JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Smart IOT Based Load Measurement System For Accident Prevention in Heavy Vehicles.

[1]Sakshi N Kupekar,[2]Susmita P More,[3]Divya D Desai, [4]Amarsinh B Farakte

[1,2,3] Final Year Engineering Students, [4]Assistant Professor

[1,2,3,4] Department of Electronics and Telecommunication Engineering, Sant Gajanan Maharaj College of Engineering, Mahagaon Maharashtra, India.

Abstract :Most of the mining field requires vehicle in the developing nation which is overloaded with a gangue material (coal, soil, sand, metals etc.) To have smooth flow of the vehicles, as well as their safety from fatal accidents this can be achieved using the smart sensors and Internet of Things (IOT) as these are emerging technologies. So, the proposed system is coming up with a smart IOT based system called "a device to measure weight load in a vehicle". In traditional system, the accuracy of weight measuring is less, and vehicle should move to the location where the weight measuring system is installed but in this proposed system, we are going to build the system into the vehicle. So, the weight can be measured during filling up the material and considering another safety measure of the vehicles.

Index Terms **- IOT (Internet of Things),smart weight measuring, load cell, automobile solution, asset tracking.**

1.INTRODUCTION:

The objective of this article is to develop a system that can be attached to vehicle to monitor the load of the material and ensure its proper distribution. The system is designed to help reduce accidents and improve efficiency in the transport of materials. The system includes various sensors, such as load cells and ultrasonic sensors, which are used to measure the weight and level of the material in the vehicle. The system also incorporates vibrators to ensure that the material is evenly spread, and a GPS and GSM system to detect accidents and send notifications in case of emergency[1]. An IOT-based load weight measurement system is a cutting-edge technology that allows for the efficient and accurate measurement of the weight of loads. This system incorporates a combination of modern technologies, such as sensors, wireless communication, and cloud computing, to collect, analyze, and transmit data in real-time. The system is designed to be used in various industrial applications, such as logistics, warehousing, and manufacturing, where accurate load weight measurement is critical for safety, efficiency, and productivity. By implementing an IOT-based load weight measurement system, companies can automate their load weighing processes, minimize human error, and optimize their operational workflows[2].

In the realm of transportation and safety, the convergence of the IOT and smart technologies has paved the way for innovative solutions to mitigate risks and enhance vehicle safety. In this article ,the implemented system presents a pioneering IOT-based load measurement system tailored for heavy vehicles, with the primary goal of preventing accidents and improving road safety. By leveraging real-time load monitoring and advanced data analytics, this system aims to revolutionize the way load weight is measured, ensuring optimal vehicle performance and reducing the potential for accidents caused by overloading.

2.LITERATURE SURVEY:

Literature survey is very important while defining the novel approach. It helps to understand the extensive survey done by various authors reading the proposed topic anddescribe the methodology used with their pros and cons.

Table No.1- Literature Survey

Ref.	Findings
[1]	-The paper provides an overview of load cells, which are commonly used sensors for measuring force or weight. -The authors discuss the working principle, types, and applications of load cells in detail. -Load cells have a limited capacity and can be easily damaged if subjected to loads beyond their rated capacity. -Overloading a load cell can result in permanent deformation or complete failure.
[2]	-This article elaborates the Analysis of Hx711 module which makes it easy for use to read weight measurement load cells and it is highly sensitive. - The module presented in this paper works on fixed position of the sensors and it fails if the changes for there is no fixed position of the sensor there will be some errors in the data obtained.
[3]	-This article is based on Vibration monitoring system which is operated on ADX335 accelerometer and Arduino 2560 interface. -It gives the detail information related to the working of accelerometer and vibrating motors. -In this study mode of the group delay is increased with increased attenuation. -The position of accelerometer should be at an initial position to get accurate values
[4]	- IOT systems rely on wireless sensors and communication networks, which may have limitations in terms of coverage, signal strength, and reliability. -Connectivity issues or sensor malfunctions could lead to inaccurate or delayed data, impacting the effectiveness of the system.
[5]	In this paper different load cells have their own pros and cons like accuracy and unstable position.
[6]	This paper explores the working principle and applications of an Arduino board.
[7]	-This paper shows that GSM has the problem like bandwidth lag. -GSM networks have been known to have security vulnerabilities that can be exploited by attackers. These vulnerabilities can lead to unauthorized access, interception of communications, and potential breaches of user privacy.
[8]	-GPS provides highly accurate timing information, which is crucial for various applications such as telecommunications, power grid synchronization, and financial transactions. -Multi-path interference occurs when GPS signals reflect off buildings, mountains, or other structures, resulting in signal distortion and reduced accuracy.
[9]	IOT-based vehicle-mounted weight sensors enable real-time weight monitoring of vehicles. This information can be valuable for various industries, such as logistics, transportation, etc.
[10]	-This paper shows the weight measuring system using toll gates which is built using various sensor. -The vehicle should be taken to the tollgate area to measure weight every time.

