CHAPTER 1

1.1 PREFACE:

Internet of Things (IOT) is rapidly gaining a foothold in the technology sector; it has managed to emerge as a highly sought-after field of study and research in computing sciences and electronics. The vastly interdisciplinary nature of the areas to which IOT can be applied has managed to pique the interest of the whole world.

Many accidents and road closures occur due to non-monitored load securing during transportation of loaded goods in heavy goods vehicles, also causing transport damages of the loaded goods, which further increases the costs. To counteract this problem, IOT based device introduces a system for monitoring the load securing in trucks and car trailers. Various measuring methods and sensors have been investigated. The sensors for measuring the force on the lashing belt have been analyzed and tested. To prove the long-term stability, all sensors were operated in continuous long-term tests. The cost of the individual sensor must be very low for this application because there are many lashing straps used on a typical truck. Monitoring and display of measured data has been implemented using IOT devices [1].

IOT is rapidly gaining a foothold in the technology sector; it has managed to emerge as a highly sought-after field of study and research in computing sciences and electronics. The vastly interdisciplinary nature of the areas to which IOT can be applied has managed to pique the interest of the whole world. Many accidents and road closures occur due to no monitored load securing during transportation of loaded goods in heavy goods vehicles, also causing transport damages of the loaded goods, which further increases the costs. To counteract this problem, IOT based device introduces a system for monitoring the load securing in trucks and car trailers. Various measuring methods and sensors have been investigated. The sensors for measuring the force on the lashing belt have been analyzed and tested. To prove the long-term stability, all sensors were operated in continuous long-term tests. The cost of the individual sensor must be very low for this application because there are many lashing straps used on a typical truck [2]. Monitoring and display of measured data has been implemented using IOT devices.

1.2 MOTIVATION:

The transportation of materials is an essential part of many industries, including construction, mining, and agriculture. Dumpers are commonly used to transport materials such as gravel, sand, and dirt from one location to another. However, the safe and efficient transport of these materials is often hindered by various factors such as uneven distribution of the load, overloading, and accidents.

These issues can lead to damage to roads, equipment, and even injury or loss of life. In addition, they can also result in delays and additional costs for companies. Therefore, there is a pressing need for a system that can monitor the load of materials and ensure their proper distribution, while also improving safety and efficiency in the transportation process. The motivation behind this project is to develop such a system that can be easily attached to dumpers and address these issues.

Here came across the problem statement **'104'** from **"SMART INDIA HACKATHON 2K23"** while searching the AICTE websites for current real-world issues. This problem statement describes the issues that arise in coal mines because of material overloading in dumpers.

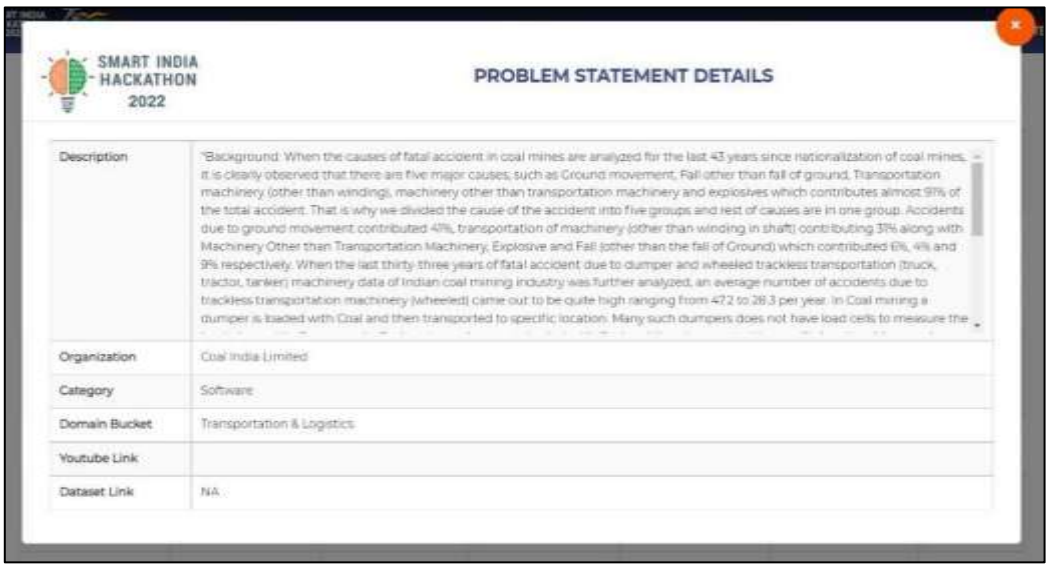


Fig.1.2 Problem Statement

The visited area is "crusher point" in Beradwadi to learn about the current issues that people are dealing with when transporting their goods to check out the real-time issues in

several domains relating to transportation and goods carrier firms. There spoke with the system operator there and gathered the following list of issues:

- ✓ Issues caused by a vehicle or dumper being overloaded with materials.
- ✓ Vehicle weight indication.
- ✓ Need for an accident detection system
- ✓ Need for a vehicle tracking system, etc.

So, after gathering all of the issues with the most recent technology that they are using, After reading the research papers to find solutions to the current issues that the globe is currently experiencing.

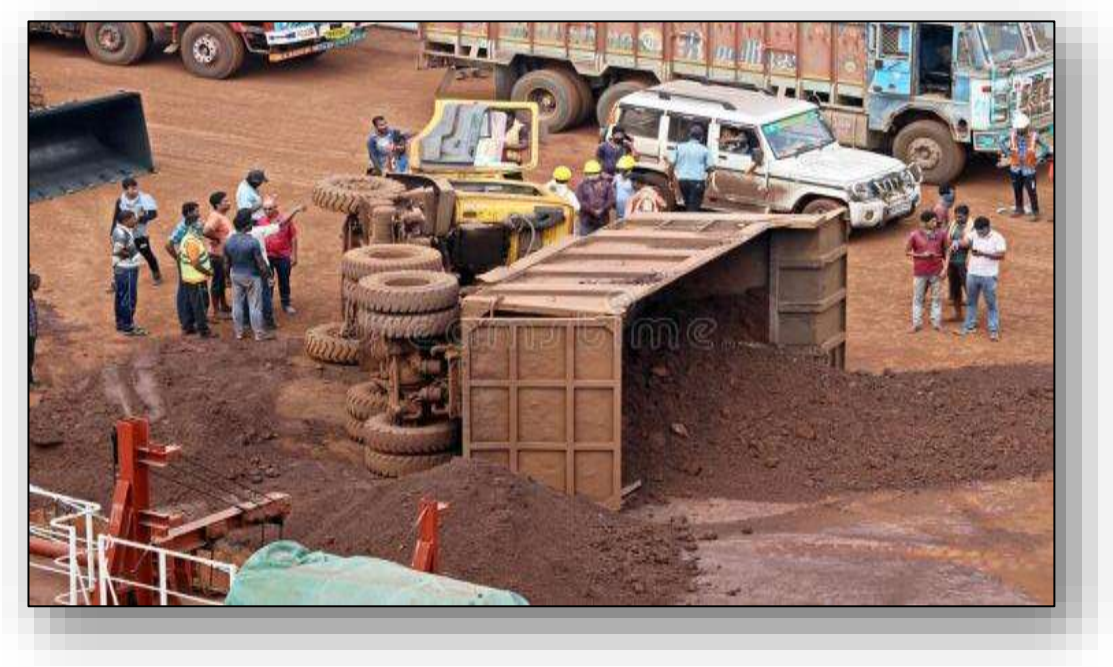


Fig.1.3 Visited Area

By incorporating various sensors and technologies, the system can monitor the weight and level of the material in the dumper and ensure that it is evenly distributed. The system can also detect accidents and send notifications in case of an emergency, helping to prevent injury or loss of life. Overall, this project aims to improve the safety and efficiency of material transportation, while also reducing the negative impact of such transportation on the environment and society.

