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VEHICLE OVERLOAD SAFETY SYSTEM

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ABSTRACT

Vehicle over weight causes accidents in highways. Sometimes loses are heavy than imaginary. Road damages occur due to heavy weight. There is no system to monitoring vehicle weight. Here we have solution that IOT based vehicle over weight safety system.

This project includes WIFI , which is having inbuilt in the controller. Load cell connected to NodeMCU through analog pin. Load cell monitor vehicle weight. Here load cell limit from 1-10Kg. DC motor connected Arduino through L293d. IR Sensor interfaced to NodeMCU digital pin.

Here NodeMCU displays weight on I2C LCD display. When vehicle detected by IR then based on weight gate will be open. If vehicle weight is more than desired value then it gives buzzer sound and gate remains as it is (Closed). It won't allow vehicle to move forward. This information always updated on LCD. At the same time information transmitted to IOT server through WIFI . User can see data in IOT server from anywhere.

INTRODUCTION

With the rapid increase in transportation and logistics, vehicle overloading has become a major concern. Overloaded vehicles not only cause severe damage to roads but also contribute to fatal accidents on highways. Excessive weight affects vehicle control, increases braking distance, and leads to tire blowouts, making roads unsafe for all users. Despite strict regulations, there is no efficient real-time monitoring system to ensure compliance with weight limits. To address this issue, we propose an IoT-based Vehicle Overload Safety System.

This system integrates Internet of Things (IoT) technology with weight monitoring mechanisms to prevent overloaded vehicles from proceeding further. The core components of the system include a load cell, NodeMCU microcontroller, IR sensor, buzzer, LCD display, and a motorized gate. The load cell measures the vehicle's weight and sends the data to the NodeMCU, which processes the information and displays it on the I2C LCD screen. If the vehicle weight exceeds the predefined limit, the system triggers a buzzer alarm, and the automated gate remains closed, preventing the vehicle from moving forward. Additionally, the data is transmitted to an IoT server via Wi-Fi, allowing remote monitoring by authorities or users from any location.

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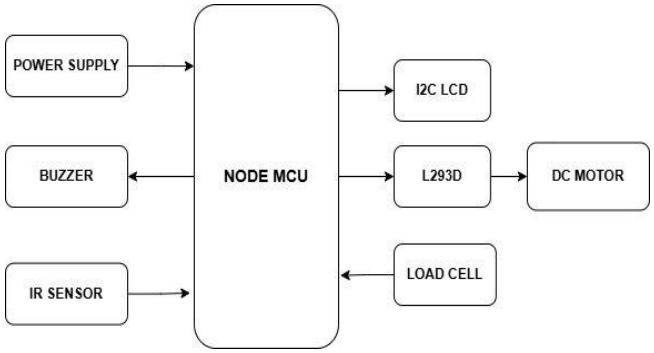

Figure.1 Block Diagram

LITERATURE SURVEY

- Smart Weighing System for Trucks Using IoT (Smith et al., 2018): This project developed an automated truck weighing system using load sensors and IoT technology. The system successfully transmitted weight data to cloud servers and provided real-time alerts for overloaded vehicles. The study emphasized the importance of integrating cloud computing to ensure efficient data analysis and improve decision-making for transportation authorities.
- Automatic Weight-Based Vehicle Restriction System (Johnson & Lee, 2019): This study proposed an automated barrier system that restricted the movement of vehicles exceeding permissible weight limits. It used load cells and microcontrollers to monitor and control vehicle access at checkpoints. The system was found to be highly effective in reducing violations and improving compliance with existing traffic regulations.
- RFID-Based Overload Monitoring System (Kumar et al., 2020): A solution integrating RFID technology to track vehicle weight history and enforce regulations. The system effectively identified habitual violators and enhanced monitoring accuracy. By leveraging RFID and cloud-based databases, authorities were able to maintain detailed logs of vehicles and ensure better law enforcement against persistent offenders.

PROPOSED SYSTEM

The proposed system not only ensures road safety by preventing overloaded vehicles from entering highways but also helps maintain road infrastructure by reducing excessive wear and tear caused by heavy vehicles. The real-time monitoring capability of the IoT-based system enhances transparency and ensures better regulatory enforcement. By implementing this intelligent weight monitoring solution, we can significantly reduce road accidents and enhance overall transportation safety.