3. CIRCUIT DIAGRAM:

The Fig No.1 shows the circuit diagram of the implemented work which includes hardware components such as load cells, Arduino UNO, buzzers and many more devices. The circuit diagram is an implementation of components on PCB board. Here the Arduino UNO is the main component which acts as the brain of the system which controls all the functions regarding its input.

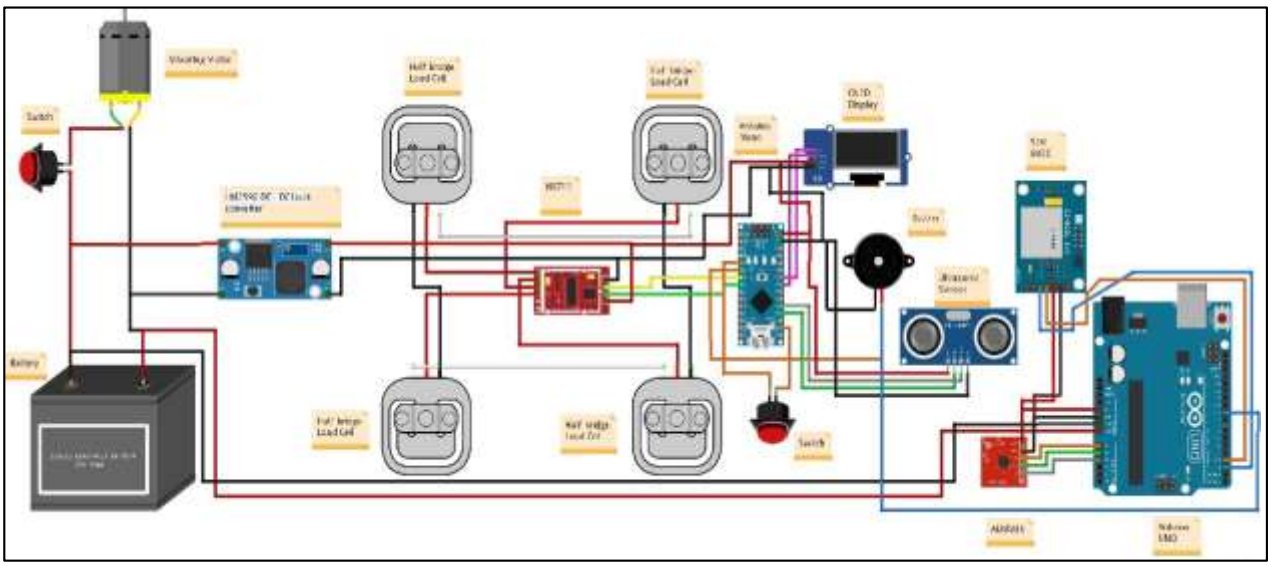


Fig No.1 Circuit Diagram

There are several steps in designing the IOT based system: Initially analyzing the problem in existing system, Market survey of material availability and costing, Selection of material to make a module, Designing basic structure of the project, followed by assembling every module, Coding and testing for the results at end.

