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**ABSTRACT**

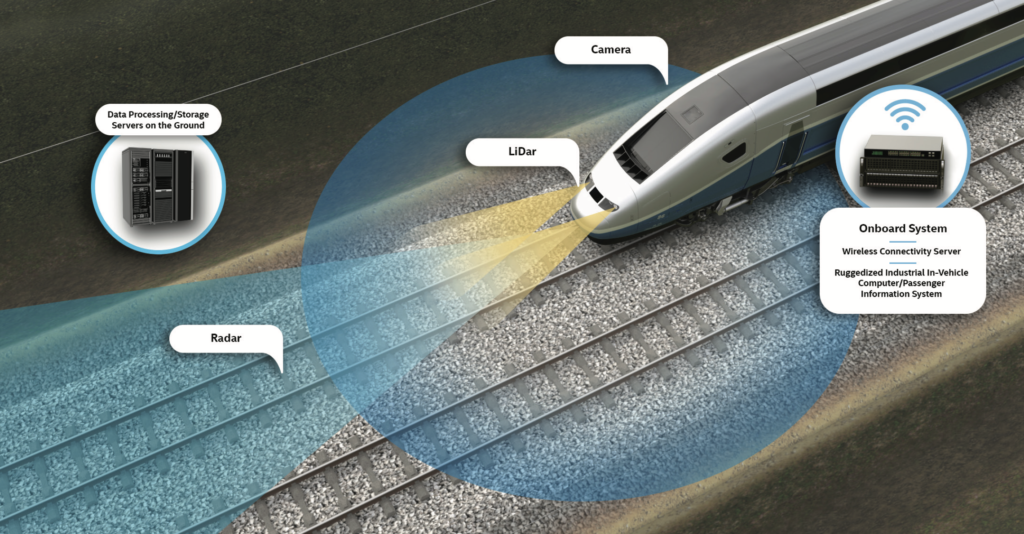
In railway system, safety and reliability are highly required factors. Because of vast Indian railway network, detecting faults is a major issue and implementing new technology includes high cost, efforts and time. The main cause for train accidents are: Derailment, Anti-collision, Wheel balance, Level crossings and tunnel. Derailment is mainly caused due to: crack and bend in the track. This occupies the highest percentage of the causes of the train accident. The unmanned railway crossings are highest accident prone areas next to derailment. Many unmanned crossing were closed causing inconvenience to road passengers. Lack of proper lighting system in tunnels is due to improper power supply and communication problems to remote areas. These factors cause accidents in tunnel. In an over populated city like Mumbai widely used mode of transport is railways, but on the other hand the accidents occurring on railway tracks has increased gradually. In a recent survey it was found that many people died and were injured in suburban train-related accidents since many years. In order to improve the safety of Indian railways the proposed project will serve objective like collision avoidance in which automatic brakes are applied after detection of object on railway track. In order to provide best facilities to the railway commuters crowd management system is also introduced in which each commuter is informed about the occupancy of each coach of train in order to distribute the crowd evenly. As chain pulling system available in Indian railways has some issues which are resolved by the advanced chain pulling system in which motorman will be informed about the emergency situation occurred in the train. At present, India has employed GPS system for tracking trains and to avoid collision of trains. Wheel balance system balances the wheels of the train and detecting imbalance in the wheels due to damage of wheels, or imbalance while the train is taking steep turns. Simple sensors are used to detect faults and microcontroller is used to control the output according to the value of the input which is the output of the sensors.

**CHAPTER – 1**

**INTRODUCTION**

* 1. **Introduction to Project**

V.Purnachandra.et.al.[1] in 1987 has proposed microprocessor based system in railways for the first time, which controls the signals and generates output within 20 seconds. This system was designed to control the input and outputs, the main disadvantage is that this system cannot detect the faults. Over the years, the system has developed to large extent. Image processing is used to detect the surface of the rail-head[2]. A camera is used for constant surveillance of the real time rail head surface. This detects the defects of the track. This system cannot detect the defect before the approach of the train. Moreover, image processing in real time has many disadvantages, it cannot detect in bad weather and at high speed. Further, research have been done to detect obstacle on the track[3]. An array of IR transmitter and receivers are placed on the parallel tracks. When there is a signal breakage then it implies the existence of obstacle. This fulfills the purpose, but the receivers are damaged due to frequent contact with train. Climatic condition will also influence the outputs. Placing this system along the whole track includes large investment and low outputs. Further to the first proposed system, the accident prevention system was developed by M.D. Anil.et.al.[4]. This system consists of microcontroller, Zigbee, and IR sensors. IR sensor detects the faults and Zigbee is used for wireless communication. This system prevents the accidents, the failure of Zigbee module is possible. Moreover, every train should consist of Zigbee module which indeed increases the cost of implementation. Furthermore, fuzzy logic based track detection system is using vibration sensor with sensor nodes[5]. Sensor nodes are given an unique ID and they track their own GPS location. A backup system of sensor nodes is attached to the opposite track.



When there is major change in vibration then it indicates the crack in the track. Vibration is highly influenced by surroundings. The output is thus highly fluctuating. Wheel based level crossing system [6], in this ultrasonic sensor detects the movement of the wheels calculating the speed of the train and communicating with crossing system using Zigbee. Ultrasonic increases the cost and wear -tear occurs due to frequent contact with the train. Accidents may occur due to defects in rolling stock [7]. This includes hot spots, deformations, and wheel balance system using strain gauge. Strain gauge system is highly complex for detecting real-time wheel balance.

* 1. **Introduction to Embedded System**

An embedded system is a computer system that is designed to perform a specific task or set of tasks. It is a combination of computer hardware and software that is integrated into a larger system. Embedded systems are used in various applications such as home appliances, transportation, healthcare, business sector & offices, defence sector, aerospace, and agricultural sector. The three main components of an embedded system are hardware, software, and firmware. Hardware refers to the physical components of the system such as microprocessors or microcontrollers. Software refers to the programs that run on the hardware. Firmware is a type of software that is embedded in the hardware and is responsible for controlling the system. An Embedded system is a special- purpose system in which the computer is completely encapsulated by or dedicated to the device or system it controls. Unlike a general-purpose computer, such as a personal computer, an Embedded System performs one or few predefined Tasks usually with very specific requirements. Since the system is dedicated to specified tasks, design engineers can optimize it, reducing the size and cost of the product. Embedded Systems are often massproduced, benefiting from economies of scale.

**Characteristics of Embedded System:**

• An embedded System is any computer system hidden inside a product other than a computer.

• Throughput – Our system may need to handle a lot of data in short period of time.

• Response – Our system may need to react to events quickly. • Test ability- Setting up equipment to test embedded software can be difficult.

• Debug ability- Without a screen or a keyboard, finding out what the software is doing wrong is a troublesome problem.

• Reliability – Embedded Systems must be able to handle any situation without human intervention.

• Memory Space - Memory is limited on Embedded Systems, and you must make the software and the data fit into whatever memory exists.

• Power Consumption – Portable systems must run on battery power, and the software in these systems must conserve power.

• Processor hogs- Computing that requires large amounts of CPU time can complicate the response problem.

* 1. **Introduction to IOT**

INTERNET OF THINGS (IOT) is the networking of physical objects that contain electronics embedded within their architecture in order to communicate Interaction amongst each other or with respect to the external environment. In the upcoming years, IOT-based technology will offer advanced levels of services and practically away people lead their daily lives. Advancements in medicine, power, gene therapy agriculture, smart cities, and smart homes are just a very few of the categorical example where IOT is strongly established. IOT is network of interconnected computing devices which are embedded in everyday objects, enabling them to send and receive data. With more than 7 billion connected IOT devices today, experts are expecting this number to grow to 10 billion by 2020 and 22 billion by 2025. Oracle has a network of device partners. The most important features of IOT on which it works are connectivity, integrating, active engagement, and many more. Connectivity refers to establish a proper connection between all the things of IOT platform it may be server or cloud. After connecting the IOT devices, it needs a high speed messaging between the devices and cloud to enable reliable, secure and bi-directional communication. IOT makes things smart and enhances life through the use of data. For example, if we have a coffee machine whose beans have going to end, then the coffee machine it orders the coffee beans of your choice from the retailer. The most important features of IOT on which it works are connectivity, analyzing, integrating, active engagement, and many more. Some of them are listed below:

**Connectivity:** Connectivity refers to establish a proper connection between all the things of IOT platform it may be server or cloud. After connecting the IOT devices, it needs a high speed messaging between the devices and cloud to enable reliable, secure and bi-directional communication.

**Analyzing**: After connecting all the relevant things, it comes to real-time analyzing the data collected and use them to build effective business intelligence. If we have a good insight into data gathered from all these things, then we call our system has a smart system.