1.3 ORGANIZATION OF REPORT:

The Introduction and Motivation behind the project were covered in the first chapter. Project literature review covered in the second chapter in this, different articles pertinent to the project and evaluated the need for it. The introduction and the problem statement with its general implementation such as block diagram, circuit diagram is included in the third chapter. Additionally, the details on how the project's operational process works, and the system created along with the information related to the components used in the system are discussed in the fourth chapter. In the fifth chapter, it includes all the software implementations work along with the detailed information of flowchart of three different modules. Sixth chapter gives the results or the outcomes of the implemented system design and future scope of the system as well as advantages and disadvantages of implemented system. At last the seventh chapter gives the concluded part of the system. It includes the overall conclusion received by the results of the implemented system.

Summary – The first chapter gives the brief information related to project preface, motivation behind project and organization of report.

CHAPTER 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 and describe the methodology used with their pros and cons.

Table (1): Literature Review

Ref.	Author Name, Journal Name and Year of Publication	Findings	Drawbacks
1	Vasudev D. Shinde et al. ***"Overview of Load Cell",*** Journal of Mechanical and Mechanics Engineering,Volume-6 (2020)	-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	Arthur Daniel Limantara et al. ***"Smart Survey model of Average Daily Traffic (ADT) for Pavement Planning and Monitoring",*** Advances in Engineering Research,(2021)	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	Keshav H. Jatakar et al. ***"Vibration monitoring System based on ADXL335 accelerometer and arduino 2560 interface",*** *Journal* of Algebraic Statistics Volume 13,(2022)	-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 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	Jurij Kuzmic et al. *"**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, (2019)	-The paper presents a driver information system for monitoring load securing using IOT (Internet of Things) technology. -The authors propose an architecture that utilizes wireless sensors placed on the vehicle to monitor the load's movement and stability.	- 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	Ranjet Kumar et al. ***"Analysis of load cell",*** International Journal of Applied Engineering Research Volume-13, (2018)	This paper shows weight measuring machines which are based on different type of load cells.	In this paper different load cells have their own pros and cons like accuracy and unstable position.
6	Leo Louis, ***"Working principle of Arduino and using it as a tool for study and research" ,*** IJAER Volume-13, (2018)	This paper explores the working principle and applications of an Arduino board.	The paper shows that Arduino's have limited memory and processing power.
7	Zia Ur Rahman et al. ***"GSM Technology :Architecture Security and Future Challenges",*** International Journal of Science Engineering and Advance Technology, IJSEAT, Vol.5 (2017)	-This article explores utilization of GSM which is used in cellular networks. -And also elaborate the points like GSM security operation and support subsystems	-This paper shows that GSM has a 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 privacy issues.

8	Francis Olawale Abulude et al. ***"Global Positioning system and its wide application",*** Continental J. Information Technology 9 (1): 22 - 32, (2015)	-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	Pavan Manjunath et al. ***"IOT Based Vehicle Mounted Weight Sensors",*** International Journal of Recent Technology and Engineering (IJRTE),Volume-8 (2019).	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.	The system is expensive and very truck owner cannot afford the IOT.
10	B. Vishnupriya et al. ***"Load Detection and Monitoring System",*** International Journal of Scientific & Technology Research ,Volume -9, (2020).	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.

Summary – The Second chapter gives the literature survey for the proposed implementation.

CHAPTER 3

IMPLEMENTED PROJECT WORK

3.1 INTRODUCTION:

The objective of this project is to develop a system that can be attached to dump trucks 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 dump truck. 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, analyse, 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.

The Arduino UNO is used as the main controller for the system [2], while an OLED display is used to provide real-time feedback on the weight and level of the material. The tri-accel gyro sensor is used to detect accidents, while the Arduino UNO also manages the GPS and GSM modules to notify the appropriate parties in case of an emergency. The system is designed to improve safety and efficiency in the transport of materials and can be easily installed on a range of dump trucks. This report details the design, development, and testing of the system, and provides an evaluation of its performance in a real-world.

The system consists of load cells that are placed underneath the loads to measure their weight. These load cells are connected to a micro controller or IOT gateway, which collects the data and transmits it wirelessly to the cloud. The cloud-based software processes the data

and provides real-time information on load weight, including alerts and notifications in case of any abnormalities.

The benefits of an IOT-based load weight measurement system are numerous. It provides accurate and reliable load weight data, reduces labour costs associated with manual weighing processes, and improves overall operational efficiency. Additionally, it helps to ensure compliance with safety regulations and provides data for quality control and product testing.

Overall, an IOT-based load weight measurement system is a valuable investment for companies that need to measure the weight of loads accurately and efficiently. It provides a robust and scalable solution for load weighing processes, enabling companies to streamline their operations and improve their bottom line.

A system of IOT devices to measure load weight in a dumper system is consists of both hardware and software parts. This chapter provides the brief information regarding block diagram, circuit diagram, PCB designing and manufacturing. An IOT-based load weight measurement system is a modern technology that enables the accurate and efficient measurement of load weight in various industrial applications [3]. This system leverages IoT technology, such as sensors, wireless communication, and cloud computing, to collect and analyse load weight data in real-time

The system comprises load cells, which are positioned beneath the loads to measure their weight. These load cells are connected to a micro controller or IOT gateway that collects and processes the data. The data is then transmitted to the cloud using wireless communication technology, where it is analyzed, and insights are generated.

IOT-based load weight measurement systems provide numerous benefits to various industries. For instance, in the logistics and warehousing sector, it helps to optimize loading and unloading processes, reduces the risk of overload and overcapacity, and improves safety and compliance. In the manufacturing industry, the system provides real-time data to support quality control and product testing, while in the agriculture sector, it helps to optimize the harvesting and transportation of crops.

In summary, an IOT-based load weight measurement system is a powerful tool that enables companies to automate their load weighing processes, reduce human error, and optimize their operations. It provides accurate and reliable load weight data, enhances safety and compliance, and supports quality control and product testing. [4].

3.2 PROBLEM STATEMENT:

In coal mining, coal is placed onto a dumper and then delivered to the desired area. Many of these dumpers lack the ability to gauge how much is loaded. Transporters prefer to load their vehicles with more coal than the required legal amount to generate money. There are numerous links between overloading and the vehicle skidding, which can lead to a head-on collision or overturn. During an off-road recovery, a truck that is overloaded is far more difficult to handle. Therefore, developed a system to implement in order to address all of these issues relating to current technologies.

3.3 BLOCK DIAGRAM OF SYSTEM:

The Fig 3.3 shows the block diagram of IOT based weight measuring Dumper. It consists of following block:

1. Arduino UNO module
2. HX711 module
3. Half bridge load cells
4. OLED Display module
5. Ultrasonic sensor module
6. Vibrating Motor module
7. Buzzer
8. ADXL335
9. Level Sensor
10. Overload Alarm

Steps:

1.In Fig.3.3 the Micro controller / (Arduino UNO) acts as the main component of the system to control the devices connected to it.

2.Four load cells are interconnected to each other and connected to Arduino UNO via HX711.HX711 acts as the converter which is used to convert the incoming analog signal to digital from load cells to the micro controller.

3.OLED display acts as output display which is used to show the measured weight on the display screen.

4.The camera, tare button and buzzers, overload alarms and projection screen acts as the

outputs of the system which is connected to micro controller.

5.Level sensor is connected to Arduino nano which is used to sense the level of the material filled in the dumper and it detects when the dumper is overloaded due to excess amount of material filled in the dumper.

6. Finally, ADXL335 is used as accident detection module which is used when the dumper tilts its position beyond the pre-defined threshold degree i.e., 380^0; then the accident alert message is sent to owner via SIM900A module.