The following section gives the details regarding hardware used for the implementation.

a) OLED Display Module:

An OLED (organic light-emitting diode) display module is a type of electronic display that uses organic materials to emit light and create images. It is used to display weight measurement messages, overload detection messages, etc. [2].

b) ADXL335 Module**:** (Accelerometer/Gyroscope)

The adxl335 module is a small, low-power, 3-axis accelerometer that is commonly used in electronic projects and products. It is mounted in our implemented design system to detect the tilt angle of system to prevent the accident of vehicle . Here it make a pre-defined threshold angle of 380^0 so that if the vehicle goes beyond 380^0 the accident alert message will be sent to owner[3].

c) Half Bridge Load Cell Module:

A load cell is a type of transducer that is used to convert a force or weight into an electrical signal. Load cells are used to measure the weight of the material which is filled in the vehicle and if the weight goes beyond the pre-defined threshold value it will indicate that the vehicle has overloaded[4].

d) ARDUINO UNO:

Arduino UNO is a micro-controller board based on the ATmega328P chip. Arduino UNO acts as the brain of the system. It is used to control all the devices with the help of outputs received by them. It is one of the most popular boards in the Arduino family due to its simplicity, ease of use, and versatility [6].

e) SIM900A Module:

The SIM900A module is a GSM/GPRS module that allows for voice and data communication over the cellular network. It is used for accident detection purposes. When the vehicle gets tilted due to any reasons beyond the threshold angle the message will be sent to the owner with the help of this SIM900A module [7].

The following section gives the details regarding software used for the implementation.

Kodular provides a wide range of components and features for app development, including user interface components such as buttons, labels, and text boxes, as well as more advanced features such as camera integration, database connectivity, and social media integration. The platform also includes a companion app that allows users to test their apps on their devices in real-time, without the need for an emulator or a physical device. Kodular provides a variety of monetization options for app developers, including in-app advertising, in-app purchases, and subscriptions. The platform also provides analytical and data tracking features that allow developers to monitor the performance of their apps and make informed decisions about updates and improvements. Overall, Kodular is a powerful and user-friendly platform that allows users to create functional and interactive Android apps without requiring extensive programming knowledge. Its drag-and-drop interface, wide range of features, and monetization options make it an ideal choice for both beginner and experienced app developers.

For the implementation of the proposed systems the flow charts discussed below considered;

