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DESIGN AND FABRICATION OF OVERLODING OF VEHICLES

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Abstract : *For the problem of overloading passenger vehicles, vehicle-mounted overloading control system for passenger vehicles was designed. The system included sensor circuit, sensor control circuit and interface circuit with AT89C51 micro-controller. The software of the control system was designed in assembly language. Based on the actual number of passengers, starting of the vehicle was controlled by the control of the amount of fuel injection. Compared with the traditional control methods, the control system designed in this paper responded quickly and saves a lot of manpower, material and financial resources .What more, the number of the passengers in the vehicles can be real-time monitored to control overloading passenger vehicles better.*

Keywords - *Overloading Control, Vehicle Safety, Load Sensors, Mechanical Design, Weight Monitoring*

I. INTRODUCTION

The heavy loading of vehicles is a problem faced globally that demands adequate attention. Overloading compromises road safety along with the health of transportation infrastructure as well as the environment. The process of urbanization alongside trade is gathering pace which has increased the desire for transportation and freight in particular. This leads to vehicles being loaded past their recommended weight which has some serious aftermaths. It compromises the safety of the vehicle, increases the stopping distance, increases the chances of an accident, and destroys vehicle stability. The overloading also results in increased maintenance expenses for congested urban areas, traffic snarl-ups, and expensive repairs. From an ecological point of view, overloaded vehicles are a menace as they increase the amount of fuel utilized which increases emission pollution considerably. Weighing vehicles by employing traditional techniques such as static weighing stations do not seem to be very effective and can be undermined. Vehicles need to be brought to a standstill which is time inefficient and promotes noncompliance. There is a need for action and with the utmost urgency, new effective techniques must be adopted that allow for monitoring without the vehicle having to come to a stop.

This project aims to develop an advanced overloading control system leveraging modern technologies, including Weigh-in-Motion (WIM) sensors, data analytic s, and real time monitoring tools. By implementing a comprehensive approach that combines technology with public awareness and regulatory compliance, the initiative seeks to enhance road safety, protect infrastructure, and promote environmental sustainability. Through collaboration among stakeholders, this project endeavours to foster a culture of responsibility and adherence to weight regulations within the transport sector.

II. PROBLEM DEFINITION

The design and fabrication process of the overloading control system involves several key steps, including system conceptualization, component selection, and the actual assembly and integration of the system in to vehicles. The following sections will detail the methodologies, materials, and procedures used.

2.1 Problem Statement and Motivation

Overloading has become a persistent issue in both urban and rural transportation systems, often due to economic pressures that lead operators to carry more weight than is legally allowed. This behaviour not only compromises safety but also contributes to the deterioration of roads, increasing maintenance costs for local governments. The traditional methods of enforcing weight limits, such as weight stations, are limited by their static nature and the time required for enforcement. There is an urgent need for a more dynamic, scalable solution to monitor and prevent overloading.

2.2 Objectives of the Paper

The main objective of this study is to design and fabricate a practical system that can monitor vehicle load in real-time. This system will not only alert the driver when the load exceeds the permissible limit but also prevent vehicles from operating under unsafe conditions. Our secondary objectives include:

- Designing a system that is easy to install and operate on a variety of vehicle types.
- Ensuring the system is cost-effective and durable enough to withstand harsh road conditions.
- Creating a user-friendly interface that provides clear feedback to the vehicle operator.

2.3 Scope of the Study

This paper focuses on the design of the mechanical system and the integration of electronic components required to monitor vehicle load. The system uses load sensors, a microcontroller, and an alert mechanism to detect and prevent overloading. While the primary focus is on road vehicles such as trucks and buses, the principles of the system can be extended to other types of transportation as well.

