

# An Review on Heavily Duty Vehicle Safety System

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**Abstract:-** In today's world, Automation is a very important part of the invention. This paper focuses on safety of loaded vehicles from the rollover, side wind, overturn etc. Presently trailer tracking by using GPS, collision mitigation technologies are used. These technologies have some limitations and are overcome by using stm32f407 microcontroller, servo valve & hydraulic system and it gives better performance and reliability. This system continuously monitors the load on each load cell and observe the elevation of the truck trailer using the accelerometer sensor. The existing load on trailer get display on LCD screen. If an overload condition is observed, a visual and audible alarm will continuously beep. Overload message will be displayed on load screen. While monitoring the load and elevation of truck trailer center of gravity will calculate. If the center of gravity changes then servo motor will operate on hydraulic cylinder and maintain it in safe zone.

**Keywords:-** Hydraulic System, Microcontroller, Relay, Servomotor, Accelerometer.

## I. INTRODUCTION

Nowadays, accidents of a heavily loaded truck are the major issue in today's world. The accidents mainly occur due to crosswind, an effect of overturning and roll over. Firstly, furniture trucks and truck transporting containers are extremely susceptible to the effect of crosswind. Remember also that your vehicle will generate its own wind as it moves along the road. The faster you go, greater the wind forces generated will be. These forces can be sufficient to blow motorcyclists over and buffet other vehicles to a point that the driver losses control.



Fig 1:- Effect of Crosswind in the Truck

Secondly, the weight of a vehicle means that when it is traveling in a straight line it will try to continue in that direction, even when the driver turns the steering wheel. Changing direction causes the vehicle's weight to move to the outside of the turn which, unless the driver controls its speed can lead to the vehicle rolling over or sliding out. nowadays fattel truck crashes are increased .fig2.shows % of accidents of different types of vehicles. The accidents of trucks/lorry are 19.2% which is in the second position of the pie chart as shown

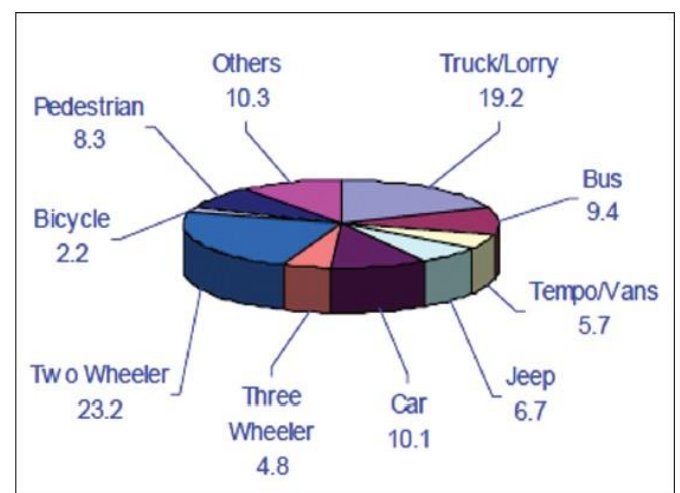


Fig 2:- % of Accidents

A system is designed to reduce the accidents of the loaded vehicle.

## II. METHODOLOGY

The center of gravity depends on the motion. The higher the center of gravity more unstable object that means centre of gravity is proportional to stability of the object. It is necessary to place the load correctly along its length to reduce the possibility of lockup of the wheels when break has been applied. There are two types of a center of gravity. Firstly longitudinal center of gravity depends on width and height, whereas the transverse center of gravity depends on the length and width of the truck. The system is designed to control the transverse center of gravity within the safe limit. When overturn occurs the center of gravity of the load shifted to the left or right according to the direction of the overturn. That will cause the rollover of the vehicle Centrifugal force (overturning or side force): Centrifugal force occurs when vehicle changes its direction. At the turning point this force causes sliding of the passenger across the seat.

**A. Load Placement**

This is most important factor in vehicle safety. The load distribution will be done properly on both front and rear axes to provide proper break balance. Also the load placed is within a certain limit to avoid the overloading conditions.