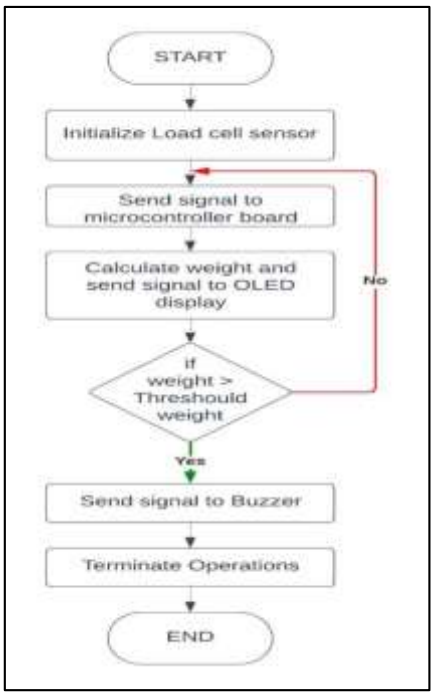


Fig No.2 Flowchart of overload detection module

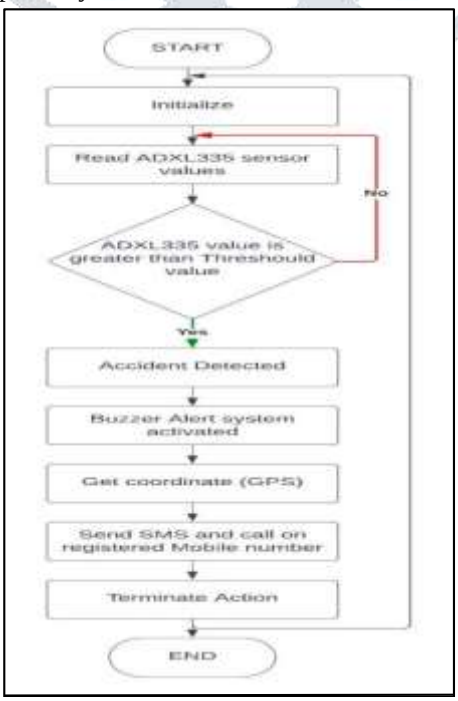


Fig No.3 Flowchart of accident detection module

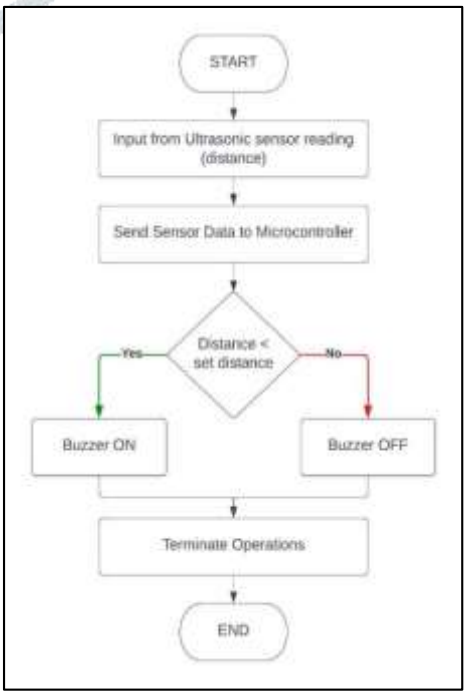


Fig No.4 Flowchart of Ultrasonic level sensor module

Fig No.2 represents the flowchart for Overload detection module and the algorithm begins with initialization, setting up the necessary components and variables. The weight is measured and the signal is transmitted to the micro controller board for processing. The measured weight is then displayed on an OLED screen, providing a visual representation. Next, the algorithm compares the weight to a predetermined threshold value. If the measured weight surpasses the threshold value, the algorithm activates a buzzer, emitting a ringing sound. Finally, the algorithm reaches its end, concluding the process.

Fig No.3 represents the flowchart for accident detection module the algorithm begins with an initialization step, where the necessary setup and preparations are performed. In the next step, the measured values obtained from the ADXL335 sensor are sent to the micro controller for processing. These values represent physical motion or acceleration. The algorithm then checks if the measured value exceeds a specified threshold, indicating the occurrence of an accident. If an accident is detected, the algorithm proceeds to activate a buzzer alarm, providing an audible alert. Additionally, an accident alert message is generated, which includes the GPS location information, and it is sent to the owner's cell phone. Finally, after completing all the required operations, the algorithm reaches its end, concluding the sequence of steps.

Fig No.4 represents the flowchart for ultrasonic level sensor module the algorithm begins with an initialization step, where the necessary setup and preparations are carried out. In the next step, the ultrasonic sensor is used to measure distance, and the obtained values are sent to the micro controller for further processing. The micro controller then compares these values with a set of predefined threshold values. The algorithm checks if the measured distance between the vehicle surface and the ground surface exceeds the specified threshold level. If the measured distance surpasses the threshold, indicating a potentially dangerous situation, the algorithm activates a buzzer, initiating a ringing sound. Finally, after completing all the required operations, the algorithm reaches its end, concluding the sequence of steps.

4. RESULTS:

The Results of the implemented system tested for Weight Measurement, overload detection module, Accident detection module and Level sensor with visual display module.

a) Weight Measurement & Overload Detection:

The Fig No.5 shows the actual measured weight of object at the time of demonstration, the OLED display shows the value of the weight which is placed in the vehicle which is **226.8g.** The threshold value is set to give the overload indication is about **3kg**. The Fig No.5 has the weight below the threshold value will perform its regular function before the overload is detected by the load cells.

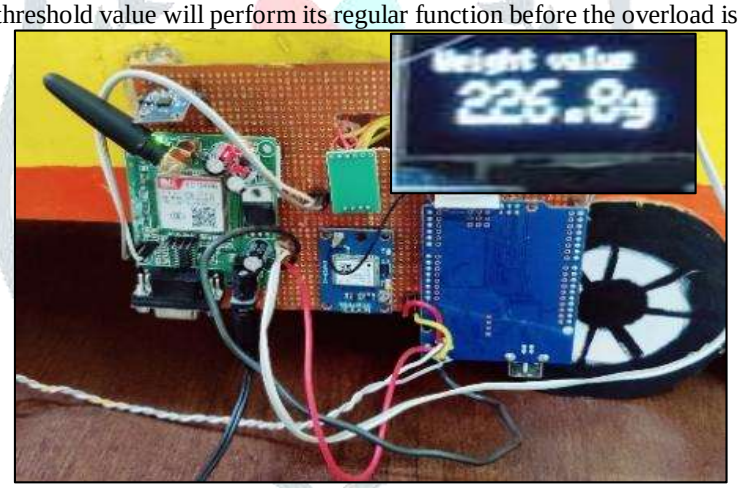


Fig No.5 Working of Weight Measurement Module

When the load crosses the threshold value then the display shows the message of "**overload",** and the buzzer starts ringing which indicates that the vehicle is overloaded as shown in Fig No 6. The weight of object has reached its threshold value so, the overload message has evoked on the OLED display. Hence, the results of Weight measurement and overload detection module has been tested successfully.