III. METHODOLOGY

3.1 Conceptual Design of the Overloading Control System

The design of the overloading control system began with identifying the key requirements, including accurate weight measurement, low power consumption, and ease of integration with existing vehicle systems. The system was designed to be simple yet robust, focusing on key components such as load sensors and a microcontroller to process data. The load sensors, which are crucial for accurately measuring the weight on the vehicle's axles, were chosen based on their durability, accuracy, and resistance to environmental factors such as heat, humidity, and vibrations.

The microcontroller was selected to interface seamlessly with the sensors, collect the data, and trigger an alarm if the vehicle exceeded its weight limit. The system was also designed to allow easy customization for different vehicle types, with considerations for varying vehicle loads and sensor placement.

3.2 Fabrication and Component Selection

The fabrication process involved selecting high-quality, durable components capable of withstanding the rigors of real-world use. The key components include:

Load Sensors (Strain Gauges): Used to measure the strain caused by weight on the vehicle's axles. These sensors were chosen for their precision and ability to function in a wide range of conditions.

Microcontroller (Arduino/ESP32**):** A central unit that receives data from the sensors, processes it, and communicates with the display and alert system.

- **Display Unit:** A real-time display showing the current load, with a color-coded indicator that changes when the vehicle is overloaded.
- **Alert System (Buzzer/Light):** An alert system that activates when the load exceeds the permissible limit, ensuring immediate feedback to the driver.

3.3 Testing the System

Once the system was assembled, it underwent several rounds of testing. The load sensors were calibrated to ensure accurate weight measurements, and the system was tested under various loading conditions. During the testing phase, real vehicles were used to simulate typical loading scenarios. The system's response to both slight and severe overloading was carefully monitored to assess its accuracy, reliability, and the efficiency of the alert system. Key parameters, such as the system's ability to handle different vehicle sizes and load variations, were evaluated to ensure it could function across a wide range of applications.

IV. CONCEPT OF OVERLOADING

4.1 TYPES OF LOADS

a. Dead Load (Static Load)
b. Wheel Load
c. Axle Load
d. Brake Load
e. Heavy Load (Oversized Load)

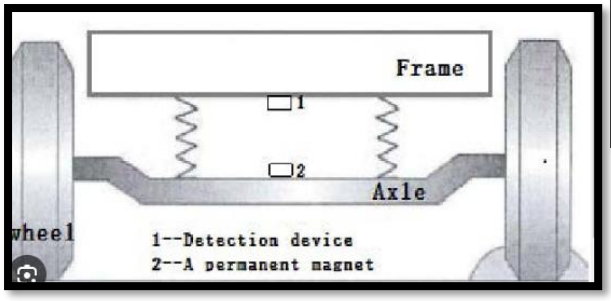

Fig.4.1 overloading vehical

Table 4.1 Materials and Components

Sr. no.	Components	Quantity	Costing
1	Weight sensors	4	200
2	Micro-controller	1	800
3	Buzzer or Alarm	1	250
4	Brake Actuator	1	700
5	Relay Module	1	120
6	Power Supply	1	300
7	Chess	1	1000
	Total	10	3370

V. CONCLUSION

In conclusion, the issue of vehicle overloading represents a significant challenge that affects road safety, infrastructure integrity, and the overall efficiency of transportation systems .By exceeding weight limits, vehicles can compromise their stability, increase the risk of accidents, and accelerate wear and tear on roads and bridges. Understanding the various types of overloading, such as gross vehicle weight and axle load overloading, is essential for developing effective control measures that can mitigate these risks. Current methods of overloading control, including weight stations, on-road enforcement techniques, and advanced technological solutions, play a vital role in addressing this issue. Weight stations facilitate compliance checks, while on-road enforcement ensures that overloaded vehicles can be identified and penalized in real time. The incorporation of technology, such as load sensors and GPS tracking, enhances monitoring capabilities and promotes accountability among drivers and fleet operators. Together, these strategies create a 15 Comprehensive framework for managing vehicle overloading, emphasizing the need for continued efforts in regulation, education, and technological advancement to safe guard public safety and infrastructure.

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