Load Detection and Warning System

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ABSTRACT: *Nowadays there is no facility to check the heaviness of the vehicle in tollgate. This system will be implemented on tollgate area to detect the load carried by the vehicle using weight sensor. The main objective of this system is to check whether the vehicle is overloaded or not. The load of the vehicle will be showed on the display screen and the weight will be checked against the database which consists the ideal weight of each type of the vehicles as per the government law. If the vehicle capacity is overloaded then it creates an alarm. This system is considered as a protected system because it prevents accident by preventing the vehicle to carry extra load and also it increases the life time of the road. We hope that if it comes in practice, it will play a major role in government sector.*

Keywords: Weighing Sensor, Vehicle

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1. Introduction

Automation plays an increasingly very important role in the world economy and in daily life. Automatic systems are being preferred over any kind of manual system. Our system is "LOAD DETECTION AND WARNING SYSTEM". Among all exciting applications, this system plays a vital role in our environment especially in Tollgate. We have seen weight machines at many shops, where machine displays the weight just by placing any item on the weighing platform. So here we are building the same Weighing machine by using Arduino and Load cells, having capacity of measuring upto5kg. This limit can be further increased by using the Load cell of higher capacity. In this system we have three modules, First Fixing the Load cell with Platform and base then to place a vehicle (Weight Item) on the weighing platform. Connect the Load cell to Load cell amplifier then the Signal can be amplified and converted into an output value. The last module is connecting the Load cell amplifier to Arduino and also connects LCD with Arduino to measure and compare the weight using Arduino. And to display the weight on LCD. Nowadays there is no facility to check the heaviness of the vehicle in tollgate. By implementing this system on tollgate area it is useful to detect the load carried by the vehicle using weight sensor. There is an ideal weight of each type of the vehicles as per the government law. The load of the vehicle will be showed on the display screen and the weight will be checked against the database which consists the ideal weight and then it will show whether the vehicle is overloaded or not. If the vehicle is overloaded then it creates an alarm.

This system helps to prevent the vehicle from an accident by preventing the vehicle to carry extra load and also it increases the life time of the road, so this system is considered as a protected system.

2. Literature Survey

Still now the load cell or weight sensor is mainly used in vehicle manufacturing company to calculate the capacity of the vehicle after the production of each vehicle. Most weigh stations use either piezo-based or strain gauge load cells. These are embedded into the road surface and the load created by each axle measured. A recent innovation is so-called Weigh-in-Motion (WIM) technology where the truck can be weighed accurately without needing to stop. These systems use a combination of load cells and inductive loops that detect vehicle presence. They are fast and accurate, and most importantly, eliminate the need for each truck to stop to be weighed. This overcomes the problems of traffic backups experienced at busy times, which often forces the temporary closure of the weigh station.

As with trucks, systems are available for both static and WIM measurement. These can determine individual axle loads, bogey loads and even the weight of an entire wagon or locomotive. Load cells are used in these systems and have accuracies of ±1% or better.

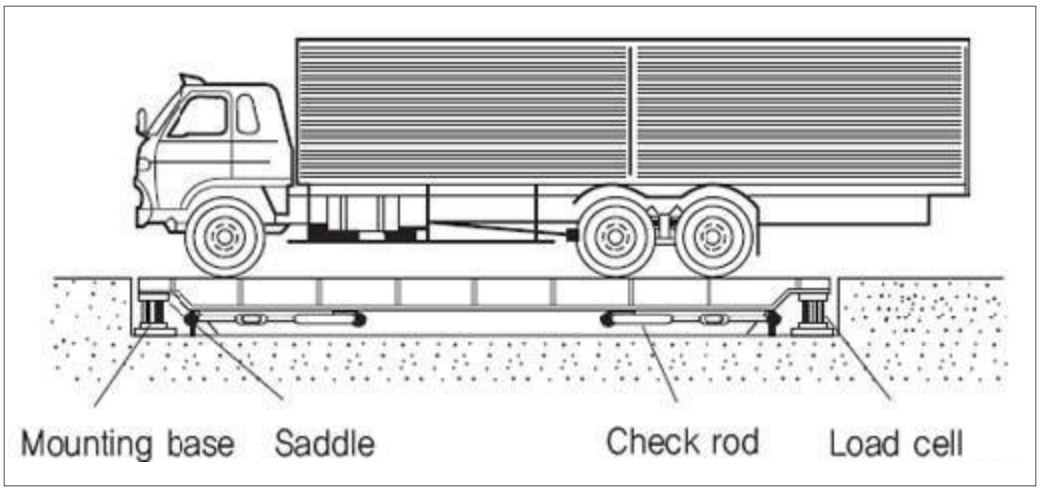

Figure 1. Measuring the truck Capacity

In this figure 1 we can able to see how the load cell or weight sensor is fixed to calculate the capacity of the vehicle. In this the Load cell is fixed under a surface of wooden plane or metal plane along with some equipment such as Mounting base, Saddle and Check rod. Now the vehicle will place over the wooden plane or a metal plane at that time the compression given by the vehicle will detect by the load cell and finally it calculates the capacity of the vehicle.