The system comprises several key hardware components, including a NodeMCU microcontroller, a load cell, an IR sensor, a buzzer, an LCD display, and a motorized gate. The NodeMCU, a Wi-Fi- enabled microcontroller, serves as the central processing unit, handling all sensor inputs and communication with the IoT server. The load cell, interfaced with the NodeMCU via the HX711 analog-to-digital converter, is responsible for measuring the vehicle's weight when it is positioned on the weighing platform. The IR sensor detects the presence of a vehicle, ensuring that weight measurements are taken only when a vehicle is properly positioned. The buzzer provides an

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audible alert in case of an overload violation, while the LCD display presents real-time weight information for the driver and monitoring personnel. The motorized gate is controlled based on the weight measurement results, either granting or denying access accordingly.

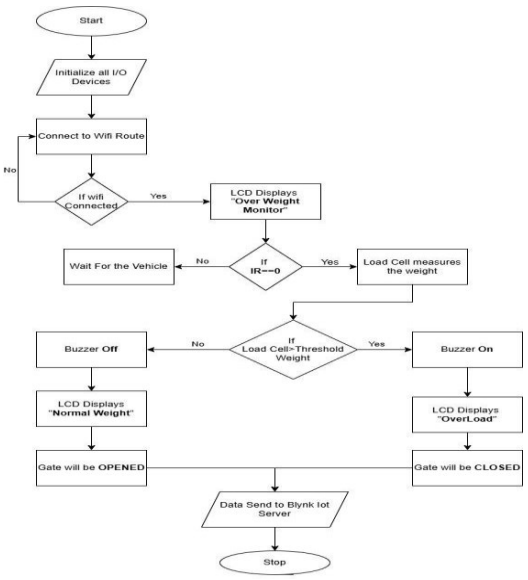

Figure.2 Flow Chart

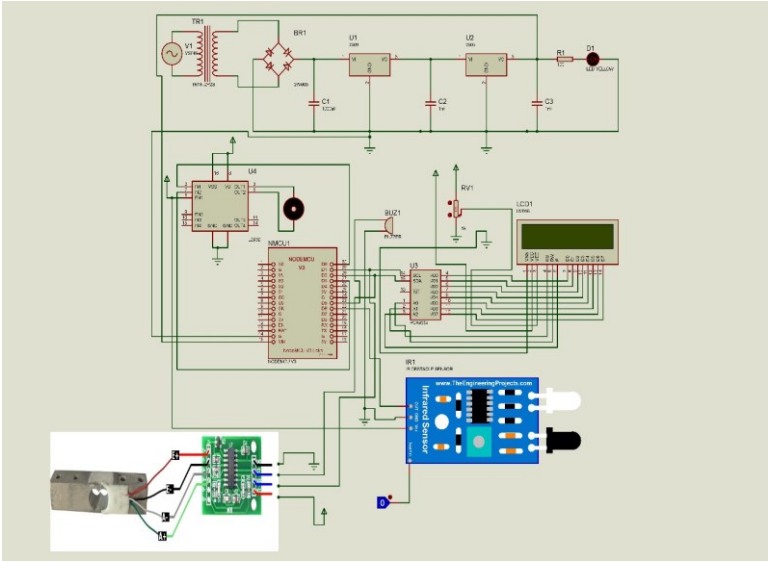

Figure.3 Schematic Diagram

RESULTS

The load cell, connected to the NodeMCU, accurately monitored the weight of vehicles passing through the checkpoint. The real-time data was displayed on the I2C LCD screen with precise readings within the specified weight range (1-10 kg).

The system's quick response ensured that any overweight vehicles were identified almost immediately, with the weight data transmitted to the IoT server for remote monitoring.