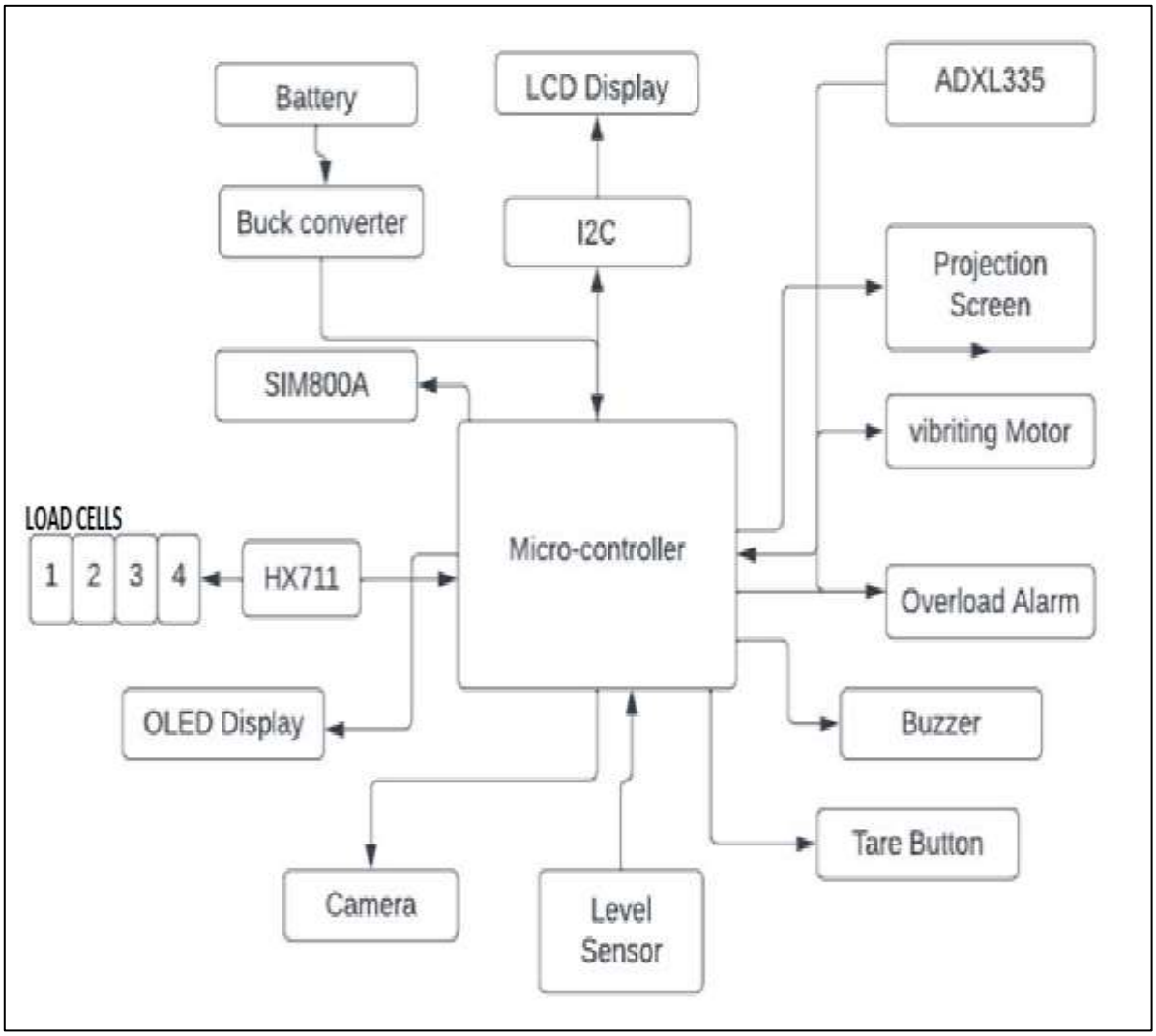


Fig. 3.3. Block Diagram of IOT Based Implemented System

3.4 CIRCUIT DIAGRAM OF SYSTEM:

The Fig. 3.4 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.

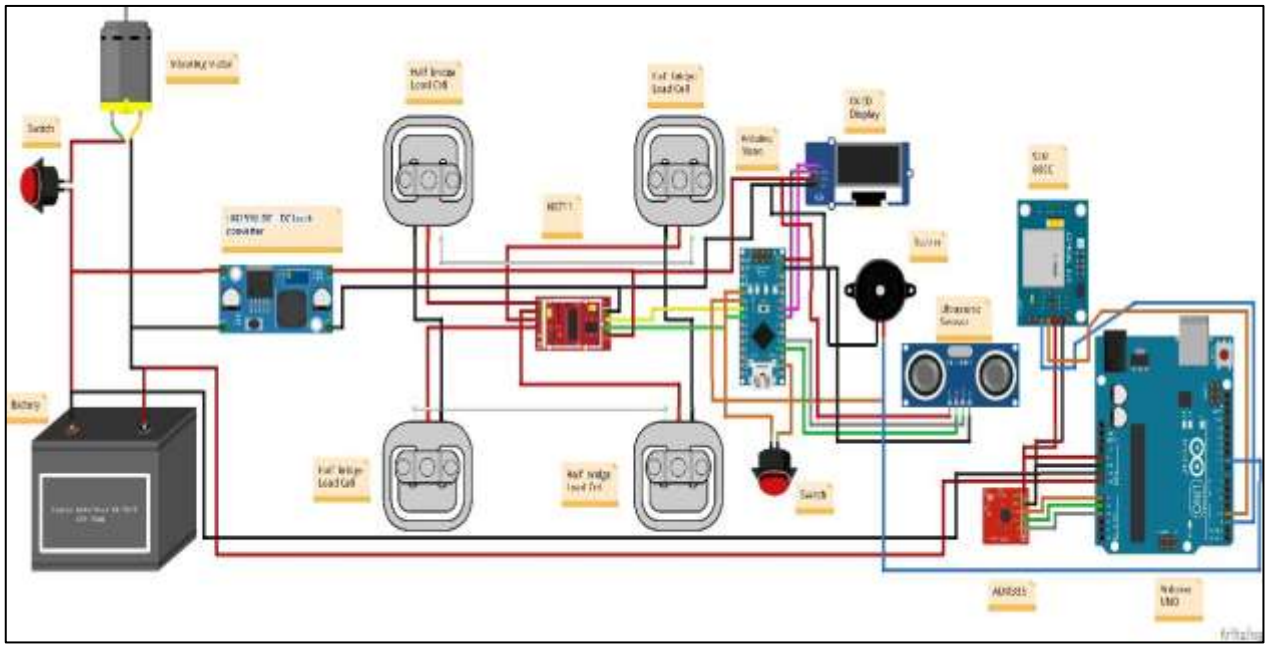


Fig.3.4 Circuit Diagram of system

- HX711 acts as converter which is used to convert the output which is received from the load cells. Load cells are generally used to measure the weight in the dumper where it has a fixed a threshold level; if the material is filled in dumper, it will weigh the load and when if it goes beyond the threshold level it will indicate the overload message to the OLED display screen and the buzzer starts to ring which indicates that the dumper has being overloaded. Hence, overloading of dumper can be prevented.

- For accident detection purpose, here the system has implemented GPS module with its antenna and also the ADXL335 which acts as function of accelerometer & gyrometer). It has fixed a threshold value of 380^0 of angle, so when the dumper tilts its angle above the threshold value the message will be send to the owner with the help of SIM900A which is connected to the Arduino UNO. It will send the 'Dumper Accident Alert' message along with the longitude and latitude of dumper, so the owner will get to know

that the dumper has got an accident and also can track its real time location with the help of GPS module.

- Arduino nano relates to the ultrasonic (level sensor) which helps to control the inputs received while filling the material/goods to its appropriate level as the material exceeds the threshold level the buzzer/alarm starts to ring which indicates that it has reached its appropriate level.
- In this way, all the devices are connected to each other as shown in the circuit diagram to perform its specific tasks.

Summary –The Third chapter gives the information about the introduction, problem statement, block diagram and circuit diagram of the implemented system.

CHAPTER 4

HARDWARE IMPLEMENTATION

A system of IOT based weight measuring dumper consists of both hardware and software parts. This chapter include information of hardware implementation of the project.

Fig.4.1 Implemented Design

Implemented Design of system:

The Fig.4.1 shows how the components are mounted on PCB board with the connecting wires. It shows that the PCB board is mounted at the left side of the dumper which includes the components such as Arduino UNO, ADXL335, GPS module, OLED display screen and many more. The whole Implemented structure is made up of MDF plywood with iron rods connected at the edges. The following section gives details of the different Hardware components which includes following components:

4.1 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. The board has 14 digital input/output pins, six analog inputs, a 16 MHz quartz crystal, a USB connection, and a power jack.