**Integrating:** IOT integrating the various models to improve the user experience as well.

**Artificial Intelligence:** IOT makes things smart and enhances life through the use of data. For example, if we have a coffee machine whose beans have going to end, then the coffee machine it orders the coffee beans of your choice from the retailer.

**Sensing:** The sensor devices used in IOT technologies detect and measure any change in the environment and report on their status. IOT technology brings passive networks to active networks. Without sensors, there could not hold an effective or true IOT environment.

**Active Engagement:** IOT makes the connected technology, product, or services to active engagement between each other.

**Endpoint Management:** It is important to be the endpoint management of all the IOT system otherwise, it makes the complete failure of the system. For example, if a coffee machine itself order the coffee beans when it goes to end but what happens when it orders the beans from a retailer and we are not present at home for a few days, it leads to the failure of the IOT system.

* 1. **Need of IOT**

The Internet of Things (IOT) stands as a transformative force, reshaping our interactions with the world and revolutionizing diverse aspects of our daily lives. At its core, IOT thrives on connectivity, fostering seamless communication between devices and promoting interoperability.. Through automation, IOT enhances efficiency by enabling devices to operate autonomously based on predefined conditions or real-time data, reducing the need for constant human intervention. In the realm of smart cities, IOT contributes to urban development by introducing intelligent transportation systems, energy management, and sustainable practices, thereby enhancing overall quality of life. Health care benefits from IOT through wearables and remote monitoring tools, offering personalized insights and timely interventions. Industries leverage Industrial IOT (IIOT) to optimize manufacturing processes, monitor equipment health, and implement predictive maintenance strategies, leading to increased productivity and cost savings. From smart homes with connected appliances to environmental monitoring and supply chain optimization, IOT's impact is far-reaching, creating a more connected, efficient, and intelligent world across various domain.

**CHAPTER – 2**

**LITERATURE SURVEY**

**2.1 Introduction:**

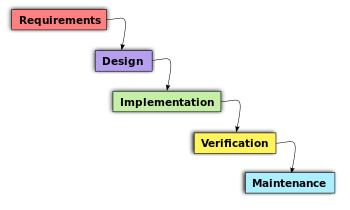
V.Purnachandra.et.al. in 1987 has proposed microprocessor based system in railways for the first time, which controls the signals and generates output within 20 seconds. This system was designed to control the input and outputs, the main disadvantage is that this system cannot detect the faults. Over the years, the system has developed to large extent. Image processing is used to detect the surface of the rail-head. A camera is used for constant surveillance of the real time rail head surface. This detects the defects of the track. This system cannot detect the defect before the approach of the train. Moreover, image processing in real time has many disadvantages, it cannot detect in bad weather and at high speed. Further, research have been done to detect obstacle on the track. An array of IR transmitter and receivers are placed on the parallel tracks. When there is a signal breakage then it implies the existence of obstacle. This fulfills the purpose, but the receivers are damaged due to frequent contact with train. Climatic condition will also influence the outputs. Placing this system along the whole track includes large investment and low outputs. Further to the first proposed system, the accident prevention system was developed by M.D. Anil.et.al. This system consists of microcontroller, Zigbee, and IR sensors. IR sensor detects the faults and Zigbee is used for wireless communication. This system prevents the accidents, the failure of Zigbee module is possible. Moreover, every train should consist of Zigbee module which indeed increases the cost of implementation. Furthermore, fuzzy logic based track detection system is using vibration sensor with sensor nodes. Sensor nodes are given an unique ID and they track their own GPS location. A backup system of sensor nodes is attached to the opposite track. When there is major change in vibration then it indicates the crack in the track. Vibration is highly influenced by surroundings. The output is thus highly fluctuating. Wheel based level crossing system , in this ultrasonic sensor detects the movement of the wheels calculating the speed of the train and communicating with crossing system using Zigbee. Ultrasonic increases the cost and wear -tear occurs due to frequent contact with the train. Accidents may occur due to defects in rolling stock. This includes hot spots, deformations, and wheel balance system using strain gauge. Strain gauge system is highly complex for detecting real-time wheel balance.

**2.2 Sensor Based System:**

The basic function of a sensor system, which is fundamental and main element of any measurement and control system, is to measure change in a property or change in a state of the analyte. It employs the sensing element which interacts chemically or physically with the analyte and it's surrounding atmosphere which causes interruption or initiation of a signal. It is then followed by the use of a transduction element to convert a physical or chemical measurand into a related parameter that can be later converted using microprocessors and analog to digital converters to display output data. In present era, sensors are being used in almost every industry for automation and process controls. In addition, electronics, aviation, agriculture and biomedical fields are increasingly accepting the use of sensors. Besides, it is logical to classify the sensors based on the type of the stimulated input signal it can perceive for measurement of quality or quantity in interest. Those primary interaction, change of state or property of analyte can be radiant, mechanical, electrical, thermal, magnetic or chemical. The change in any mentioned discipline can be useful to measure more than one property by using empirical formulas and different types of transducers. For example, mechanical change measured by sensing element can occur due to acoustic waves and also due to applied pressure or load. Apart from need of high accuracy and sensitivity, advancement in the micro electro mechanical systems (MEMS) and Nano electro mechanical systems (NEMS) has forced researchers to develop miniature sensors to monitor electric devices [83–85]. For MEMS devices and many other type of sensor not mentioned in the discussion above, the trend of using nano structured sensing surfaces have been followed increasingly.

**2.3 Object Based System:**

Object Oriented System, the software developer focuses on the task, not on the tools and it organizes the application on the basis of Object-Oriented Concepts. The behavior of the System depends on the collaboration between different Objects. As we go further to Design any system, there are four major Phases of Software Development using Object-Oriented Development. Object-Oriented Development is a structured approach to design and build software systems using the principle of Object-Oriented Programming(OOP). The Process of designing a system consists of several Phases, which help to ensure that the system is well-designed, and meets all the requirements of the user. Phases of the Object-Oriented Approach promote modularity, and reusability which helps developers to manage the system easily throughout the cycle.

****

Object Oriented Design is a Key phase in Software Development followed by Object Oriented Analysis. OOD is a process of creating a well-structured and Organized Design for a Software System based on Object Oriented Paradigm and it is important part in System Design. Object Oriented Design focuses on the implementation of System based on Analysis and it involves taking the models and insights gathered during the analysis phase and turning out into well-structured ,efficient software system.

Object Oriented Design includes both:

* System Design
* System Design is critical part in Object Oriented Design where we design a Software System based on the information gathered during Analysis of the requirement of the Software. System Design focuses on the roadmap that provides how various components and modules of the software will work together. Designing a system is done according to both Analysis and the purposed Architecture of system
* Object Design
* Object Design is critical part of Object Oriented Design where the main focus is on the detailed design of individual Classes and Objects, Specifying how they are Implemented on the System design of Software Development. Object Design is the foundation of writing Actual Code for the Software Development and it must be ensured that system is efficient, easily maintainable and extensible.

**2.4 IR Based System:**

There are five basic elements used in a typical infrared detection system: an infrared source, a transmission medium, optical component, infrared detectors or receivers and signal processing. Infrared lasers and Infrared LED's of specific wavelength used as infrared sources. IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An **IR Sensor**  can measure the heat of an object as well as detects the motion. Usually, in Infrared Spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations. The emitter is simply an IR LED **(Light Emitting Diode)** and the detector is simply an IR photodiode . Photodiode is sensitive to IR light of the same wavelength which is emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.

There are five basic elements used in a typical infrared detection system: an infrared source, a transmission medium, optical component, infrared detectors or receivers and signal processing. Infrared lasers and Infrared LED’s of specific wavelength used as infrared sources.

The three main types of media used for infrared transmission are vacuum, atmosphere and optical fibers. Optical components are used to focus the infrared radiation or to limit the spectral response.

**2.5 Motor Based System:**

An **electric motor** is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and electric current in a wire winding to generate force in the form of torque applied on the motor's shaft. An electric generator is mechanically identical to an electric motor, but operates in reverse, converting mechanical energy into electrical energy.

Electric motors can be powered by direct current (DC) sources, such as from batteries or rectifiers, or by alternating current (AC) sources, such as a power grid, inverters or electrical generators. Electric motors may be classified by considerations such as power source type, construction, application and type of motion output. They can be brushed or brushless, single-phase, two-phase, or three-phase, axial or radial flux, and may be air-cooled or liquid-cooled.

Standardized motors provide power for industrial use. The largest are used for ship propulsion, pipeline compression and pumped-storage applications, with output exceeding 100 megawatts.

Applications include industrial fans, blowers and pumps, machine tools, household appliances, power tools, vehicles, and disk drives. Small motors may be found in electric watches. In certain applications, such as in regenerative braking with traction motors, electric motors can be used in reverse as generators to recover energy that might otherwise be lost as heat and friction.