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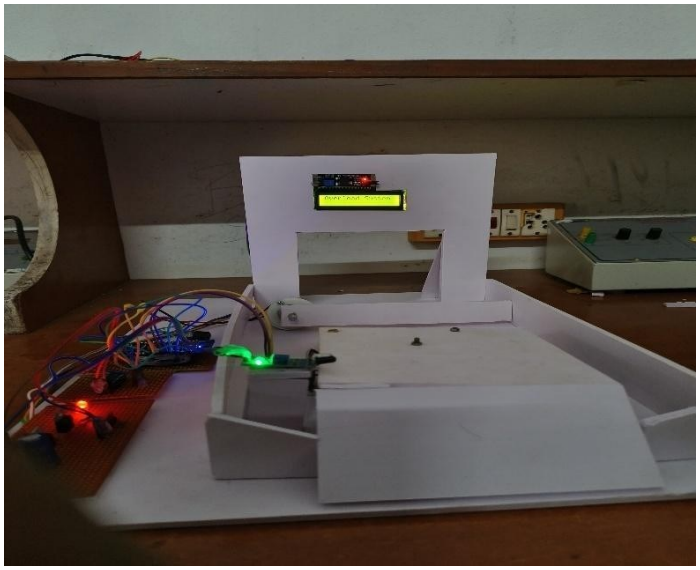

Figure.4 Hardware Working System

The system detected the presence of vehicles using the IR sensor and activated the gate control mechanism accordingly.

When an overweight vehicle was detected, the system activated the buzzer and kept the gate closed, preventing the vehicle from moving forward. This prevented potential road damage caused by overloaded vehicles.

The gate control system performed as expected, with the gate only opening for vehicles within the acceptable weight range.

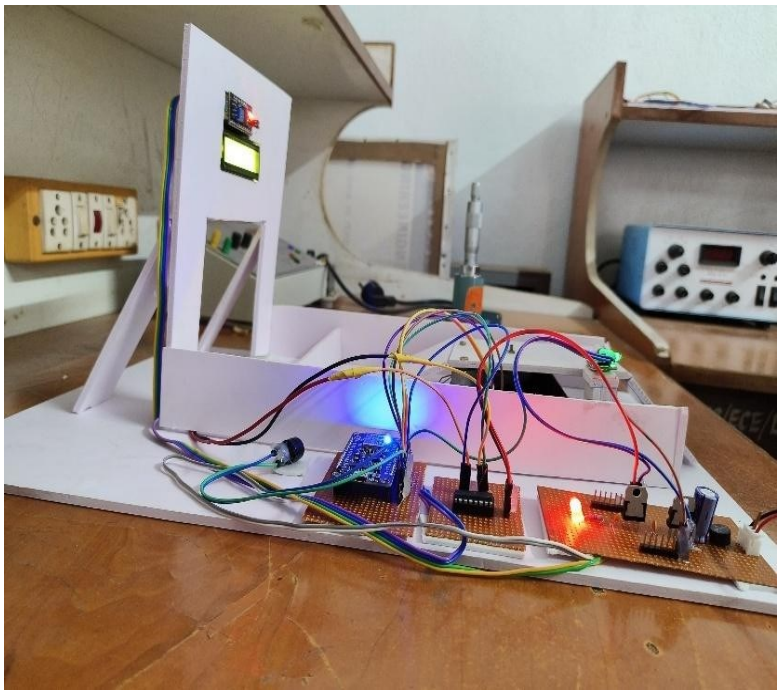

Figure.5 Side view of the kit

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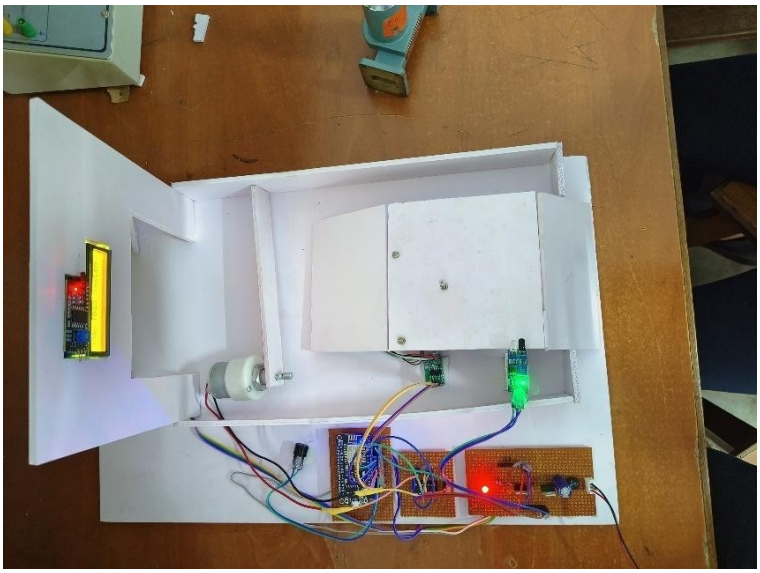