Fig.4.1.1 Arduino UNO

The digital pins can be configured as inputs or outputs and can be used for tasks such as controlling LED's, motors, or other electronic devices. The analog inputs allow the board to read analog signals from sensors or other devices. The USB connection is used to program the board and to communicate with it from a computer. The Arduino Uno board can be programmed using the Arduino programming language, which is a simplified version of C++ and is easy to learn. There are many libraries and examples available to help users get started with the board and to create projects quickly and easily. Overall, the Arduino UNO board is an excellent choice for beginners and experienced users alike who want to experiment with electronics and create their own projects [6].

4.2 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 dumper and also if the weight goes beyond the pre-defined threshold value it will indicate that the dumper has overloaded [4].

Fig.4.1.2 Half Bridge Load Cell

Four half bridge load cells of per **50kg** are used to measure the weight filled in the dumper. It is commonly used in industrial and scientific applications where weight or force measurement is required. A load cell typically consists of a metal structure with one or more strain gauges attached to it. When a force is applied to the metal structure, it deforms slightly, causing a change in the resistance of the strain gauges. This change in resistance is then converted into an electrical signal by a Wheatstone bridge circuit [5].

Load cells are widely used in a variety of applications, including weighing scales, force measurement devices, and material testing machines. They are also used in automotive, aerospace, and medical industries, among others.

4.3 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 the accident detection purpose. When the dumper gets tilt due to any reasons beyond the threshold angle the message will be send to the owner with the help of this SIM900A module.

Fig.4.1.3 SIM900A Module

This message is send to the owner due to the Sim card which is placed inside this SIM900A module. It is a compact module that integrates a powerful Quad-band GSM/GPRS engine, a GPS receiver, and an audio codec on a single board. It can be used in a variety of applications that require wireless communication, such as remote monitoring, telematics, and IoT (Internet of Things) devices. The module also supports SMS and MMS messaging, as well as voice calls and audio playback and recording [7].

The module can be controlled using AT commands over a UART (Universal Asynchronous Receiver-Transmitter) interface. It can be powered by a 5V DC power supply and consumes around 1.5W of power during transmission. The module also has several I/O pins that can be used for interfacing with external sensors and devices. Overall, the SIM900A module is a versatile and reliable GSM/GPRS module that is well-suited for a wide range of wireless communication applications [8].

4.4 HX711 Module (Converter):

The HX711 module is a high-precision, 24-bit analog-to-digital converter (ADC) designed for weight sensing applications. It is used to covert the signal which is received from four half bridge load cells which is mounted below the dumper, which is used to measure the weight of the material filled inside the vehicle.

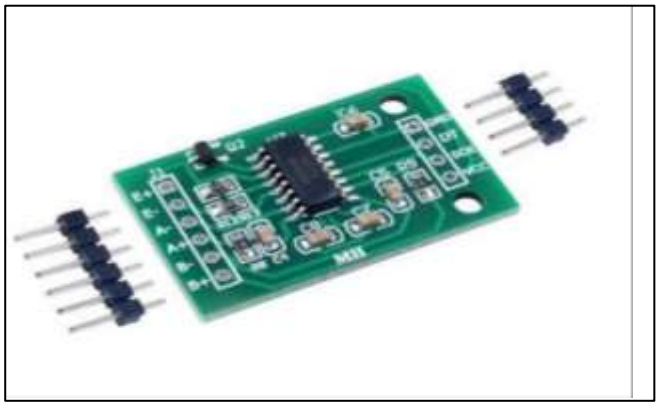


Fig.4.1.4 HX711 Module

It is commonly used in conjunction with load cells to measure weight. The HX711 module features a differential input voltage range of ±20mV, an input impedance of 1MΩ, and a programmable gain amplifier (PGA) with selectable gain values of 128 and 64. It uses a two-wire serial interface to communicate with micro-controllers and other devices, and it supports continuous reading and data rate adjustment.

The module includes a 10mV/°C temperature sensor and over voltage protection, as well as other features that enhance its accuracy and reliability. It operates on a wide range of power supply voltages, typically from 2.6V to 5.5V, and consumes very low power (less than 1mA). The HX711 module can be interfaced with a variety of micro-controllers, such as Arduino and Raspberry Pi, using standard libraries and code examples. It requires a load cell with a Wheatstone bridge configuration, and it can measure weights up to several

hundred kilograms with high accuracy. Overall, the HX711 module is a reliable and cost-effective solution for weight sensing applications that require high accuracy and precision [10].

4.5 Ultrasonic Level Sensor Module:

An ultrasonic level sensor module is a device that uses sound waves to measure the distance between the module and the target object. It is used to detect the level of the material which is filled in the dumper.so that it will indicate that the material will not exceeds from the dumper and will be filled below its prescribed level.

Fig.4.1.5 Ultrasonic Level Sensor Module

It is commonly used in industrial and scientific applications to measure liquid or solid levels in tanks, bins, and other containers. The ultrasonic level sensor module consists of an ultrasonic transducer and a control circuit. The transducer emits a high-frequency sound wave that travels through the air and reflects off the surface of the target object. The reflected wave is then received by the transducer, and the time it takes for the wave to travel to and from the object is measured by the control circuit [9].

The distance between the module and the object is calculated based on the time-of-flight of the sound wave, which is proportional to the distance. The ultrasonic level sensor module can measure distances up to several meters, depending on the model and configuration. It is often used in harsh environments, as it is resistant to dust, moisture, and other contaminants. Overall, the ultrasonic level sensor module is a reliable and accurate solution for measuring distance and level in a wide range of industrial and scientific applications.

4.6 Vibration Motor Module:

A vibration motor module is an electromechanical device that generates vibrations when a current is applied to it. Here we have mounted vibrating motor in our implemented design to segregate the material equally in the dumper, so that it will be equally distributed which will help ultrasonic level sensor to sense the level or height of the material to prevent causes of such overloaded material in dumper.

Fig.4.1.6 Vibrating Motor Module

It is commonly used in electronic devices such as cell phones, game controllers, and wearable devices to provide haptic feedback or alert notifications. The vibration motor module typically consists of a small DC motor with an eccentric weight attached to the shaft. When the motor rotates, the weight causes the motor to vibrate, creating a tactile sensation. The module may also include a vibration control circuit that can adjust the vibration intensity or duration.

The vibration motor module can be interfaced with a variety of micro controllers and devices using standard interfaces such as GPIO, PWM, or analog voltage. It requires a power supply voltage typically between 3V and 5V and consumes low power (usually less than 100mA). The module can be configured to vibrate continuously or in specific patterns or frequencies to provide different types of feedback to the user. Overall, the vibration motor module is a simple and cost-effective solution for adding haptic feedback to electronic devices. It is widely available and can be easily integrated into a variety of projects and applications [3].

4.7 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 dumper. Here we have made a pre-defined threshold angle i.e., 380^0.So that if the dumper goes beyond 380^0 the accident alert message will be sent to owner.

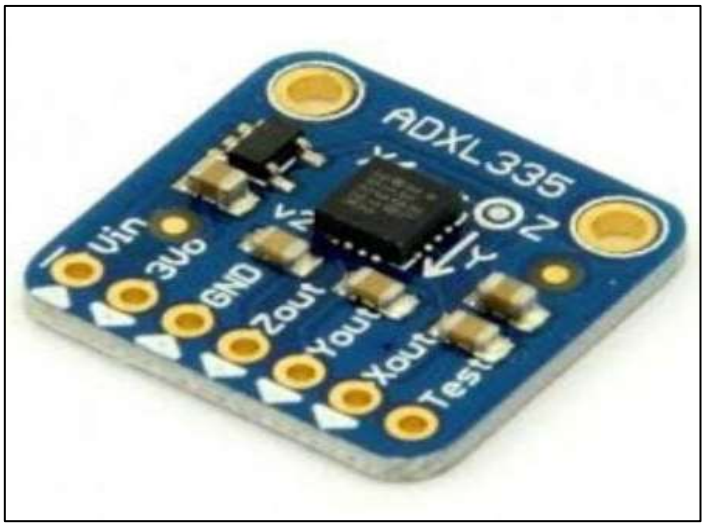


Fig.4.1.7 ADXL335 Module

It measures acceleration in three dimensions, enabling applications such as tilt sensing, motion detection, and vibration monitoring. The ADXL335 module consists of a MEMS (microelectromechanical system) sensor that detects acceleration along the X, Y, and Z axes, and an analog signal conditioning circuit that amplifies and filters the sensor output. The module typically includes a voltage regulator and a decoupling capacitor to provide stable power to the sensor and reduce noise.