Electric motors produce linear or rotary force (torque) intended to propel some external mechanism. This makes them a type of actuator. They are generally designed for continuous rotation, or for linear movement over a significant distance compared to its size. Solenoids also convert electrical power to mechanical motion, but over only a limited distance.

**2.6 Motion Detector Based System:**

A **motion sensor alarm** is a device that uses an optical, microwave, or acoustic sensor to detect motion around your home or workspace. Its normal use, within physical security, is to detect intruders within a facility and trigger an alarm.

A complete motion sensor alarm system has a few main components. The first is a motion detector, which is the most outwardly evident part of it (that’s why the whole motion sensor alarm system is sometimes only known as a motion detector). This motion detector is generally composed of a component that emits either infrared radiations, microwave radiations, or ultrasonic waves, and a receiver that captures these waves/radiations. The third component of a motion sensor alarm is the electronic control panel. This is usually an integrated panel that controls multiple sensors, and interprets the signals from the motion sensors, and translates them into usable signals.

Finally, this is all managed from a mobile or a desktop app. The best modern systems are cloud-based, or at the very least integrated with some sort of online platform, which is the layer that you will interact with when looking at the data from your motion sensor alarm. A complete motion alarm system can also be connected to a motion sensor camera. The camera sets off when the alarm is activated to send a visual message to the responder. The responder can consequently take the most appropriate action for each specific intrusion. Although motion sensors’ main purpose is to warn the business owner or admin of unwelcome “visitors”, such as burglars or thieves, they are also used for other situations where motion is the kickoff event, such as the automatic opening of doors, or the automatic turning on of lights. **Motion detectors** either provide safety or create an easier lifestyle. Typical alternative applications of motion sensors are smart lighting, detection of poaching animals, and activation of door locks and automatic gates in residential and commercial premises. You can use your smart phone to implement affordable motion detectors that cover up to 15 feet of distance. Advanced and more expensive motion sensor models extend to larger surfaces and can keep you feel safe on large-scale properties and spacious business buildings.

**2.6 Buzzer Based System:**

**Buzzer meaning** electronic component that generates sound through the transmission of electrical signals. Its primary function is to provide an audible alert or notification and typically operates within a voltage range of 5V to 12V. There are various types of these modules that differ in their sound generation mechanisms, operating principles, and applications.

A buzzer is not a sensor. It is an output device used to make a sound or tone. Sensors are input devices that detect changes in the environment, like temperature or light, and convert them into electrical signals. Instead, receives electrical signals to generate sound. Buzzer devices quietly blend into the fabric of our daily routines, their unassuming presence guiding us through the symphony of modern life. From the gentle morning wake-up call to the subtle reminders throughout the day, these unobtrusive companions play a vital role in keeping us organized and on track. Whether it’s in industrial settings, home electronics, or even in the excitement of a game show, the unmistakable sound they emit unites functionality and fun. Amidst the hustle and bustle, it’s the subtle buzz that underscores their significance, reminding us of their simplicity and efficiency.

**2.8 Combined Based System:**

The locker security system is as shown in view of RFID, FINGERPRINT, PASSWORD and GSM technology containing door locking frameworks which can be without much of a stretch, initiated, authenticated and validated by the authorized person. It unlocks the locker door in real time manner.

**LITERATURE REVIEW**

India has the biggest rail network and becomes major mode of public transportation. According to the survey of public relation office of Indian railways, there are more than 30,300 railway crossings in India. More than 11000 railway crossings are unmanned where there is no man to manage barriers while arrival and departure of trains. Many techniques have been developed to enhance the security system of railway crossings. Many of the systems use ultrasonic sensors and infrared sensors to detect the arrival of train and access it at control room that can manage railway barriers. Some systems used GPS and GSM for tracking train to avoid accidents at railway crossings. Image processing has also been used to develop a system for secured railway crossings. Overall, a reliable system is required to operate in robust condition and able to prevent accident at the railway tracks. Review of various systems which has been proposed is discussed in the section of literature survey.

In multiple ways the railway accident identification and alert systems are prepared using different technologies. Likewise one the technology is GSM technology. The methodology for this research consists of several

stages, including data collection, data processing, machine learning model training, and system integration. The

first, stations & other data sources. Using ESP32 module stage of the research involves collecting data from railway capture the elephant live location & feed those data to My SQL database in time frame of one second. Neo 6M GPS module used to grab the train live data & feed them to backend database for do the model training part. Once the data has been processed, we will train a machine learning model to detect potential accidents and breakdowns based on the sensor data. Using a supervised learning approach, where the model is trained using historical data on accidents and breakdowns. We will be using machine learning libraries like scikit-learn and

Tensor Flow to develop and train the model.

**A. Elephant & train collision**

One goal is to address elephant collisions involves modifying the system to detect potential elephant crossings and alerting train operators accordingly. In this study we continue the earlier research done for similar domain. In that research, GPS collars were used to grab the location of the elephant as a GPS signal. Here we supposed that every elephant wears that GPS collar. Using ESP-32 it will update the real time location of the elephant to My SQL database every time. As example, database table which contain elephant, longitude, latitude. It will update every time using the ESP-32. So, if 500 elephant out there, this will automatically update the real time live location to database as data collection stage. Using neo 6M, train live location will be captured in a time frame of 1 second also. Then using regression model, this system will calculate the distance between elephant location & train location with the direct google Map API access. Calculating distance, we can come up the level of threat which has to the train & then we predict the warnings as a dashboard meter to the train driver. So, driver can take necessary action to prevent or follow the protocols which set to follow in that kind of situation. Overall, admin/ control board can monitor all the train & nearby elephants locations and their movement accordingly.

**B. Eye Detection (Drowsiness Detection)**

Previous acceptable research shows that to detect the drowsiness, a fast and accurate neural network is needed. YOLOv3 CNN is applied as a pre trained network, which is proved to be utilized as a powerful means for object detection. Further developing the existing research, in this study, as soon as driver start the trip, there will be a camera pointing to the driver face & start the capturing. Then those data are sent to the jango backend server Real time. Python programming language and libraries like Open CV, Pandas, and Numpy to process and analyze the data. Once the data has been processed, we will train a machine learning model to detect signs of drowsiness based on the sensor data. We will be using a supervised learning approach, where the model is trained using historical data on drowsiness detection. Then using the prediction model we calculate the percentage of drowsiness & alert the driver the warning levels as well as the control board to monitor the driver condition while on the trip with accurate

location & time.

**C. Crack Detection**

Firstly, identifying considerable cracks is a vital thing to make success this research. So, after doing good observation, able to find out dataset containing crack image, location (longitude & latitude respectively), crack severalty. With that, trained a logistic regression model to identify the upcoming threat level by analyzing backend data which we feed earlier. Model is trained using historical data on crack formation. Then the system will work with ESP32 module that communicates with the regression model and triggers alerts or warnings when cracks are predicted to form.

**D. Automatic breakdown detection & live informer**

This system is designed to provide live updates on any breakdowns that may occur during a train journey. It works by collecting data from neo 6m GPS module and monitoring the condition of the train's critical components, such as the engine, brakes, and wheels. If any kind of emergency occurred driver can push this button to send the real time live location using neo-6m GPS module & raspberry pi device. It allows for real-time monitoring of the train's condition, which can help prevent accidents caused by breakdowns. This system is designed to work seamlessly with the other components of the safety system, such as the ESP32 module, the drowsiness detection system, and the crack detection system.

By the literature survey we came to know that the main objective of this work is to design and construct an Arduino based system: to detect the railway cracks, obstacle and gate controlling. The paper discusses three major approaches to detection and controlling robotic system. The first involves the detection of track crack and its location using ultrasonic sensor, GPS and GMS. The second approach is to detection of obstacle on track and its location using IR sensor, GPS and GMS. The third approach is to controlling of gate. Moreover, it is also possible to detect the distances of cracks. This system will play an important role for the detection of faulty part easily compared to manual detection techniques and it is flexible way.