3. System Model and Working

Our system is to implement the load cell sensor in tollgate area to calculate the heaviness of the vehicle by applying the existing system process. In this system we are going to compare the load of the vehicle with its capacity.

3.1 Weighing Sensor

By weighing the vehicle when loaded, the load carried by the vehicle can be calculated. To create an alarm when the vehicle capacity is overloaded. Load cell is fixed under a surface of wooden plane or metal plane and then the vehicle will place over the wooden plane or a metal plane at that time the compression given by the vehicle will detect by the load cell. The load of the vehicle will be compare to the capacity of that vehicle which is already initialized in the coding. When the load of the vehicle cross the particular capacity, the buzzer will create an alarm (beeeeeep sound).

3.2 Architecture Diagram

An architecture diagram is a graphical representation of a set of concepts that are part of architecture, including their principles,

elements and components. The below figure 2 represents the connection of the system. At first the load cell is connected with the amplifier which converts the signal taken from the load cell into value and then it connected with the arduino which calculate the weight as per the coding. These can determine individual axle loads, bogey loads and even the weight of an entire wagon or locomotive.

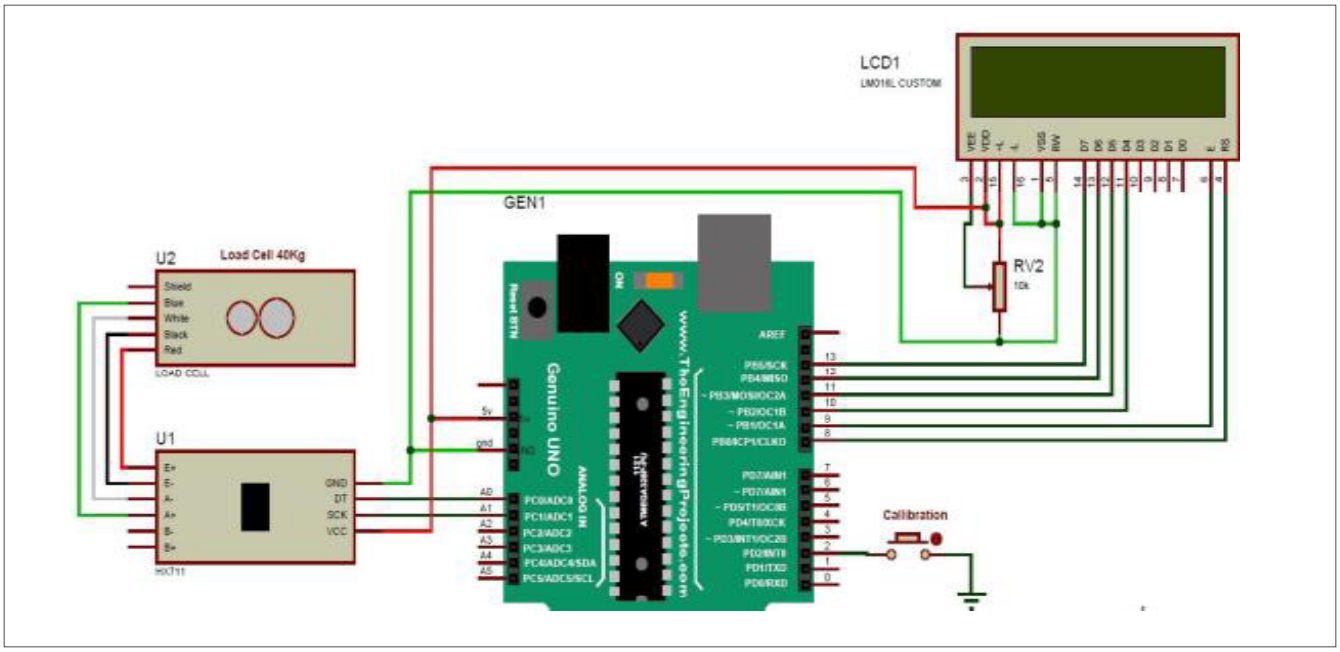

Figure 2. Architecture/block diagram

3.3 Dataflow Diagram

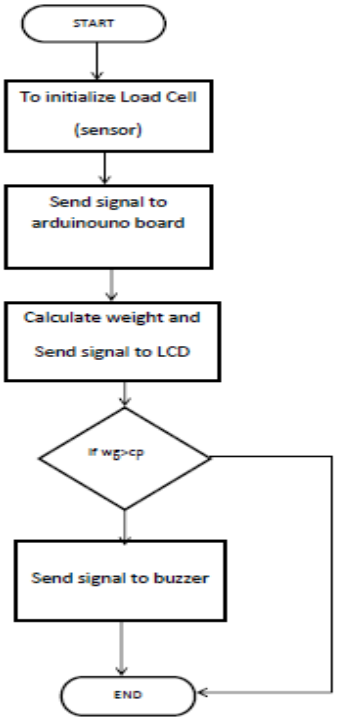

Figure 3. Flow chart

4. Implementation and Results

4.1 Modules

The figure 3 shows the modules of the system

1) Fixing the Load cell with Platform and base: To place a vehicle (Weight Item) on the weighing platform.

2) Connect the Load cell to Load cell amplifier: Signal can be amplified and converted into an output value.

3) Connect the Load cell amplifier to Arduino and also connect LCD with Arduino: To measure and compare the weight using Arduino. And to display the weight on LCD.

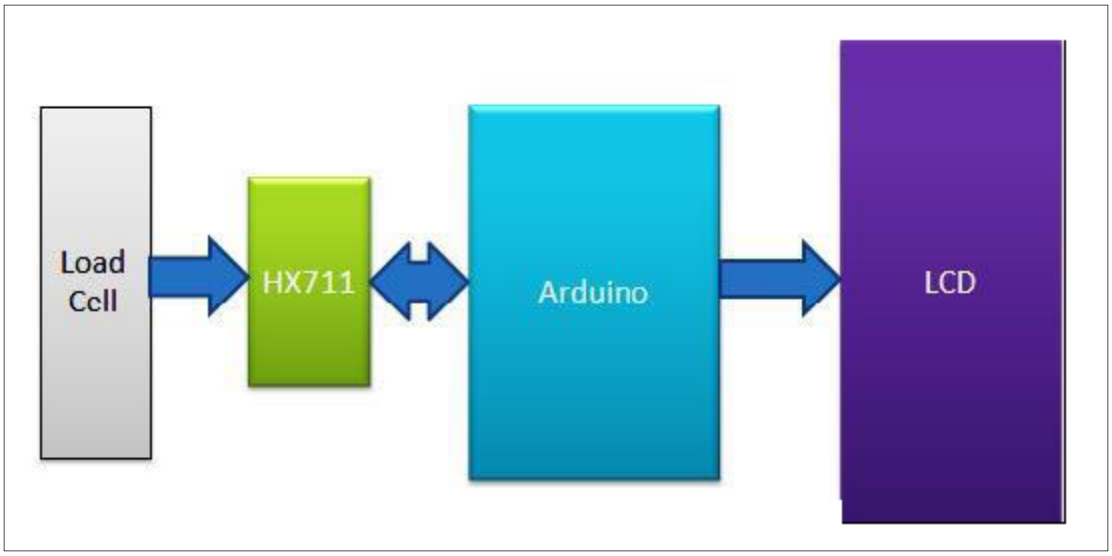

Figure 4. Modules of the system

4.2 Phases

Setup phase 1 (Connection between Load cell and amplifier)

In this section, the setup of the whole research work is depicted in a step by step manner. Sample screenshots are displayed once the components are fixed and connected to each other**.** In this phase Load cell is connected to the amplifier using the jumper wires and thus completes the system setup which helps one to understand the steps in a simple and easy way.

