid the fake load reports. Our product also ensures that the whole weight of the load is measured as we can't expect maximum load to be loaded every time. It may be a half load or the goods can be loaded at any corner of the half body.

It will play a vital role in helping the traffic police department in finding the overloaded vehicles by using overload buzzer system. Then it also avoids the accident due to over load vehicles. This product mainly focus on load such as iron, scraps, paint loads. An instant result with great accuracy is displayed and hence the malpractices done before can be avoided to a greater extend. The main components of

our product includes a load cell, computational processor, an LCD display and a buzz system.

The heart of our product lies within the load cell. A load cell is a transducer that is used to create an electrical signal whose magnitude is directly proportional to the weight being measured. We are using this load cell for the measurement of the load. The suitable load cell for our product is BP320. The uniqueness of BP320 load cell is that it can measure the Heavy load ranging from 50 to 2000kg (0.05 to 2tons). Usually the HMV is loaded up to 1.5tons. Hence this load cell suits well for out product. The range of the load does not affects the accuracy of our product. The compactness of load cell is a major merit as it avoids a separate location in the vehicle. The use hydraulic load cell increases the body weight of vehicle which consequently reduces the efficiency of engine. BP320 plays a major role to avoid the above demerit. Load cell BP320 is an aluminum construction and so it is dust and rust free. The operating temperature range is (238 – 338K). So its suitable for any temperature locations. A protective glass IP65 is provided with the load cell and hence it doesn't require any additional protective coating . The above features makes it's an non-destructive product..

2. DESIGN AND REQUIREMENTS

A. Load cell BP320

Type BP320 is an high performance single point type load cell for direct mounting of large weighing platforms.

The most common type is a strain gauge load cell which consists of an insulating flexible backing with metallic foil supports pattern . To accomplish that, a Full Speed Ahead (FSA) commercial crank set and its virtual model, developed by [3], was used as reference to ergonomic characteristics as the length between the pedal axle and the bottom bracket, and the distance between the frame and the pedal during rotation method. To determine the static simulation loads, it was considered a body weight of 75kg, which implied on a maximum force of 735.5N, since the total force applied to the pedal hardly exceeds the weight of the athlete [4], [5]. The maximum platform size of the load cell is 1200 x 1200mm. Although its size is compact it can measure gigantic structures. The safe overload efficiency is upto 150%. Accuracy is <0.03. Insensitive to side load. Output sensitivity is 2.0 ± 0.2. Repeatability of the product is <0.01. Full load output is 2.0(±0.25%)mV/V. All temperature sensitive components are positioned close to the gauges to minimize the errors due to temperature gradients.

B. LOAD CELL INTERFACE MODULE HX711

This Load cell amplifier using to interface the load cell and microcontroller combined together. This Amplifier module uses 24 high-precision Analog to Digital converter, is major invented for high accurate precision for electronic scale and design with two analog input channels, the internal

programmable gain amplifier integrated multiplier 128. This weight amplifier having two input pins which is called serial clock and data pin to be configured to provide a bridge voltage electrical bridge (such as pressure, weight) sensor model is an high- precision and low-cost sampling. There is no programming needed for thee internal registers.

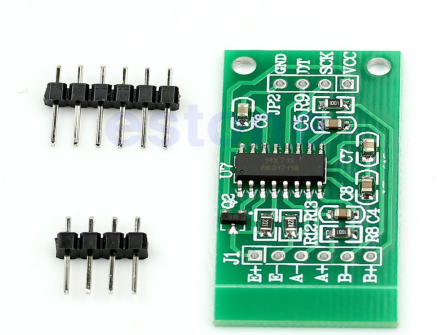

Fig.2(B) HX711 Interface Module

PD_SCK Pulses	Input channel	Gain
25	A	128
26	B	32
27	A	64

Table 1 Input Channel and Gain Selection

3. DESCRIPTION

The strain gauge has been in use for many years and is the fundamental sensing element for many types of sensors, including pressure sensors, load cells, torque sensors, position sensors, etc. Strain gauge patterns offer measurement of tension, compression and shear forces. All the Wheatstone bridges were composed by four strain gages of the same production batch for temperature compensation [6].