**CHAPTER – 3**

**DESIGNED SYSTEM**

**3.1 Introduction**

In today’s world, transport, being one of the biggest drainers of energy, its sustainability and safety are issues of paramount importance. In India, rail transport occupies a prominent position in quenching the ever urge owing needs of a rapidly growing economy. The major problem is that there is no efficient and cost-effective technology to detect problems in the rail tracks and the lack of proper maintenance. However, the proper operation and maintenance of transport infrastructure has a large impact on the economy. This model says about a proposed prototype of testing train for detecting cracks, obstacles and automatic gate controlling when these problems occurred, then train can be automatically controlled without driver control. This work introduces a project that aims in designing robust railway crack detection using ultrasonic sensor assembly system which avoids the train accidents by detecting the cracks on railway tracks and IR sensors for detecting obstacles on track. And also capable of alerting the authorities in the form of SMS messages along with location by using GPS and GSM modules. The system also includes distance measuring sensor which displays the track deviation distance between the railway tracks. In case of rail gate control the presently existing system is that once the train leaves the station the stationmaster informs the gatekeeper about the arrival of the train through the telephone. Once the gatekeeper receives the information, he closes the gate depending on the time at which the train arrives. Hence if the train is late due to certain reason, then gate remain closer for a long-time causing traffic near the gates. By employing the automatic railway gate control at the level crossing the arrival of the train is less compared to the manually operated gates and also reduces the human labor. This type of gates can be employed in an unmanned level crossing where the chances of accident are higher and reliable operation is required. Since the operation is automatic, error due to manual operation is prevented. The proposed testing train is cost effective and analysis time is less. With this proposed system the exact location of the faulty rail track can be easily located, so that many lives can be saved.

**3.2 Objectives**

Main objective of the work is to resolve the crisis of train accidents and solution in terms of alert system and time factor to avoid such accidents. To detect the Rift on track and send information to railway surveillance team. By this model the regions where manual inspection is not possible, the rifts can be easily detected. To detect the obstacles on the track. To alert the pedestrians near railway crossing.

The main contributions of this Project are as follows:

(1)A reinforcement learning (RL) method is introduced to achieve railway active accident prevention. The RL method achieves an effective way to learn useful information from accident records and predict the cause of the coming accident ahead of a period, allowing the staff to make a good preparation for accident prevention. Three metrics are designed to verify the performance of the proposed method.

(2) Multi-modal data, including text and numerical data, is organized for accident prediction, representing categorical data by embedding vectors.

(3) Randomness is introduced to be an indicator denoting the influence of personal skills to make the proposed method aware of the impact of human factors. Considering that accident prevention highly depends on the experiences of employees, the randomness makes the proposed method able to reflect the influence of personal skill level. In the experimental section, this paper presents the results from the different levels of randomness and advises some measures for improving personal skills.

**3.3: Block diagram**

**ARDUINO UNO**

**IR SENSOR**

SENSOR

**BUZZER**

**UV SENSOR**

**DC MOTOR**

**Fig 3.1: Block diagram**

**3.4 Tools Required**

**3.4.1 Hardware Components**

* Node MCU
* Power Supply
* Ultrasonic sensor
* Infrared sensor
* Buzzer
* DC motor

***3*.4.2 Software Requirements**

* Arduino ESP8266
* Proetus
* Code develops through Embedded C

**3.4.3 Techniques Used**

IoT technology From the block diagram we notice that we use hardware and software components. Each component will do their related work. Servomotor is used for rotating or shifting the in gate and exit gate. ESP8266 is used for taking the inputs and outputs. We use software app for searching the slots and parking their vehicle in that app we done the payment also. Ultrasonic sensors are used for detecting the distance and give the information to the micro controller. Here we give the power supply. The Internet of Things ( IOT ) is a revolutionary technological paradigm that involves linking everyday objects to the internet, enabling them to exchange data. These objects, equipped with sensors and actuators, form a network of interconnected authentication, and secure communication protocols. IoT applications span from smart homes and healthcare to industrial automation, showcasing its capacity to enhance efficiency, provide real-time insights, and improve overall quality of life. Interoperability and standardization are essential for seamless collaboration among different devices known as the "Internet of Things." This connectivity allows devices to communicate with each other and centralized systems, fostering a wide array of applications across various domains. Key components include the integration of devices with sensors, diverse connectivity protocols such as Wi-Fi and Bluetooth, data processing capabilities either locally or in the cloud, and the critical role of cloud computing for data storage and analysis. Ensuring the security of IoT devices and the data they generate is a paramount concern, addressed through encryption. IoT devices, regardless of their manufacturers. Despite its transformative potential, challenges such as security, privacy, and the establishment of industry standards continue to shape the evolving landscape of IoT.

**3.5 WORKING**

There are numerous methods to solve our objectives. Here we use sensors to make our project simple and handy. All the parts represent similar block diagram as in Figures in a broader view. ATmega8 microcontroller is used, with different sensors. Many other sensors can be used to fulfill these requirements. Proteus of anti-collision, level crossing and tunnel, and derailment is as in the above figures. Wheel imbalance can mainly occur while taking steep turns. Although, occurrence is very less but on occurrence major accidents with huge life loss is observed. Earlier wheel balance was checked using strain gauges.

**CHAPTER – 4**

**HARDWARE IMPLEMENTATION**

**4.1 Node MCU ESP8266**

**4.1.1 Description**

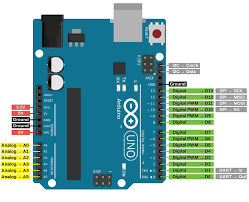
Node MCU ESP8266 Description Node MCU is an open-source firmware for which opensource prototyping board designs are available. The name “Node MCU” combines “node” and “MCU” (micro-controller unit). The term “Node MCU” strictly speaking refers to the firmware rather than the associated development kits. Both the firmware and prototyping board designs are open source. Node MCU ESP8266 and Node MCU ESP32 are becoming very popular and are almost used in more than 50% IoT based projects today.



The firmware uses the Lua scripting language. The firmware is based on the eLua project and built on the Espressif Non-OS SDK for ESP8266. It uses many open-source projects, such as luacjson and SPIFFS. Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented. The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards. The design was initially was based on the ESP-12 module of the ESP8266, which is a WiFi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IOT applications.

**About the Node MCU ESP8266 Pinout:**

Node MCU ESP8266 Wi-Fi Module is an open-source Lua based firmware and development board specially targeted for IoT based applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. Arduino UNO is a microcontroller board based on the **ATmega328P**. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.



**Fig 4.2 : Pin Diagram of Node MCU**

**4.1.2 Node MCU ESP8266 Features:**

Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106

Operating Voltage: 3.3V

Input Voltage: 7-12V

Digital I/O Pins (DIO): 16

Analog Input Pins (ADC): 1 UARTs: 1

SPIs: 1 I2Cs: 1

Flash Memory: 4 MB

SRAM: 64 KB

Clock Speed: 80 MHz

USB-TTL based on CP2102 is included onboard, Enabling Plug n Play PCB

Antenna Small Sized module to fit smartly inside your IoT projects

****

**Fig 4.3: Layout of the Node MCU**

**4.1.3 Node MCU ESP8266 Pinout:**

For practical purposes ESP8266 Node MCU V2 and V3 boards present identical pinouts. While working on the Node MCU based projects we are interested in the following pins.

Power pins (3.3 V).

Ground pins (GND). Analog pins (A0).

Digital pins (D0 – D8, SD2, SD3, RX, and TX – GPIO XX) .

Most ESP8266 Node MCU boards have one input voltage pin (Vin), three power pins (3.3v), four ground pins (GND), one analog pin (A0), and several digital pins (GPIO XX).