Figure.6 Vehicle Overload System with IR Sensor and Motor and LCD

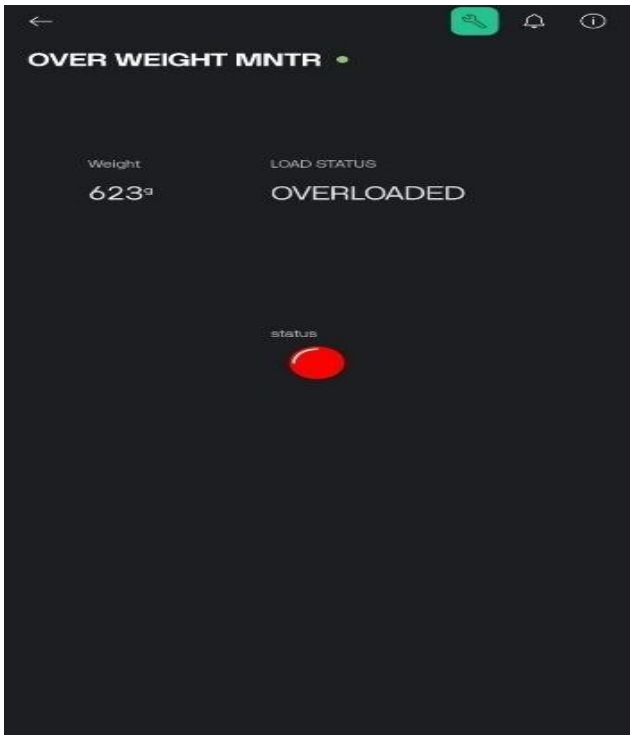

Figure.7 Overload Updating On Blynk

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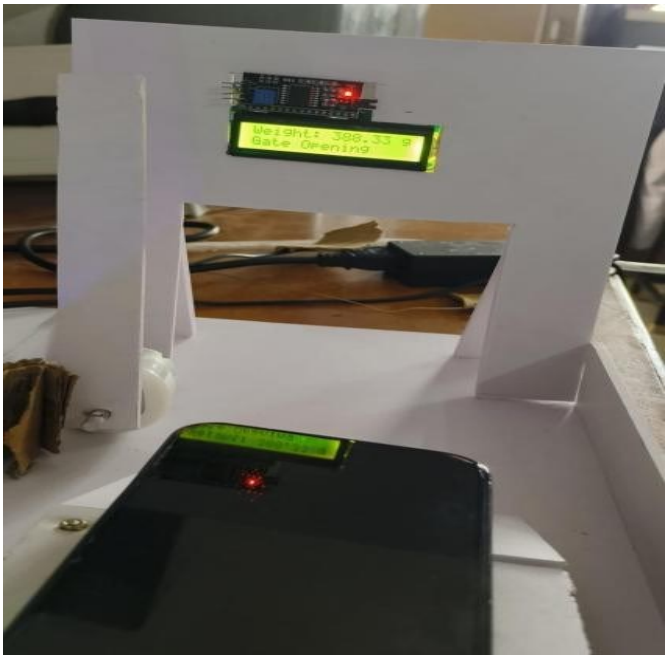