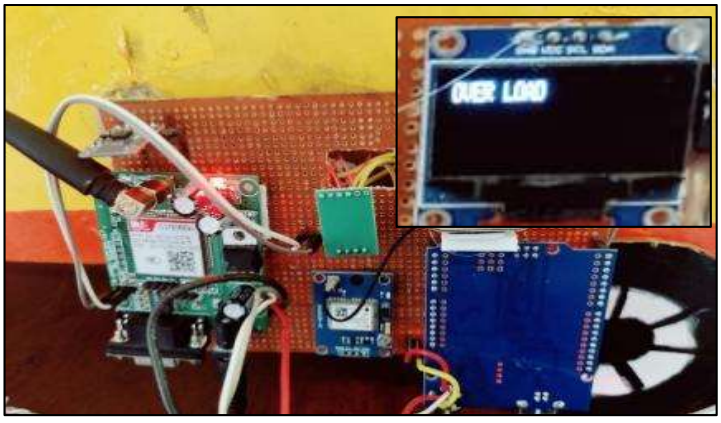


Fig No.6 Overload of vehicle

b) Accident Detection Module:

Accident module is used to detect and locate the exact position of the vehicle after the accident. Fig No.7 shows the vehicle is at its initial position that is below the threshold degree tilt , and it work as per its regular functioning.

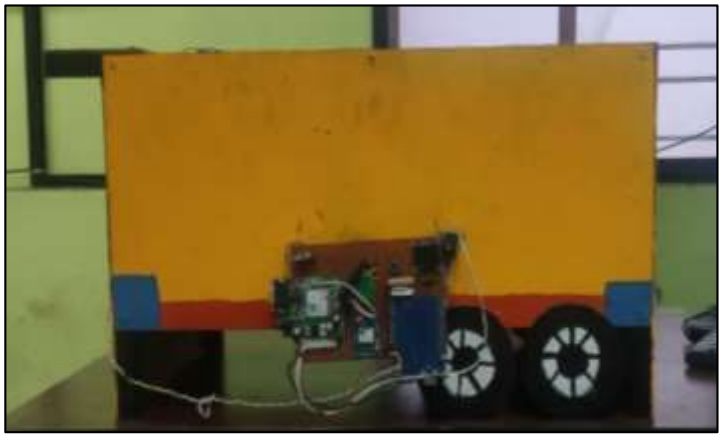


Fig No.7 Static Position of vehicle

But when the ADXL335 gets the value beyond threshold degree which is limited to 380^0 then accident alert message is sent to owner. In Fig.8 the vehicle has tilted to 400^0 that is beyond the predefined threshold level, so the accident alert message is sent to the owner. Hence, Accident detection module has tested successfully.