**Pin Code Arduino alias**

A0 A0 A0

D0 GPIO 16 16

D1 GPIO 5 5

D2 GPIO 4 4

D3 GPIO 0 0

D4 GPIO 2 2

D5 GPIO 14 14

D6 GPIO 12 12

D7 GPIO 13 13

D8 GPIO 15 15SD2 GPIO 9 9

SD3 GPIO 10 10

RX GPIO 3 3

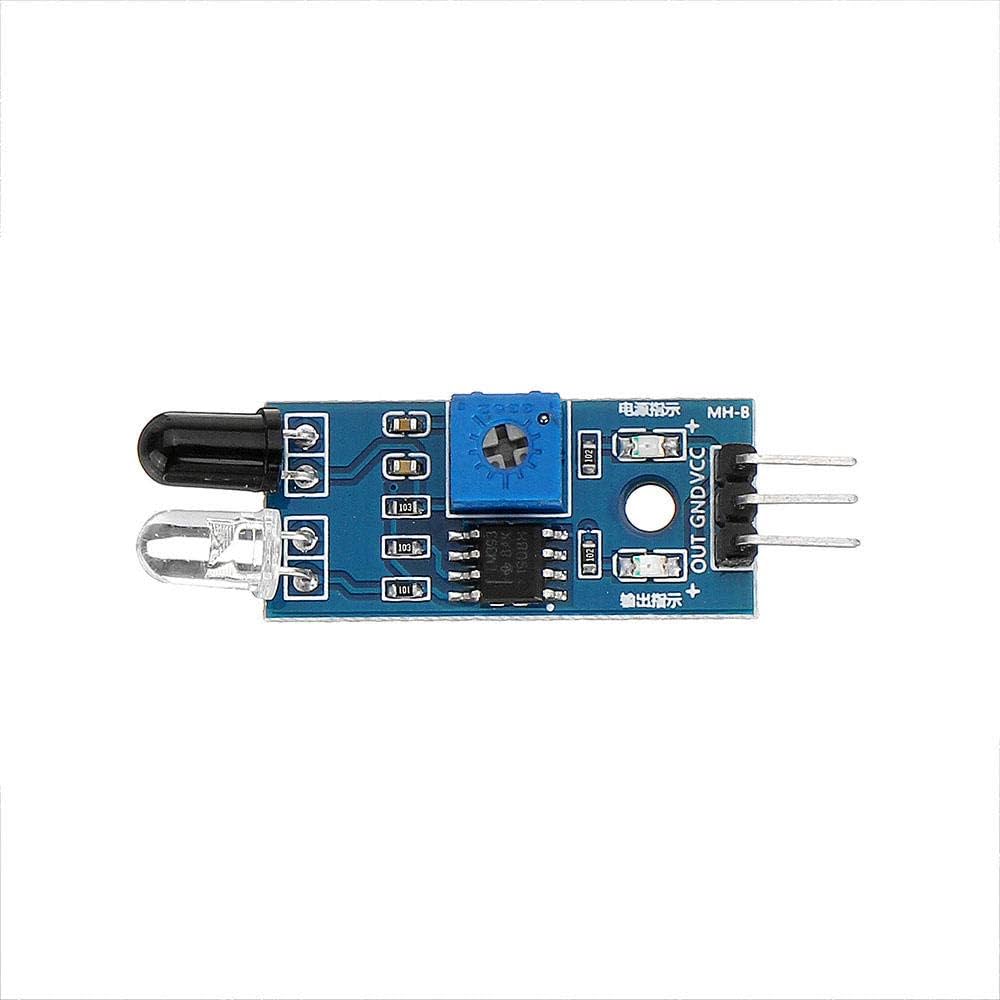
TX GPIO 1 1

**4.2 IR Sensor**

**A Infrared Sensor is an electrical sensor that is used to sense the object present infront of it. It is a object sensor. Here’s a brief description and working principle of a IR Sensor:**

**4.2.1 Description**

**An infrared sensor is a ra**diation-sensitive optoelectronic component with a spectral sensitivity in the infrared wavelength range 780 nm……50um. IR sensors are now widely used in motion detectors, which are used in building services to switch on lamps or in alarm systems to detect unwelcome guests. In a defined angle range, the sensor elements detect the heat radiation (infrared radiation) that changes over time and space due to the movement of people. Such infrared sensors only have to meet relatively low requirements and are low-cost mass-produced items. Infra Tec develops, produces and sell pyroelectric detectors.



**4.2.2 Working Principle**

Infrared radiation works on the lower end of the electromagnetic spectrum and is therefore invisible to the human eye. The infrared section of the electromagnetic spectrum is found between the visible waves and the microwaves. The infrared wavelength is between 0.75 and 1000µm and is separated into three regions:

* Near-infrared - from 0.75 to 3 3µm
* Mid-infrared - from 3 to 6µm
* Far-infrared - higher than 6µm

Astronomer Herschel discovered the infrared section of the electromagnetic spectrum with the famous prism refraction experiment.

Infrared radiation is a characteristic of all objects that have a temperature higher than the absolute zero (0 Kelvin or -273 Celsius). Such objects have thermal energy and can emit infrared waves. IR sensors usually use infrared lasers and LEDs with infrared wavelengths.

In order for the thermal energy to reach the IR sensor, it must use a transmission medium. Compatible mediums are the atmosphere, vacuum, or optical fibers. Optical lenses made from combinations of metals and minerals, such as quartz, calcium fluoride, polyethylene, germanium, aluminum, and silicon are used as radiation convergents. The converged or focused radiation is afterward detected by infrared detectors. Infrared detectors must additionally use pre-amplifiers to strengthen the signal.

Infrared technology is widely used for commercial purposes. IR sensors also find use in studying the weather, gas detection, petroleum examination, and water analysis, as well as in medicine for anesthesiological purposes. IR sensors are used for security as part of access control systems. PIR motion sensors are specific IR sensors, also called passive infrared sensors or pyroelectric sensors. The acronym PIR stands for “passive infrared”. PIR motion detectors are intended for a specific use of infrared radiation - the part which detects the infrared wavelength coming from the environment. They are inexpensive but very sensitive to detect and indicate whether a person is in or has left a detection field.

**4.2.3 Features**

* 5VDC Operating voltage
* I/O pins are 5V and 3.3V compliant
* Range: Up to 20cm
* Adjustable Sensing range
* Built-in Ambient Light Sensor
* 20mA supply current
* Mounting hole

**4.3 Ultrasonic Sensor**

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).

**4.3.1 Description**

Ultrasonic sensors, along with [stereo vision](https://www.sciencedirect.com/topics/engineering/stereovision), are used on [UAVs](https://www.sciencedirect.com/topics/engineering/unmanned-aerial-vehicle) to obtain the distance of the vehicle from the ground. Ultrasonic sensors can then be used by a flight control system to maintain the vehicle at a specific altitude. In practice, an ultrasonic sensor sends ultrasonic pulses towards the ground and receives back their reflection as they bounce off of the ground. The sensor calculates the distance to the ground as the time lapses between the transmitted waves and the [reflected waves](https://www.sciencedirect.com/topics/engineering/reflected-wave). An ultrasonic sensor, such as the one  is a miniature version of the sonar technology used in ships and submarines. The range of such sensors is limited to four meters due to their small sizes. Although light, smoke, dust, color of the target, and some target materials do not affect the output of the sensor, external noise and gusts have an effect on the range of the sensor. The quality of the reflected signal can be affected by tilted and soft surfaces such as water or vegetation. Despite these drawbacks, an enlarged version of this sensor designed for use on a helicopter might be capable of detecting obstacles, including wires. The operating frequency of the sonic sensor would need to be chosen carefully in order to successfully detect obstacles in the vicinity due to the large amounts of noise and airflow near and around the [airframe](https://www.sciencedirect.com/topics/engineering/airframe) generated by the helicopter.

**4.3.1 Description**

Ultrasonic sensors are used primarily as proximity sensors. They can be found in automobile self-parking technology and anti-collision safety systems. Ultrasonic sensors are also used in robotic obstacle detection systems, as well as manufacturing technology. In comparison to infrared (IR) sensors in proximity sensing applications, ultrasonic sensors are not as susceptible to interference of smoke, gas, and other airborne particles (though the physical components are still affected by variables such as heat).

**4.3.2 Working Principle**

Ultrasonic sensors work by sending out a sound wave at a frequency above the range of human hearing. The transducer of the sensor acts as a microphone to receive and send the ultrasonic sound. Our ultrasonic sensors, like many others, use a single transducer to send a pulse and to receive the echo. The sensor determines the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse. The working principle of this module is simple. It sends an ultrasonic pulse out at 40 kHz, which travels through the air, and if there is an obstacle or object, it will bounce back to the sensor. By calculating the speed and distance of the sound. Ultrasonic sensors are a great solution for the detection of clear objects. For liquid level measurement, applications that use infrared sensors, for instance, struggle with this particular use case because of target translucence. For presence detection, ultrasonic sensors detect objects regardless of color, surface, or material (unless the material is very soft, like wool, as it would absorb sound).

**4.3.3 Features**

* [Transparent object detectable] Since ultrasonic waves can reflect off a glass or liquid surface and return to the sensor head, even transparent targets can be detected.
* [Resistant to mist and dirt] Detection is not affected by accumulation of dust or dirt.
* [Complex shaped objects detected].

**4.4 DC MOTOR**

A DC motor is an electrical machine that converts electrical energy into mechanical energy. In a DC motor, the input electrical energy is the direct current which is transformed into the mechanical rotation. In this session, let us know what is a DC motor, types of DC motor and their applications.

**4.4.1 Description**

**A DC motor is defined as a class of electrical motors that convert direct current electrical energy into mechanical energy.**

From the above definition, we can conclude that any electric motor that is operated using direct current or DC is called a DC motor. We will understand the DC motor construction and how a DC motor converts the supplied DC electrical energy into mechanical energy.

**4.4.2 Working Principle**

A magnetic field arises in the air gap when the field coil of the DC motor is energized. The created magnetic field is in the direction of the radii of the armature. The magnetic field enters the armature from the North pole side of the field coil and “exits” the armature from the field coil’s South pole side.

The conductors located on the other pole are subjected to a force of the same intensity but in the opposite direction. These two opposing forces create a torque that causes the motor armature to rotate.