Full-bridge strain gauge circuit

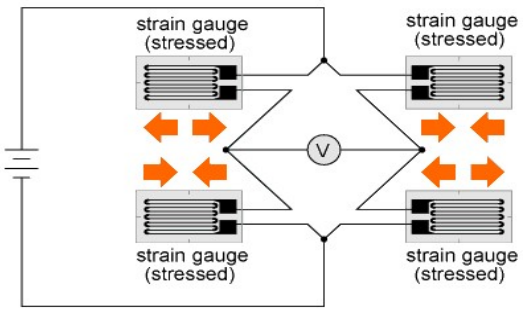

Fig.3 Full Bridge strain gauge

They consist of a pattern of resistive foil which is mounted on a backing material. They operate on the principle that as the foil is subjected to stress, the resistance of the foil changes in a defined way. The complete Wheatstone Bridge is excited with a stabilized DC supply and with additional conditioning electronics, can be zeroed at the null point of measurement. As stress is applied to the bonded strain gauge, a resistive changes takes place and unbalances the Wheatstone Bridge. This results in a signal output, related to the stress value. As the signal value is small, (typically a few millivolts) the signal conditioning electronics provides amplification to increase the signal level to 5 to 10 volts, a suitable level for application to external data collection systems such as recorders or PC Data Acquisition and Analysis Systems.

If a strip of conductive metal is stretched, it will become skinnier and longer, both changes resulting in an increase of electrical resistance end-to-end. Conversely, if a strip of conductive metal is placed under compressive force (without buckling), it will broaden and shorten. If these stresses are kept within the elastic limit of the metal strip (so that the strip does not permanently deform), the strip can be used as a measuring element for physical force, the amount of applied force inferred from measuring its resistance. Such a device is called a strain gauge. Strain gauges are frequently used in mechanical engineering research and development to measure the stresses generated by machinery.

A. Cabling

A load cell may have a cable with four or six wires. A six-wire cable, besides having +/- excitation and +/- signal lines also has + and - sense lines. It is a common misconception that the possibility to sense the actual voltage at the load cell is the only difference between 4-wire and 6-wire load cells. A load cell is compensated to perform within specifications over a certain temperature range (usually -10 6 +40 EC). Since cable resistance is a function of temperature, the cable response to temperature changes must be eliminated. The 4-wire cable is part of the temperature compensating system of the load cell. The load cell is calibrated and compensated with a certain amount of cable attached. **Never cut a 4-wire load cell cable**.

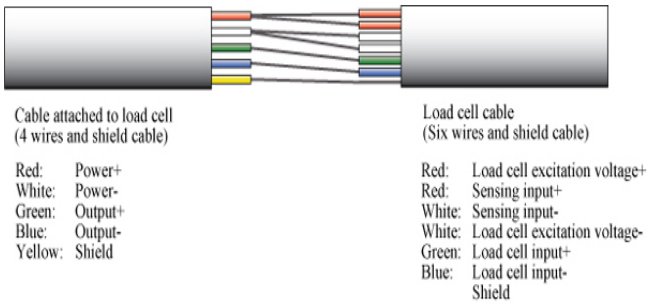

Fig.3(A) Cable

The 6-wire cable is not part of the temperature compensating system of the load cell. The sense lines are connected to the sense terminals of the indicator, to feed back the actual voltage at the load cells. The indicator either adjusts its output voltage or adjusts its amplifier to compensate for any resistance change in the cable. The advantage of using this "active" system is the possibility to cut (or extend) the 6-wire

load cell cable to any length. **A 6-wire load cell will not perform within specifications if the sense lines are not used**.

B. Computational System

Arduino is a single-board microcontroller, intended to make the application of interactive objects or environments more accessible. The hardware consists of an open-source hardware board designed around an 8-bit Atmel AVR microcontroller, or a 32-bit Atmel ARM. There are several similar learning modules [7] that are dedicated to learn other characteristics of particular processor. Such systems can be used in different areas. Example of this is the area of measurement of power consumption in households [8], where microprocessor is used to sense current overflow. Current models feature a USB interface, 6 analog input pins, as well as 14 digital I/O pins which allows the user to attach various extension boards. It comes with a simple integrated development environment (IDE) that runs on regular personal computers and allows users to write programs for Arduino using C or C++..