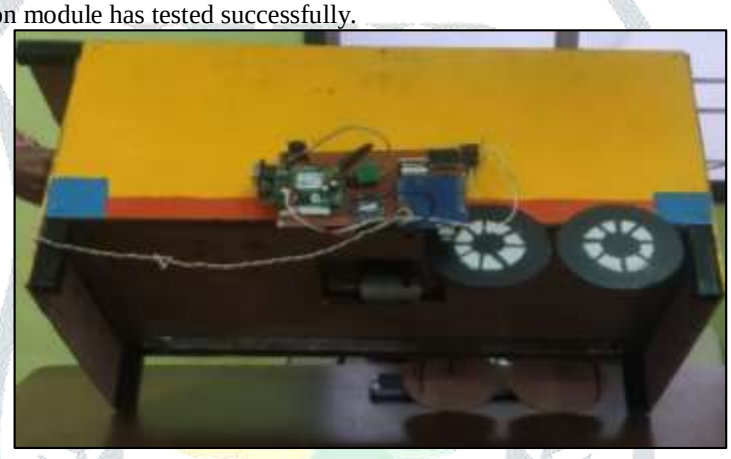
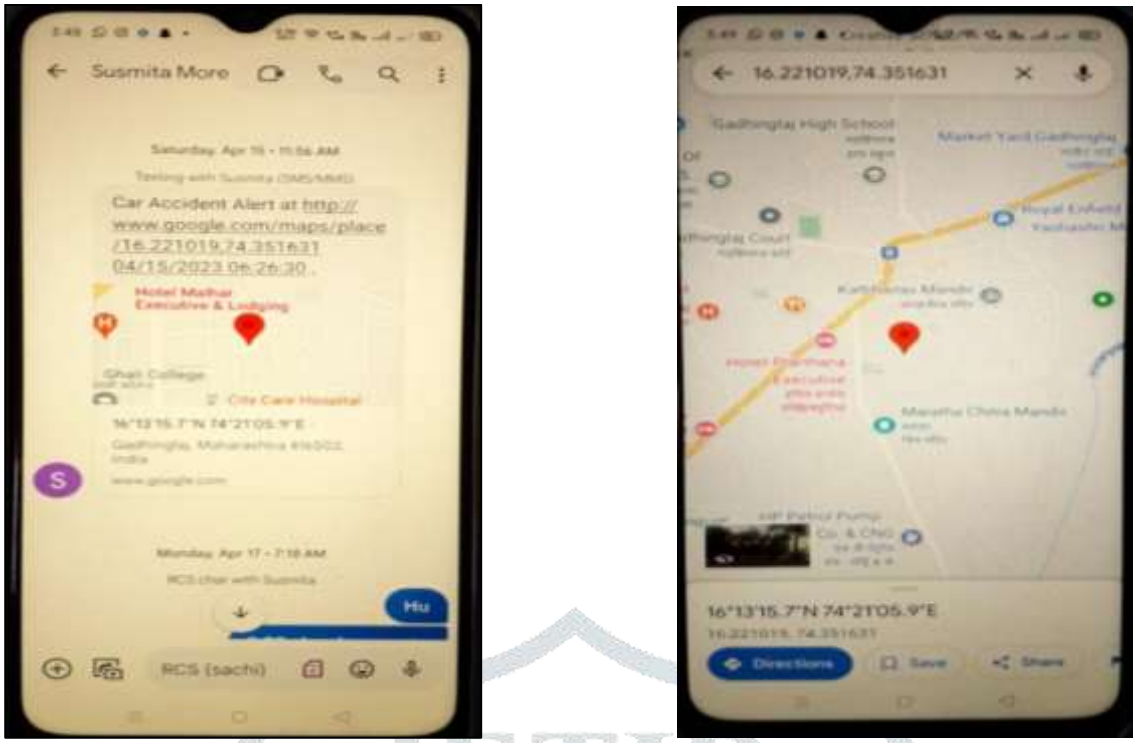


Fig No.8 Tilted Position of vehicle

Thereafter, when the ADXL335 detects the position of vehicle that is beyond the threshold degree an accident message is sent along with the real time latitude and longitude of the location where vehicle has met to an accident. So, with the help of this GPS tracking system, the owner can easily find the location of the vehicle and will be helpful for tracking purposes. Fig No.9 shows that accident alert message has been sent to users' phone along with the latitude and longitudinal degrees.The Accident alert message includes: Latitude and Longitude of the vehicle and GPS Map.

So, with the help of this accident detection system, users can easily track their vehicles.This module helps to track the exact location of the vehicle and get notified with the alert message along with the latitude and longitudinal degrees in GPS map. Hence, accident detection module has been tested successfully.



Message received on mobile **Accident location on google map**

Fig No.9 Accident Detection Module

c) Level sensor and visual display:

A level sensor is used to show when the vehicle has filled the material to its maximum capacity that is at the height of **15 cm** above the vehicle surface. Therefore, it is employed to identify when the material loaded into the vehicle exceeds the level. If it exceeds the level, a buzzer begins to ring, alerting the operator that the vehicles capacity has been reached. Ultrasonic level sensor helps to detect the threshold level of the filled material.

A camera and projection screen are also included in the system to achieve further system advancements. It has a camera at the front side of the vehicle and a projection screen at the back side of the vehicle in the event that any vehicle tries to overtake the vehicle and to prevent accidents caused by overtakes.