**Types of DC motor**

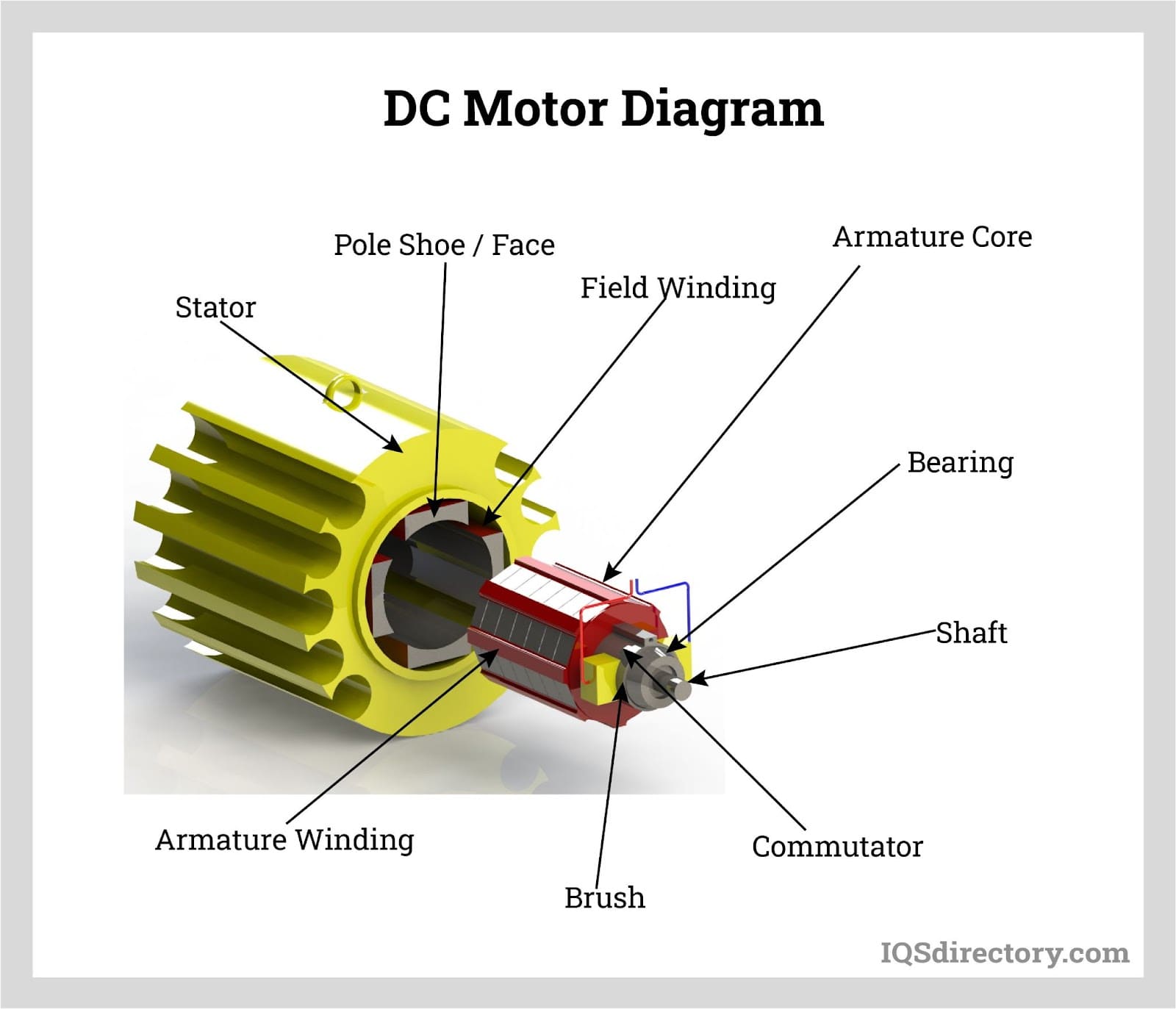
DC motors have a wide range of applications ranging from electric shavers to automobiles. To cater to this wide range of applications, they are classified into different types based on the field winding connections to the armature as:

* Self Excited DC Motor
* Separately Excited DC Motor

**Self Excited DC Motor**

In self-excited DC motors, the field winding is connected either in series or parallel to the armature winding. Based on this, the self-excited DC motor can further be classified as:

* Shunt wound DC motor
* Series wound DC motor
* Compound wound DC motor

****

**Fig 4.4: DC Motor**

**4.4.3 Features**

* No need for a drive circuit when running at constant speed.
* High-efficiency design.
* Able to operate at high speeds.
* High startup torque.
* Responsive and easy to use as speed and torque can be controlled by voltage.

**4.5 Buzzer**

It is an output device used to make a sound or tone. Sensors are input devices that detect changes in the environment, like temperature or light, and convert them into electrical signals. Instead, receives electrical signals to generate sound.

**4.5.1 Description**

Buzzer devices quietly blend into the fabric of our daily routines, their unassuming presence guiding us through the symphony of modern life. From the gentle morning wake-up call to the subtle reminders throughout the day, these unobtrusive companions play a vital role in keeping us organized and on track. Whether it’s in industrial settings, home electronics, or even in the excitement of a game show, the unmistakable sound they emit unites functionality and fun. Amidst the hustle and bustle, it’s the subtle buzz that underscores their significance, reminding us of their simplicity and efficiency.

**4.5.2 Working**

1. **Power Source**: The buzzer requires a power source to operate, typically a direct current (DC) supply.
2. **Electromagnetic Coil**: Inside the buzzer, there is an electromagnetic coil. When electricity is supplied, the coil becomes magnetized.
3. **Metal Diaphragm**: Adjacent to the coil, there's a metal diaphragm. This diaphragm is usually made from a ferromagnetic material, which means it's attracted to magnets.
4. **Operation Mechanism**: When the current flows through the coil, it creates a magnetic field. This magnetic field causes the metal diaphragm to be attracted towards the coil, moving away from its original position.
5. **Sound Production**: As the diaphragm moves, it compresses and rarefies the air in front of it, creating sound waves. The rapid movement back and forth of the diaphragm produces the buzzing sound we hear.
6. **Oscillation**: In some buzzers, particularly piezoelectric types, the electric current causes the piezoelectric material (usually a ceramic disc) to bend back and forth. This bending motion creates the sound. The frequency of the current determines the frequency of the sound, and thus its pitch.
7. **Volume Control**: The volume of the sound can often be controlled by the amount of current supplied to the buzzer. Higher currents produce a louder sound.

These types are selected based on diverse application requirements, with sound level, power consumption, size, and other factors serving as crucial criteria that influence the buzzer type chosen.

****

**Fig 4.5: Buzzer**

**4.5.3 Features**

* Color is black.
* The frequency range is 3,300Hz.
* Operating Temperature ranges from – 20° C to +60°C.
* Operating voltage ranges from 3V to 24V DC.
* The sound pressure level is 85dBA or 10cm.
* The supply current is below 15mA.

**CHAPTER – 5**

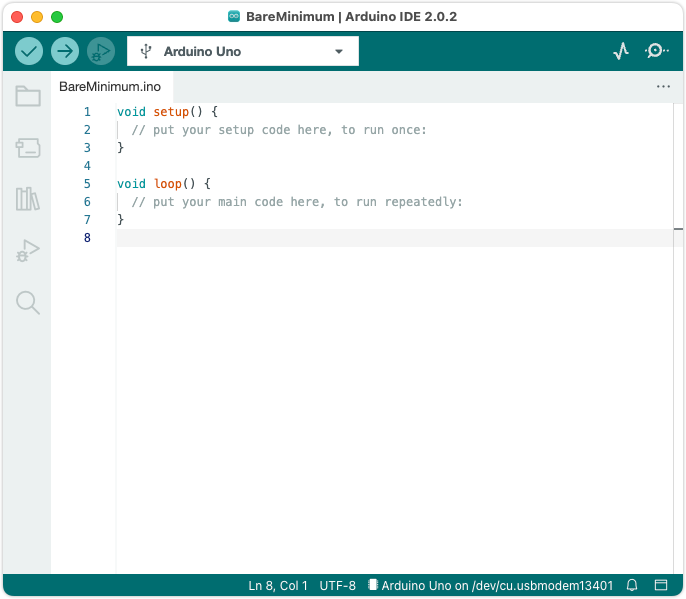
**SOFTWARE IMPLEMENTATION**

**5.1 ARDUINO IDE**

**5.1.1 Introduction to Arduino IDE**

IDE stands for Integrated Development Environment - An official software introduced by Arduino.cc that is mainly used for writing, compiling and uploading the code in almost all Arduino modules/boards. Arduino IDE is open-source software and is easily available to download & install from Arduino Official Site.

In this post, I'll take you through the brief Introduction of the Software, how you can install it, and make it ready for your required Arduino module. Let's dive in and get down to the nitty-gritty of this Software.