The ADXL335 module can measure accelerations ranging from ±3g to ±11g, depending on the selected sensitivity range. It outputs an analog voltage proportional to the acceleration along each axis, with a sensitivity of 330mV/g. Overall, the ADXL335 module is a versatile and reliable solution for measuring acceleration and motion in electronic projects and products Its small size, low power consumption, and analog output make it easy to integrate into a variety of applications.

4.8 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. So, the Implemented system includes OLED screen to get the visual display of the measured weight of the material filled in the dumper also it will gives us the overload message when dumper gets beyond the threshold value.

Fig. 4.1.8 OLED Display Module

It is commonly used in electronic devices such as smartphones, wearable devices, and smartwatches due to its high contrast, low power consumption, and flexibility. The OLED display module consists of a thin film of organic material sandwiched between two conductors, which emit light when a voltage is applied. The module typically includes a control circuit and a driver chip that converts digital signals into pixel data and controls the brightness and colour of each pixel. The OLED display module can display images and text in high resolution and colour depth, with fast response time and wide viewing angles. It is available in various sizes and shapes, ranging from small screens for wearable devices to large panels for TVs and monitors [2].

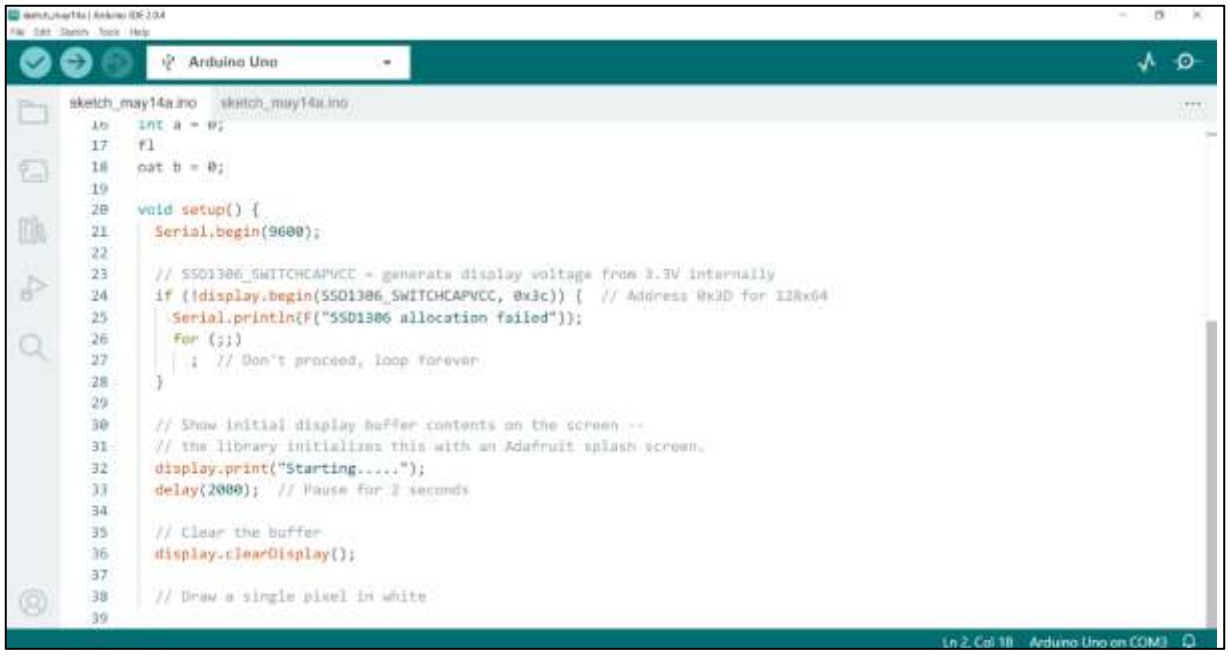
Summary – The Fourth chapter gives all the detailed information related to hardware components used in this system.

CHAPTER 5

SOFTWARE IMPLEMENTATION

The software implementation starts with the programming in Embedded C using Arduino IDE software tool. The below Fig(a) and (b) shows the Example of software program implemented in Arduino IDE tool.

Fig(a)



Fig(b)

5.1 APPLICATION RELATED INFORMATION:

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 analytics 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.

5.2 FLOW CHART OF SYSTEM:

The IOT based weight measuring dumper consists of three separate flowcharts for each module they are as follows:

5.2.1 Flow chart of Overload Detection Module :

The Flowchart of overload detection module consists of design flow of the system to detect overloading of the vehicle.

- **Algorithm :**

I. Initialization
II. Weight measured signal to micro controller board.
III. Displays measured weight on OLED screen.
IV. Compare weight to threshold value.
V. If measured weight is above threshold value, then buzzer starts ringing.
VI. End

Fig.5.2.1 Flowchart of overload detection module helps to understand the steps which are required to perform the operation. It includes algorithm steps based on programming done in Embedded C in Arduino IDE software tool. This Flowchart steps can be useful for operations performed during overload detection module.