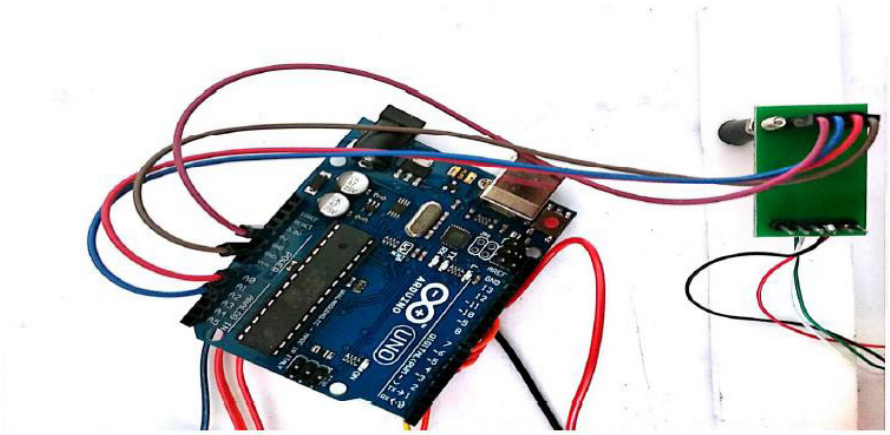

Figure 5. Connection between Load cell and amplifier

The Figure 5 depicts the initial setup of the hardware. All the components are in accordance to every other component.

The Arduino board is about to be mounted and connected to the external power supply for the flow of current. Then the amplifier is going to be connected to the Arduino board. All the wirings with the breadboard are installed.

4.3 Setup phase 2 (Arduino coding)

load_cell | Arduino 1.8.9 (Windows Store 1.8.21.0)

File Edit Sketch Tools Help

load_cell

```
#include <LiquidCrystal.h>
//LiquidCrystal lcd(8, 9, 10, 11, 12, 13);
LiquidCrystal lcd(2, 3, 4, 5, 6, 7);
#define DT A0
#define SCK A1
#define sw 8
#define bz 12
long sample=0;
float val=0;
long count=0;

unsigned long readCount(void)
{
  unsigned long Count;
  unsigned char i;
  pinMode(DT, OUTPUT);
  digitalWrite(DT,HIGH);
  digitalWrite(SCK,LOW);
  Count=0;
  pinMode(DT, INPUT);
  while(digitalRead(DT));
  for (i=0;i<24;i++)
  {
    digitalWrite(SCK,HIGH);
    Count=Count<<1;
    digitalWrite(SCK,LOW);
    if(digitalRead(DT))
    Count++;
```

Done compiling.

```
Sketch uses 5384 bytes (16%) of program storage space. Maximum is 32256 bytes.
Global variables use 372 bytes (18%) of dynamic memory, leaving 1676 bytes for local variables. Maximum is 20
```

Figure 6. Arduino code compiling

4.4 Setup Phase 3 (Connection between Arduino and LCD)

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. The LCD (Liquid Crystal Display) is fixed on the breadboard, and the LCD pins are connected to the Arduino pin port. The Figure 7 shows the connection between Arduino and LCD.

• 8 and 9 pin of Arduino is connected to RS and E pin of LCD

• 10 and 11 pin of Arduino is connected to D4 and D5 pin of LCD

• 12 and 13 pin of Arduino is connected to D6 and D7 pin of LCD

• ‘ 5v pin of Arduino is connected to VDD and L+ pin of LCD

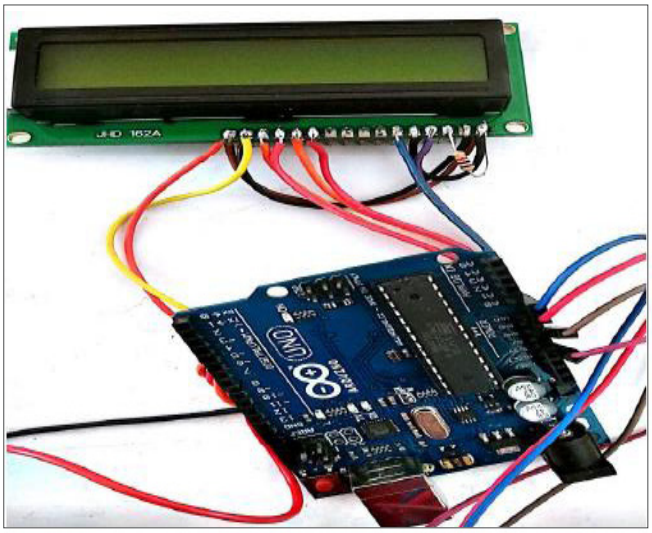

Figure 7. Connection between Arduino and LCD

5. Conclusion

This system is used to detect whether the vehicle is overloaded or not based on IOT application. Here the load of the vehicle detected by the load cell, which is also connected with amplifier [HX711]. The amplifier is used to convert the electrical signals to Arduino. After the load detection we are going to compare the load of the vehicle with its capacity. When the load of the vehicle cross the particular capacity, the buzzer will create an alarm (beeeeeep sound). This system play a vital role in our environment especially in Tollgate.

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