****

**Fig 5.1: Arduino Uno Editor Page**

Arduino IDE is an open-source software, designed by Arduino.cc and mainly used for writing, compiling & uploading code to almost all Arduino Modules. It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process.It is available for all operating systems i.e., MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role in debugging, editing and compiling the code.A range of Arduino modules available including Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro and many more.Each of them contains a microcontroller on the board that is actually programmed and accepts the information in the form of code.The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board.The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module. This environment supports both C and C++ languages.

**5.1.2 How to download Arduino Uno**

You can download the Software from Arduino main website. As I said earlier, the software is available for common operating systems like Linux, Windows, and MAX, so make sure you are downloading the correct software version that is easily compatible with your operating system. 8.1 or Windows 10, as the app version is not compatible with Windows 7 or older version of this operating system. You can download the latest version of Arduino IDE for Windows (Non admin standalone version), by clicking below button:

**Arduino IDE Download**

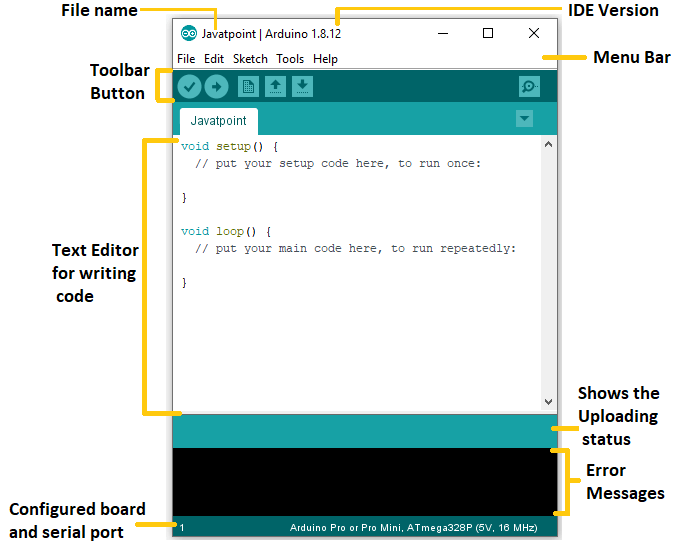
The IDE environment is mainly distributed into three sections.

1.Menu Bar

2.Text Editor

3.Output Pane

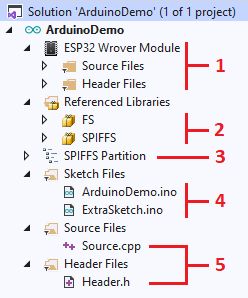
As you download and open the IDE software, it will appear like an image below:

****

**Fig 5.2 Inroduction to Arduino Uno**

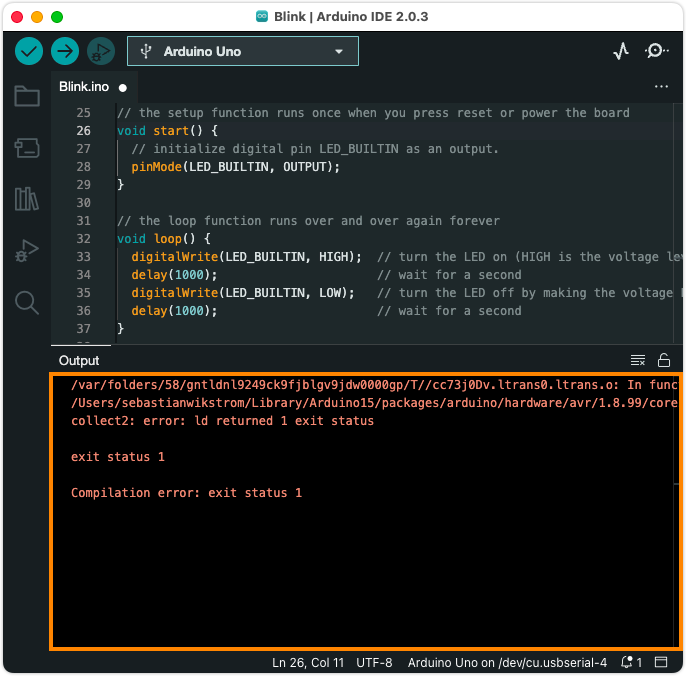
The bar appearing on top is called Menu Bar that comes with five different options as

* File - You can open a new window for writing the code or open an existing one. The following table shows number of further subdivisions the file option is categorized into:

****

**Fig 5.3: File subdivisions of Arduino Uno**

* As you go to the preference section and check the compilation section, the Output Pane will show the code compilation as you click the upload button.

****

**Fig 5.4: Selection of compilation**

And at the end of the compilation, it will show you the hex file it has generated for the recent sketch that will send to the Arduino Board for the specific task you aim to achieve.

****

**Fig 5.5 Hex File Generation**

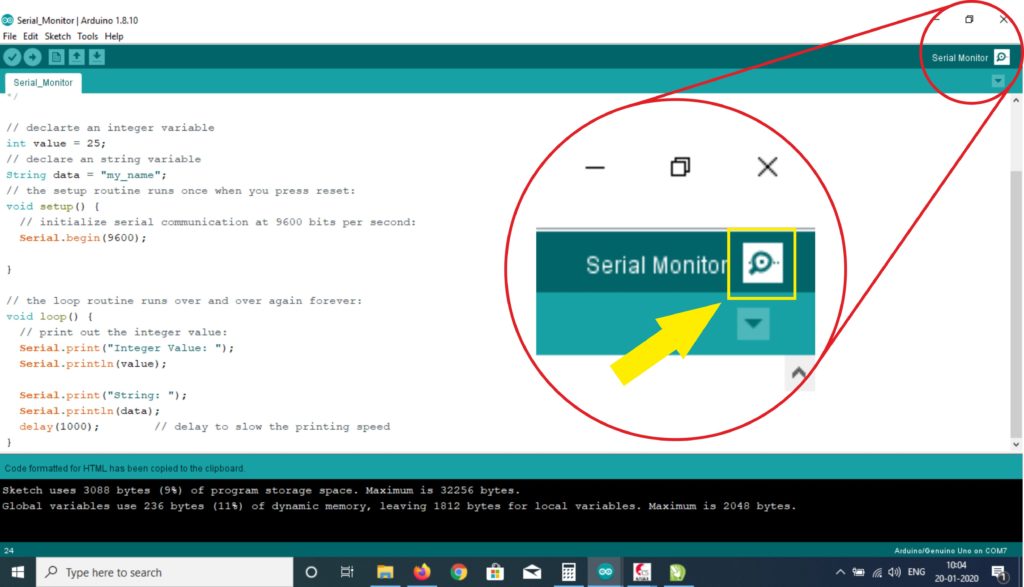
• Sketch - For compiling and programming

• Tools - Mainly used for testing projects. The Programmer section in this panel is used for burning a boot loader to the new microcontroller.

• Help - In case you are feeling Edit - Used for copying and pasting the code with further modification for font

• sceptical about software, complete help is available from getting started to troubleshooting.

• The Six Buttons appearing under the Menu tab are connected with the running program as follows.

****

**Fig 5.6: Serial Monitor**

The check mark appearing in the circular button is used to verify the code. Click this once you have written your code.

• The arrow key will upload and transfer the required code to the Arduino board.

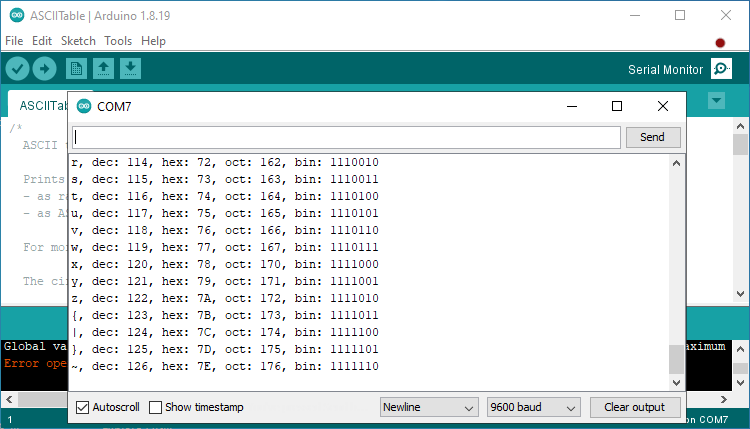
• The dotted paper is used for creating a new file.

• The upward arrow is reserved for opening an existing Arduino project.

• The downward arrow is used to save the current running code.

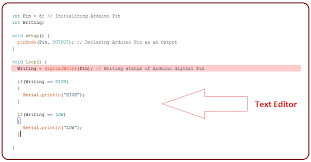
• The button appearing on the top right corner is a Serial Monitor - A separate pop-up window that acts as an independent terminal and plays a vital role in sending and receiving the Serial Data. You can also go to the Tools panel and select Serial Monitor, or pressing Ctrl+Shift+M all at once will open it instantly. The Serial Monitor will actually help to debug the written Sketches where you can get a hold of how your program is operating. Your Arduino Module should be connected to your computer by USB cable in order to activate the Serial Monitor.