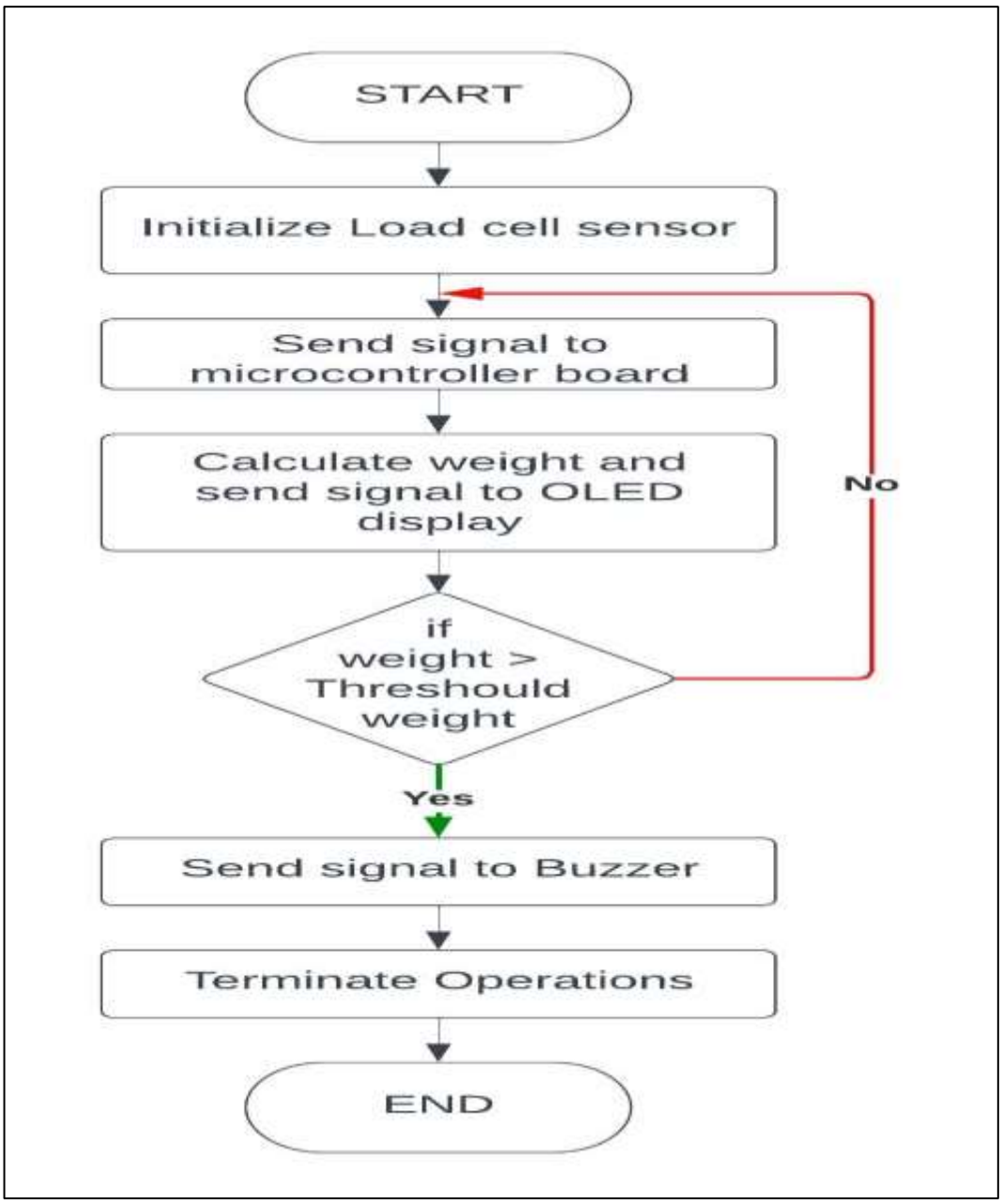


Fig 5.2.1 Flowchart of Overload Detection Module

5.2.2 Flow chart of Accident Detection Module:

The Flowchart of accident detection module consists of design flow of the system for accident detection of a dumper.

- **Algorithm:**

I. Initialization
II. Measured values by ADXL335 sensor sent to micro controller
III. If measured value is greater than threshold values accident is detected
IV. After accident detection,buzzer alarm gets activated
V. Accident alert message with GPS location sent to owners cell phone
VI. End

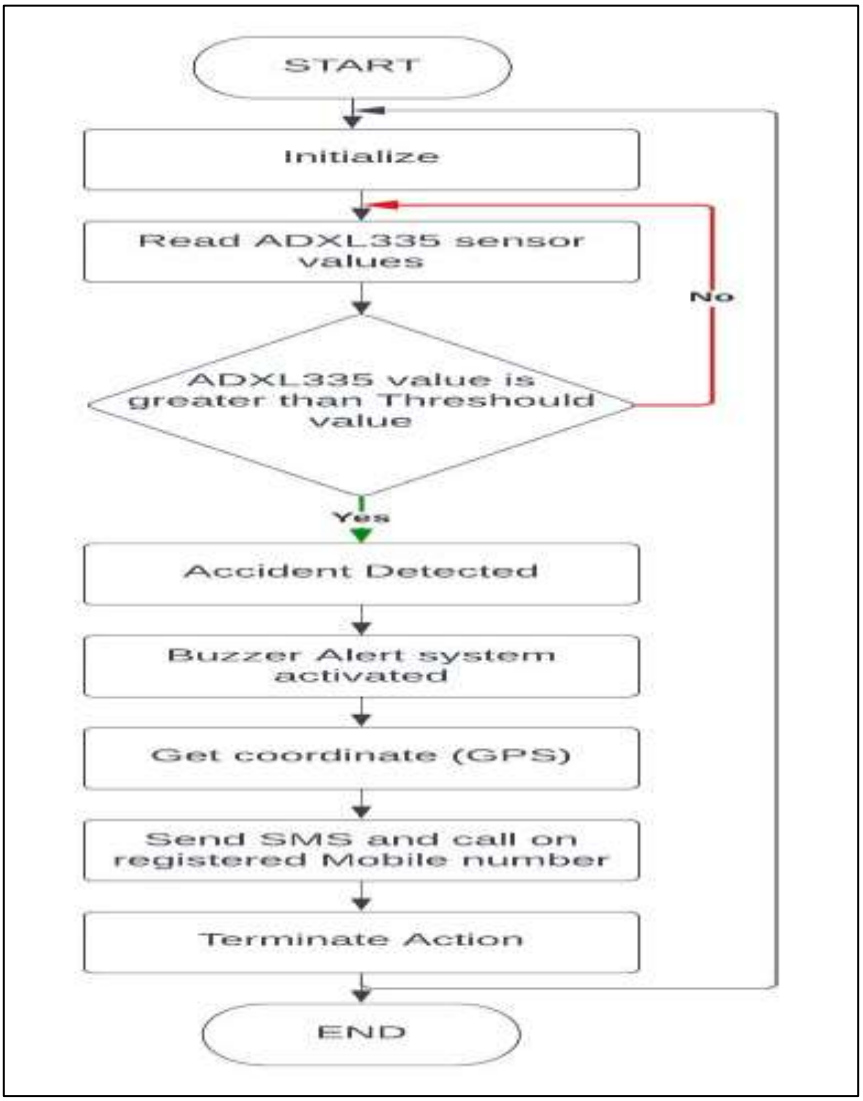


Fig.5.2.2 Accident Detection Module

5.2.3 Flow chart of Ultrasonic level sensor module:

The Flowchart of Ultrasonic level sensor module consists of design flow of the system to check whether the material filled in the dumper is below the threshold level.This module consists of algorithm steps are as follows.

- **Algorithm:**

I. Initialization
II. Measured values by ultrasonic sensor sent to micro controller
III. Values received by micro controller are compared between actual measured values and threshold values
IV. If the distance between dumper surface and ground surface is beyond threshold level
V. Buzzer starts ringing
VI. End

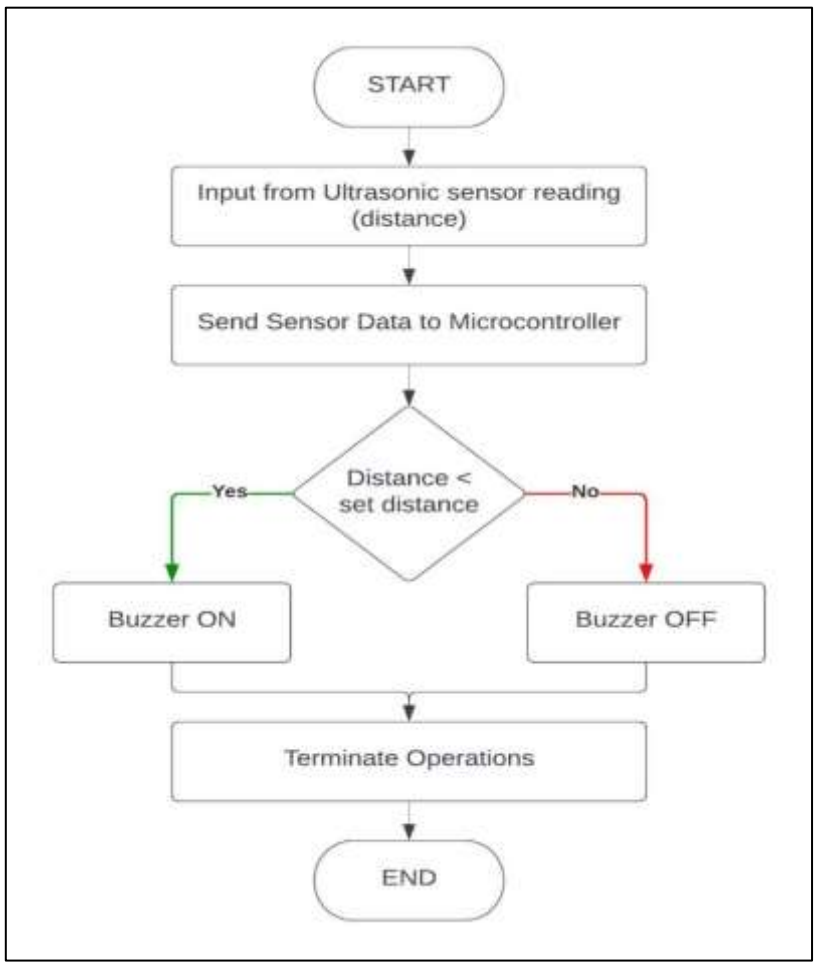


Fig.5.2.3 Ultrasonic Level Detection Module

Summary- The fifth chapter gives software related tools and information related to programs used in the implemented system.