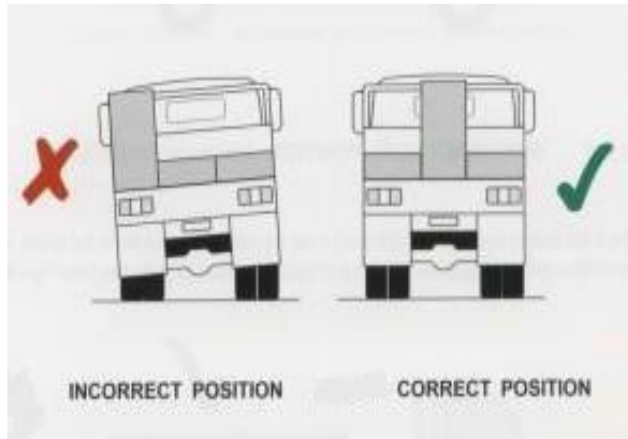


Fig 3:- Load placement

**B. Load Security**

Load will decrease the stability of vehicles during cornering. the load is placed from sides of vehicles at a distance greater than 100 mm. the vehicle must be restrained as-it will take full weight in forward direction, half weight during sideways and rearward direction as shown in fig.4 below.

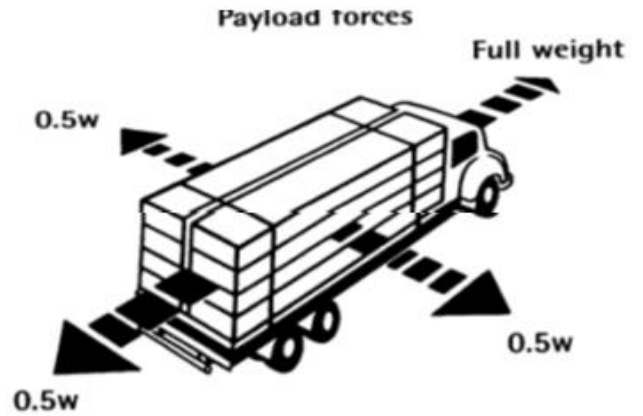


Fig 4

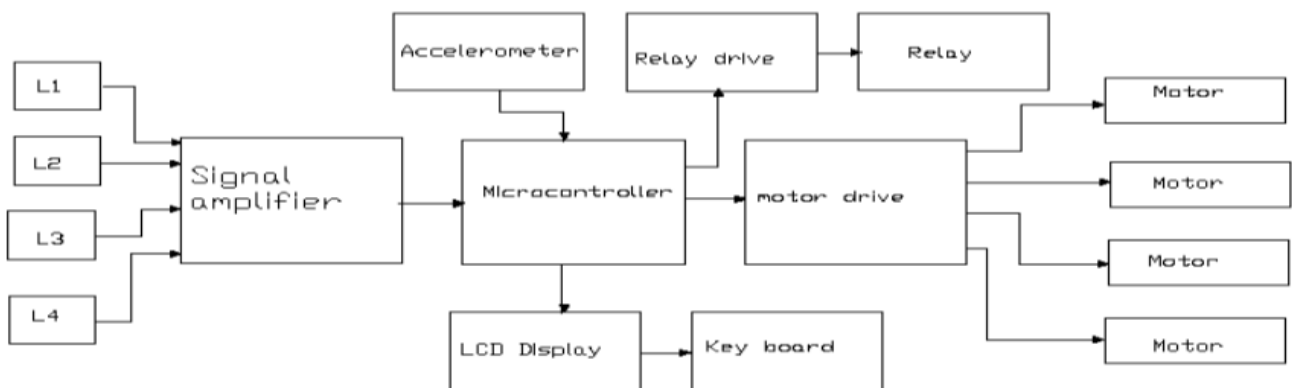


Fig 5:- Block Diagram

- The Strain gauge load cell measures the pressure on the tires. It is a device for measuring the changes in the distance between two points in solid bodies that occur when the body is deformed and they respond to mechanical strain. Load cell consists of under stressed sleeved steel rod usually installed alongside to tieback or rock bolt.