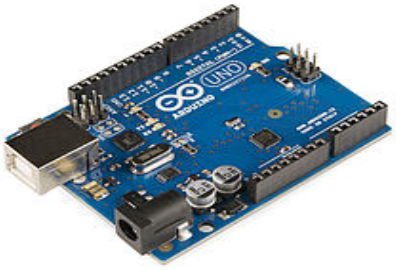

Fig. 3(B) Arduino

early Arduino board with an RS-232 serial interface (upper left) and an Atmel ATmega8 microcontroller chip (black, lower right); the 14 digital I/O pins are located at the top and the six analog input pins at the lower right. Most boards include a 5 volt linear regulator and a 16 MHz crystal oscillator (or ceramic resonator in some variants), although some designs such as the LilyPad run at 8 MHz and dispense with the onboard voltage regulator due to specific form-factor restrictions. An Arduino's microcontroller is also pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory, compared with other devices that typically need an external programmer. This makes using an Arduino more straightforward by allowing the use of an ordinary computer as the programmer.

4. Methodology

The HMV Load Speculator is an smart device that will be incorporate with the Heavy Motor Vehicle and LCV vehicles to measure the load or weight lifting by the vehicle as well as it will give LCD notification of weight limits and current weight and if there's any mal function occurs in the vehicle, this device will sense the load and send the alert notification to who owned the vehicle and registered RTO number as text message. This project consist of 40 kg load cell to measure weight, HX711 interface module to interface load cell with arduino and arduino board to control the entire unit and GSM module to send information as text including with LCD module to display the information's.

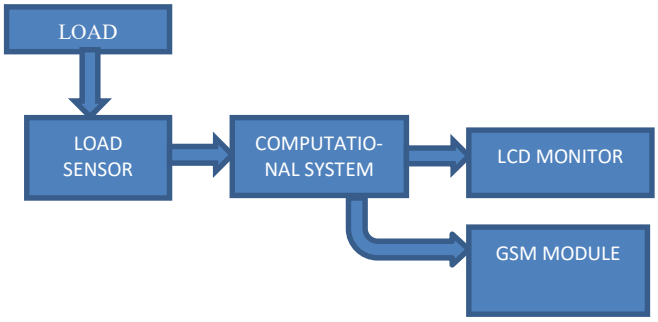

Fig. 4 Block Diagram

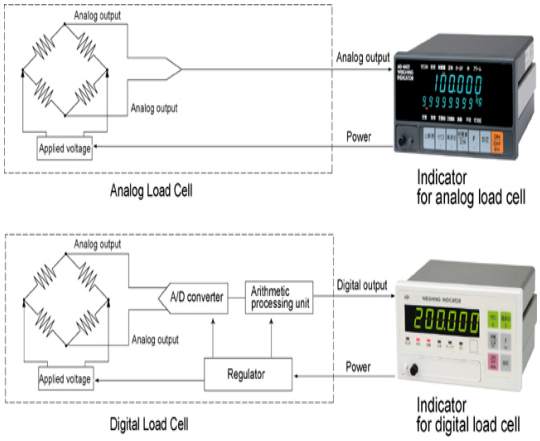

Fig.IV Indicator design for analog and digital load cell

The Load cell will generate the analog value as per the weight which is sensing by the module. To pass the analog value to arduino board from load cell, it has integrated with the HX711 Analog to digital converter module with the circuit. Once the value reached the arduino board it will deal with coding process and will compare the value one with each other. Hence, this system has integrated with GSM module to share or monitor the details of vehicle loading and unloading system. If any changes occurred after loading and unloading, those statuses will be updated to owner via text message.

5. RESULT AND GENERAL DISCUSSION

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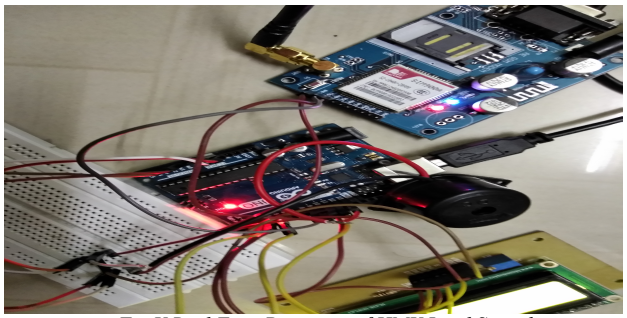

Fig.V Real Time Prototype of HMV Load Speculator

Strain gauge load cells convert the load acting on them into electrical signals. The gauges themselves are bonded onto a beam or structural member that deforms when weight is applied. In most cases, four strain gauges are used to obtain maximum sensitivity and temperature compensation. Two of the gauges are usually in tension, and two in compression, and are wired with compensation adjustments when weight is applied, the strain changes the electrical resistance of the gauges in proportion to the load. Other load cells are fading into obscurity, as strain gauge load cells continue to increase their accuracy and lower their unit costs.

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