Figure.8 Normal Load Gate is Open

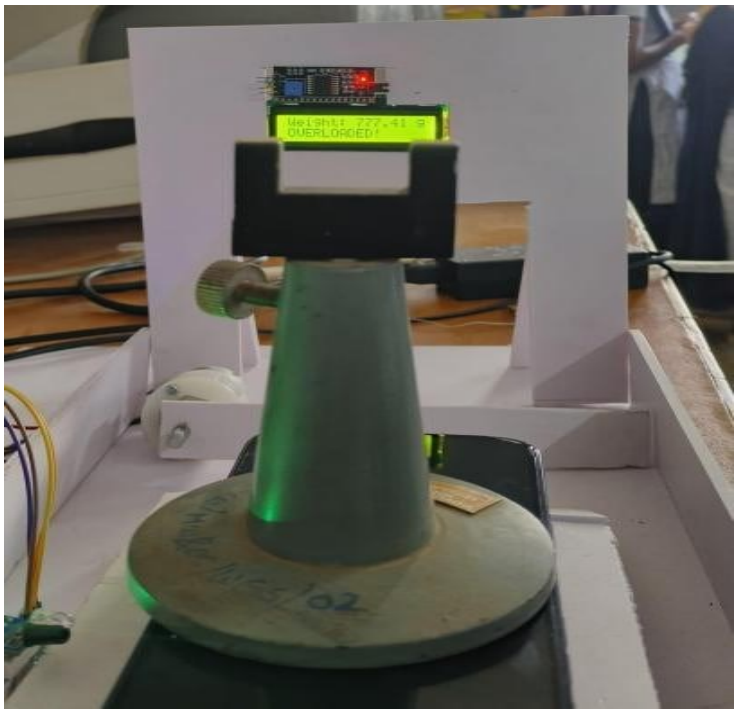

Figure.9 Overload Gate is Closed

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ADVANTAGES

- **Enhanced Road Safety:** The system prevents overweight vehicles from passing, protecting roads and bridges from damage. This helps avoid costly repairs and enhances infrastructure longevity.
- **Real-Time Monitoring and Alerts:** The system provides remote monitoring through IoT, displaying live data on vehicle weight. It sends immediate notifications if an overweight vehicle is detected, ensuring fast action.
- **Efficiency and Speed of Operation:** The system detects overweight vehicles and activates gate control within seconds. This rapid response minimizes delays compared to manual systems, improving traffic flow.
- **Cost-Effective Solution:** The IoT-based system is affordable and scalable, making it a cost-effective alternative to traditional weight monitoring solutions. It offers a budget-friendly solution for infrastructure management.
- **Reduction in Manual Labor and Human Error:** By automating vehicle detection and gate control, the system reduces the need for manual intervention. This minimizes human error, ensuring more accurate weight monitoring.

APPLICATIONS:

- **Highway and Toll Gate Management:** The system can be deployed at highway checkpoints to monitor and manage vehicle weights. It ensures that only vehicles within the weight limit pass, protecting the infrastructure.
- **Bridge and Tunnel Monitoring:** It can be installed at bridge or tunnel entrances to prevent overweight vehicles from crossing. This ensures the structural integrity of sensitive infrastructure like tunnels and bridges.
- **Logistics and Fleet Management:** The system can monitor fleet vehicles in real- time to ensure compliance with weight regulations. It helps prevent fines and accidents caused by overloading, improving operational efficiency.
- **Industrial Areas and Warehouses:** It can be used to monitor vehicles entering or exiting industrial areas and warehouses. This ensures that loading and unloading operations remain within legal and safety limits.
- **Parking Lot and Depot Management:** In parking lots or depots, the system ensures that vehicles parked or entering are within specified weight limits. This protects the facility from damage and ensures efficient use of space.

CONCLUSION

The IoT-based vehicle overweight safety system is an effective solution for monitoring and controlling vehicle weight at checkpoints, ensuring road safety, and minimizing infrastructure damage caused by overloaded vehicles. By integrating load cells, IoT technology, and automated gate control, the system provides a fast, reliable, and cost- effective method to detect overweight vehicles. The real-time data display and notifications through the IoT platform improve efficiency, allowing authorities to act swiftly and prevent potential accidents or road damage. With the system's scalability and flexibility, it can be

easily adapted for use on highways, bridges, industrial areas, and various other applications, providing a comprehensive tool for road safety management. The overall performance in testing indicates that the system operates efficiently, with quick response times, minimal human intervention, and accurate weight detection.

FUTURE SCOPE

While the current system demonstrates strong capabilities, there are several areas for potential improvement and expansion. First, the system could be adapted to handle higher weight ranges for larger vehicles, such as trucks and freight transport, by upgrading the load cells or incorporating additional sensors. The integration of GPS tracking could provide real-time location data for overloaded vehicles, allowing authorities to track them more effectively. Enhancing the IoT interface with advanced analytics could offer insights into vehicle trends, helping authorities optimize checkpoints and improve traffic flow management. In addition, the system could be expanded to include environmental monitoring, such as weather sensors, to further enhance road safety. Additionally, the incorporation of machine learning algorithms could allow the system to predict traffic patterns, optimize checkpoint placement, and provide proactive alerts for potential road hazards. By addressing these areas, the system has the potential to become a more.

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