Fig No.10 Front Camera of the System

In Fig.10 camera is installed at the front side of the vehicle which gives its input in the form of images to the projection screen which is located at the back side of the vehicle. The visualization in front of the vehicle is captured by the camera and it is sent to the visual display module. The images captured by the camera are displayed on the projection screen. In Fig No.11 the projection screen acts as the output of visual display module. Hence, with the help of input/output devices i.e., front camera and projection screen accidents due to overtake of vehicles can also be prevented. Hence, the results of level sensor and visual display modules has been tested successfully.

Fig No.11 Projection Screen

CONCLUSION:

A system of IOT based device is an effective solution for measuring load weight in a heavy vehicles. By using a combination of sensors, micro controllers, and wireless connectivity, the system works accurately and reliably measures the weight of the load and transmit the data to the central server for further processing and analysis. This can provide valuable insights into the efficiency of the load carrying process, as well as help optimize the use of resources and can prevent fatal accidents. However, it is important to ensure that the system is properly designed, implemented, and maintained to ensure accurate and consistent results, as well as to address any potential security and privacy concerns related to the use of IOT devices and data implemented system is more useful to prevent fatal accidents. The result tested ensure that the IOT-based weight measuring for heavy vehicles have the potential to revolutionize the construction and transportation industries, providing significant benefits to businesses and their customers.

ACKNOWLEDGMENT:

This work was implemented in Sant Gajanan Maharaj College of Engineering, Mahagaon and funded by the Sant Gajanan Maharaj Hospital and Research Centres, Mahagaon.

REFERENCES:

[1] Vasudev D. Shinde, Jayant K. Kittur, "Overview of Load Cell", Journal of Mechanical and Mechanics Engineering e-ISSN: 2581-3722 Volume-6, Issue-3 (September-December), 2020.

[2] Arthur Daniel Limantara, Tjahjaning Tingastuti Surjosuseno, "Smart Survey model of Average Daily Traffic (ADT) for Pavement Planning and Monitoring", Advances in Engineering Research, volume 203 Proceedings of the 2nd Borobudur International Symposium on Science and Technology (BIS-STE), 2020.

[3] Keshav H. Jatakar, Gopal Mulgund, A D. Patange, B B. Deshmukh, "Vibration monitoring System based on ADXL335 accelerometer and Arduino Mega2560 interface", JOURNAL OF ALGEBRAIC STATISTICS Volume 13, No.2, p. 2291-2301 ISSN: 1309-3452, 2022.

[4] Jurij Kuzmic, Gunter Rudolph, Walter Roth, Michael Rubsam, "IOT Based Driver Information system for Monitoring the Load Securing", In Proceedings of the 4th International Conference on Internet of Things, Big Data and Security - Volume 1: IoTBDS, ISBN 978-989-758-369-8, pages 262-269, 2019.

[5] Ranjeet Kumar, Sandeep Chhabra "Analysis of load cell", International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, pp. 274-277, Research India Publications Number 6, 2018.

[6] Leo Louis "Working principle of Arduino and using it as a tool for study and research" International Journal of Control, Automation, Communication and Systems (IJCACS), Vol.1, No.2, April -2016.

[7] Zia Ur Rahman, Ihtesham Ulhaq, Shahid Ali "GSM Technology : Architecture Security and Future Challenges" International Journal of Science Engineering and Advance Technology, IJSEAT, Vol.5, Issue 1 ISSN 2321-6905 January, 2017.

[8] Francis Olawale Abulude , Akinyinka Akinnusotu "Global Positioning system and its wide applications" Continental J. Information Technology 9 (1): 22 - 32, 2015 ISSN: 2141 - 4033, Wilolud Journals, 2015.

[9] Pavan Manjunath, Pritam Gajkumar Shah, Michael Herrmann "IOT Based Vehicle Mounted Weight Sensors" , International Journal of Recent Technology and Engineering (IJRTE) ISSN:2277-3878 (Online), Volume-8 Issue-4, November, 2019.

[10] B. Vishnupriya, M. Susmitha, S. Valarmathi, S. Dheenathayalan, R. Rajakumari "Load Detection and Monitoring System", International Journal of Scientific & Technology Research, Volume 9, Issue 02, ISSN 2277-8616, February, 2020.