➤ **Amplifier- LM324**

Amplifier- LM324 is a 14 pin integrated circuit which four independent op-amps inside it. the operational amplifier operated by single power supply. It increases the voltage signal and is used for wireless communication.

➤ **Microcontroller STM32F407**

**Connecting the Servo** All you need to do for this project is connect the red power wire to the 5v pin on the STM32F4 Discovery board, and the ground to the GND pin on the STM32F4 Discovery and the white control cable to pin PB6. **Controlling the Servo Position** If you connect up

just the power terminals of the servo you will see that nothing interesting happens, this is because before a servo will move you need to tell it what position it should move to, this is where the white control wire comes in. A servo is controlled by sending a pulse (a square wave) to it, you can think of this as essentially switching pin PB6 on and off very quickly – the rate at which you switch the pin on and off determines the position that the servo will move to and stay in until a new signal is received. As we need to control the pulses to the servo very precisely in order to be able to accurately control its position we need to use the STM32F4 discoveries pulse width modulation capabilities. Essentially using PWM we are able to create a signal on the white wire that pulses at whatever rate we require, by changing this rate we can then tell the servo to move between positions.

➤ *Accelerometer*

Accelerometer is an electromechanical device that can be used for various applications like tilt detection, obstacle detection, motion inputs, earthquake sensing, etc. Tilt detection is a simple application of an accelerometer where a change in angular position of the system in any direction is detected and indicated the corresponding angle scaled from microcontroller output.

➤ *Dc Servo Motor*

Servo motor controls the angular or linear position, velocity, and acceleration. it controls the sliding mode of trolley.

➤ *Relay*

A relay is an electromagnetic switch, which operates on the principle of an electromagnetic field. The relay consists of an electromagnet to perform switching operation. at overload condition, it will trip.

*C. Working Principle*

There are 4 load cells L1 to L4 there output is in mv. the signal amplifier is used to amplify the load cell's output in volt. At overload condition, STM32F4 microcontroller gives the command to relay at that time truck will not start. the measurement of the angle will be done by an accelerometer. It measures the tilting angle of the truck and decides how trolley will slide by using hydraulic system and bring the vehicle to the safe zone. In hydraulic system, the moments of the piston will be done by using a servo motor. The LCD display displays the overload condition and tilting angle of the truck, the weight of the load in kg. keyboard is used to give Hydraulic system-fig 6 shows a basic block diagram of hydraulic system. In our system to maintain the center of gravity, we slide the trolley to the left or right. this movement of trolley will be done by using hydraulic system. In basic hydraulic system reservoir is main functional part where all hydraulic oil is stored. filter is used to remove the impurities from the oil. The pump connected pumps hydraulic oil through the pipe with high pressure. The control valve controls the movement of hydraulic cylinder. In our system instead of a mechanical control valve, we are using a servo valve to control the motion of cylinder.

**III. CONCLUSION**

This paper reviews the performance and reliability of the vehicle. also reduces the road accidents. & help of weight distribution system is ensure a smooth. it improve the steering and stoping of vechicle. apply the correct driving techniques to manage the numerous forces at work.

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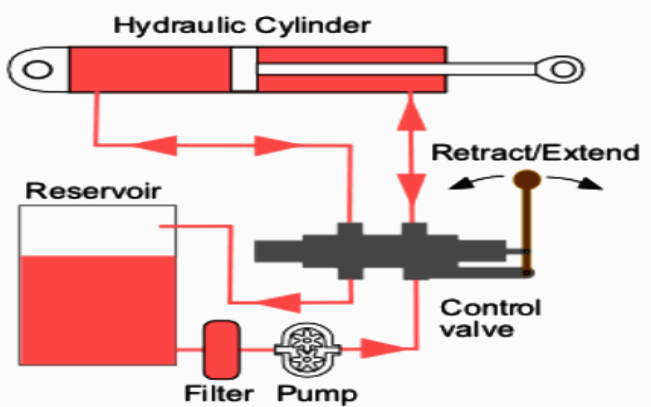


Fig 6:- Hydraulic System