CHAPTER 6

RESULTS AND FUTURE SCOPE

6.1 RESULTS OF IMPLEMENTED SYSTEM:

The results of the implemented system tested for following Modules:

- Weight Measurement and overload detection module.
- Accident detection module.
- Level sensor and visual display module.

6.1.1 Weight Measurement & Overload Detection:

The below Fig 6.1.1(a) 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 dumper which is 226.8g. The threshold value is set to give the overload indication is about 3kg. Fig.6.1.1(a) has the weight below the threshold value will perform its regular function before the overload is detected by the load cells.

Fig.6.1.1(a) Applied Weight in a Dumper

Fig.6.1.1(b) shows the working of weight measurement module before the overloading is detected,the measured weight is **226.8g** which is displayed on OLED screen.

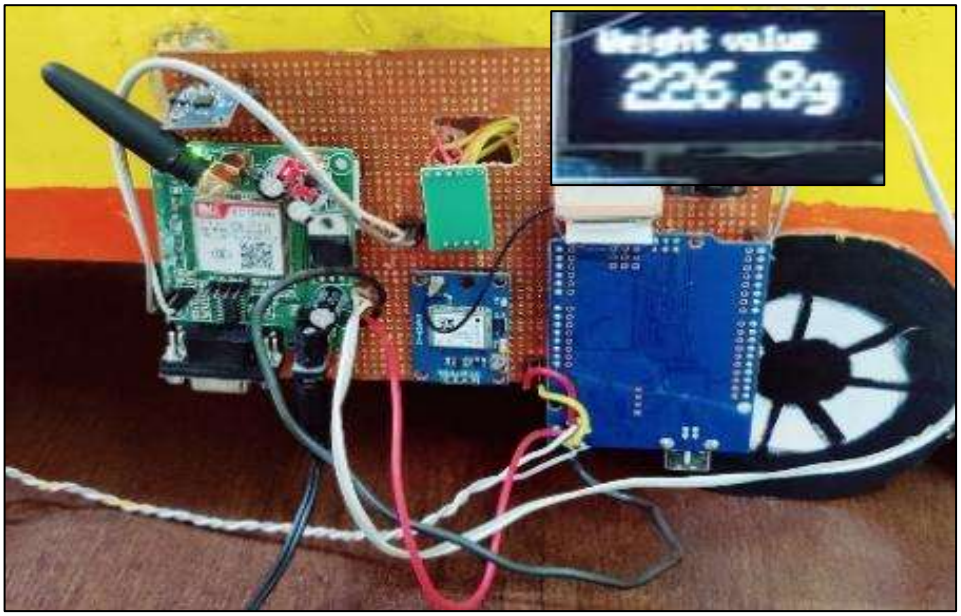


Fig.6.1.1 (b) Working of Weight Measurement Module

When the load crosses the threshold value then the display shows the message of "**overload"** and also the buzzer starts ringing which indicates that the dumper is overloaded. As shown in Fig.6.1.1(c) shows that 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.

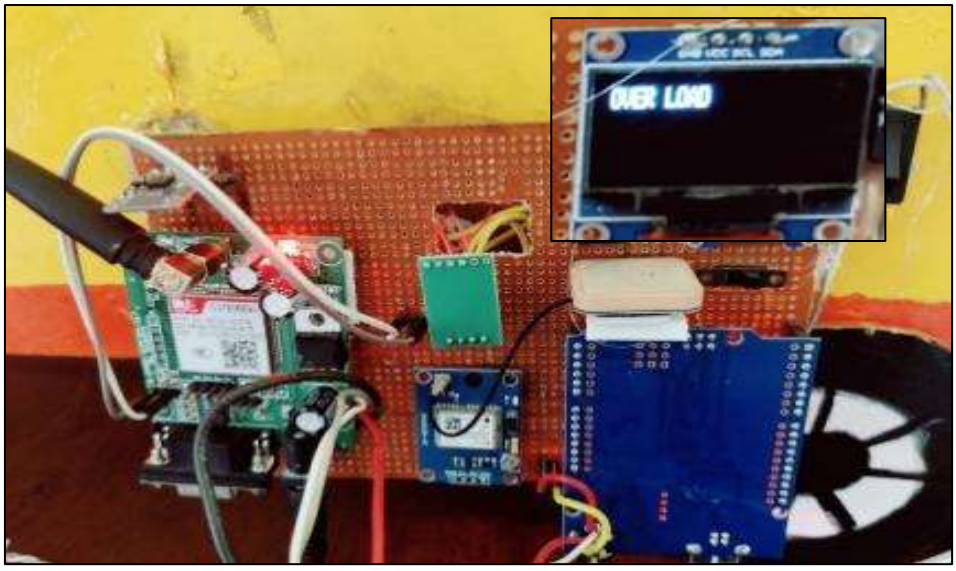


Fig.6.1.1(c) Overload of Dumper

6.1.2 Accident Detection Module:

The Fig 6.1.2 (a) shows the dumper is at its initial position that is below the threshold degree, and it work as per its regular functioning.

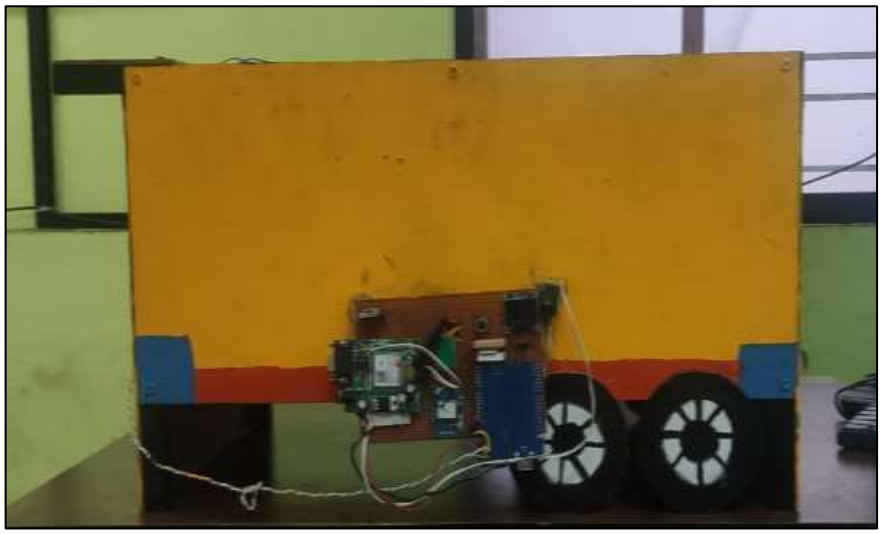


Fig.6.1.2 (a) Static Position of Dumper

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 the Fig.6.1.2(b) the dumper has tilted to 400^0 that is beyond the predefined threshold level, so the accident alert message is sent to owner. Hence, Accident detection module has tested successfully.

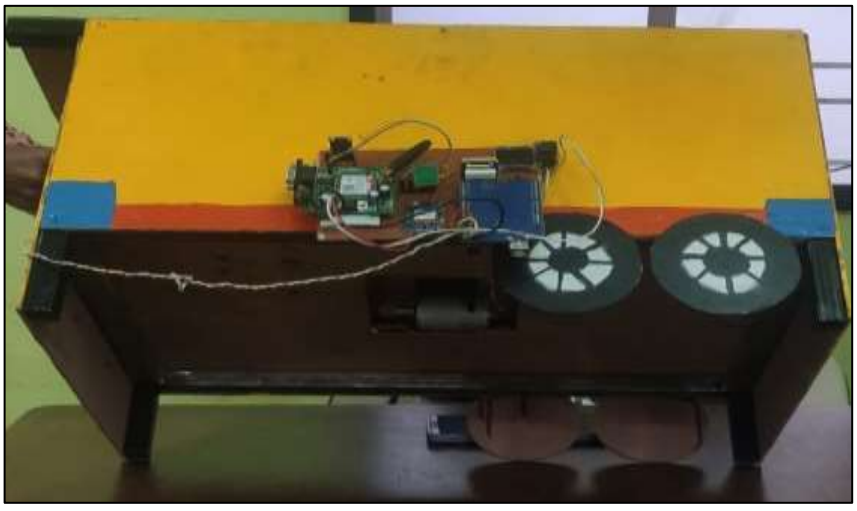


Fig.6.1.2(b) Tilted Position of Dumper

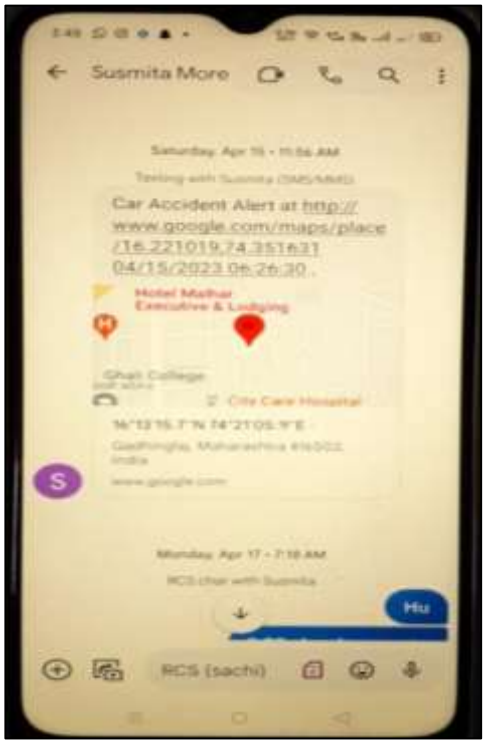
Thereafter, when the ADXL335 detects the position of dumper that is beyond the threshold degree an accident message is sent along with the real time latitude and longitude

of the location were dumper has met to an accident. So, with the help of this GPS tracking system, the owner can easily find the location of dumper and will be helpful for tracking purpose. Fig.6.1.2(c) shows that accident alert message has sent to users' phone along with the latitude and longitudinal degrees.

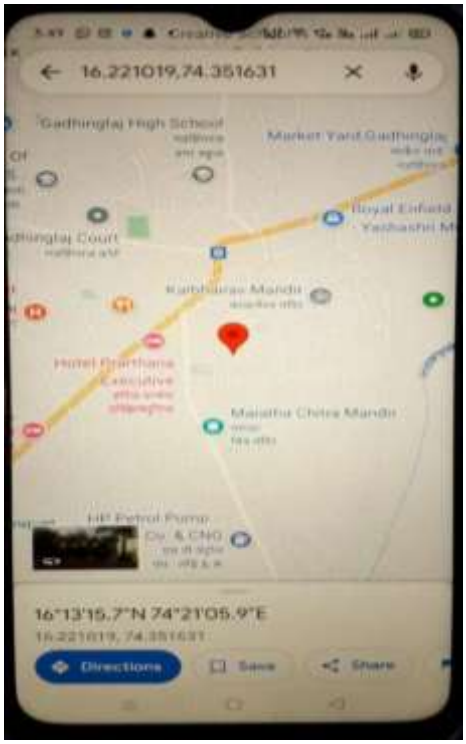
The Accident alert message includes:

- Accident alert Message
- Latitude and Longitude of Dumper
- GPS Map

So, with the help of this accident detection system, user can easily track their vehicles. This module helps to track the exact location of the dumper 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.6.1.2 (c) Accident Detection Module

6.1.3 Level sensor and visual display:

A level sensor is used to show when the dumper has filled the material to its maximum capacity that is at the height of **15 cm** above the dumper surface. Therefore, it is employed to identify when the material loaded into the dumper exceeds the level. If it exceeds the level, a buzzer begins to ring, alerting the operator that the dumpers 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 dumper and a projection screen at the back side of the dumper in the event that any vehicle tries to overtake the dumper and to prevent accidents caused by overtakes.

Fig.6.1.3 (a) Front Camera of the System

In Fig.6.1.3(a) camera is installed at the front side of the dumper which gives its input in the form of images to the projection screen which is located at the back side of the dumper. The visualization in front of the dumper is captured by the camera and it is send to the visual display module. The images captured by the camera are displayed on the projection screen.

In Fig.6.1.3(b) 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.

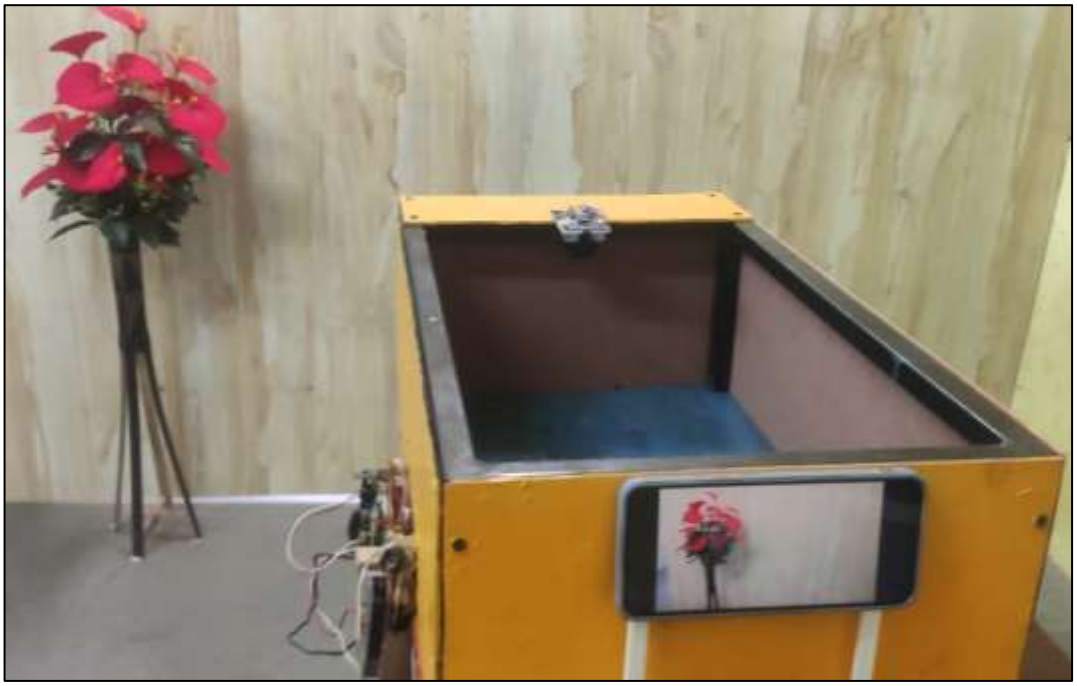


Fig.6.1.3(b) Projection Screen

6.2 FUTURE SCOPE:

The IOT-based weight measuring dumper has a promising future in several industries, including construction, mining, and agriculture. Here are some potential future developments for this technology:

- Increased Connectivity:
- Improved Safety:

Overall, the future of IOT-based weight measuring dumpers is promising. The integration of improved connectivity, autonomous operation, improved safety, and remote monitoring are some potential developments that can revolutionize the mining, construction, and agricultural industries.

6.3ADVANTAGES:

There are several advantages of IOT-based weight measuring dumpers over traditional dumpers. Here are some of them:

- Improved Accuracy
- Reduced Maintenance Costs
- Enhanced Safety
- Improved Customer Service
- Real-time Monitoring

6.4 DISADVANTAGES:

- Initial Investment Cost
- Technical Expertise Required
- Connectivity Issues

Summary- The sixth chapter gives the overall results of the implemented system along with that future scope, advantages and disadvantages of implemented system.

CHAPTER 7

7.1 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.

REFERENCES

1. RESEARCH PAPERS

[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 et al **"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.

2. WEBSITES

2.1 https://www.ijrte.org/wpcontent/uploads/papers/v8i4/D8304118419.pdf

2.2 https://iotdesignpro.com/projects/smart-weighing-machine-for-remote-weight-measurement

2.3 https://www.arduino.cc/reference/en/

2.4 https://randomnerdtutorials.com/guide-for-oled-display-with-arduino/

2.5 https://www.researchgate.net/publication/357004140_IoTBased_Waste_Height_andWeight_Monitoring_System