* You need to select the baud rate of the Arduino Board you are using right now. For my Arduino Uno Baud Rate is 9600, Monitor, the output will show as the image below.

****

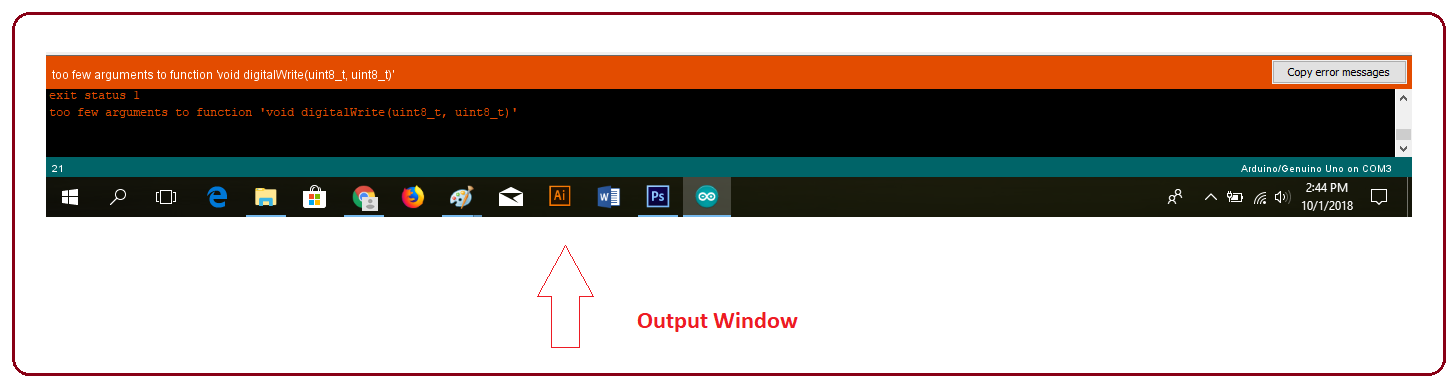
**Fig 5.7: Output of Serial Monitor**

* The main screen below the Menu bard is known as a simple text editor used for writing the required code.

****

**Fig 5.8: Text Editor**

* Output Pane that mainly highlights the compilation status of the running code: the memory used by the code, and errors that occurred in the program. You need to fix the bottom of the main screen is described as those errors before you intend to upload the hex file into your Arduino Module.

****

**Fig 5.9: Output Window**

* More or less, Arduino C language works similar to the regular C language used for any embedded system microcontroller, however, there are some dedicated libraries used for calling and executing specific functions on the board.

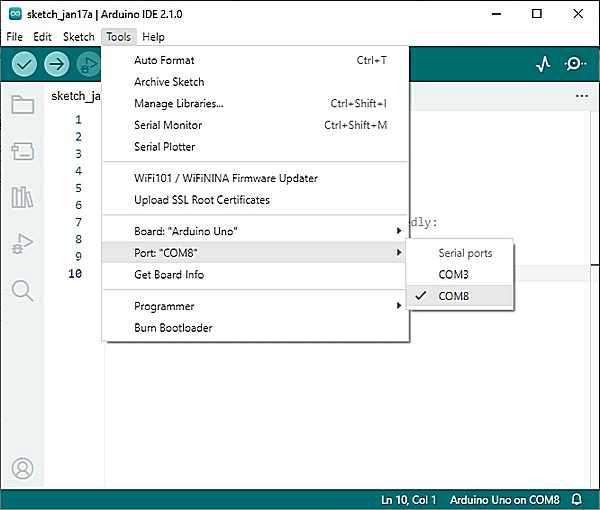
**5.1.3 Libraries**

• Libraries are very useful for adding extra functionality into the Arduino Module.

• There is a list of libraries you can check by clicking the Sketch button in the menu bar and going to Include Library.

• As you click the Include Library and Add the respective library it will be on the top of the sketch with a #include sign. Suppose, I Include the Liquid Crystal library, it will appear on the text editor as

#include<LiquidCrystal.h>

****

**Fig 5.10: Selection of Tools**

* As you click the Include Library and Add the respective library it will be on the top of the sketch with a #include sign. Suppose, I Include the Liquid Crystal library, it will appear on the text editor a
* #include <LiquidCrystal.h>
* Most of the libraries are preinstalled and come with the Arduino software. However, you can also download them from external sources.

**5.1.4 Making Pins Input or Output.**

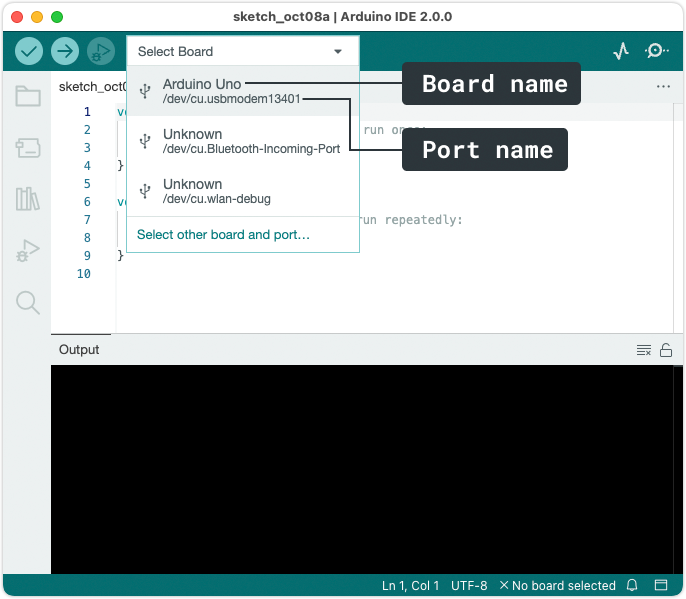
The digitalRead and digitalWrite commands are used for addressing and making the Arduino pins as an input and output respectively. These commands are text sensitive i.e., you need to write them down the exact way they are given like digitalWrite starting with small "d" and write with capital "W". Writing it down with DigitalWrite or digitalWrite won't be calling or addressing any function.

**5.1.5 How to Select the Board**

• In order to upload the sketch, you need to select the relevant board you are using and the ports for that operating system.

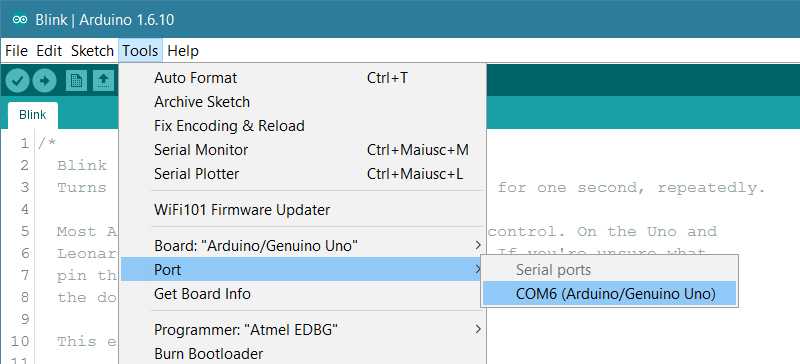
• As you click the Tools on the menu, it will open like the figure below:

In IDE 2 you can also access it by clicking the button in the left-most sidebar. Either search for the package name (e.g. “megaAVR”), or the board (e.g. “Uno”, “MKR1000”, or “Portenta”), by typing in the search field. Find the package that includes your board.

****

**Fig 5.11: Selection of board Manager**

* Just go to the "Board" section and select the board you aim to work on. Similarly, COM1, COM2, COM4, COM5, COM7 or higher are reserved for the serial and USB board. You can look for the USB serial device in the port section of the Windows Device Manager.
* The following figure shows the COM4 that I have used for my project, indicating the Arduino Uno with the COM4 port at the right bottom corner of the screen.
* After correct selection of both Board and Serial Port, click the verify and then upload button appearing in the upper left corner of the six-button section or you can go to the Sketch section and press verify/compile and then upload.
* The sketch is written in the text editor and is then saved with the file extension into. It is important to note that the recent Arduino Modules will reset automatically as you compile and press the upload button the IDE software, however, the older versions may require the physical reset on the board.
* Once you upload the code, TX and RX LEDs will blink on the board, indicating the desired program is running successfully.

****

**Fig 5.12:Selection of Port**

Note: The port selection criteria mentioned above are dedicated to Windows operating system only, you can check this Guide if you are using MAC or Linux. The amazing thing about this software is that no prior arrangement or bulk of the mess is required to install this software, you will be writing your first program within 2 minutes after the installation of the IDE environment.

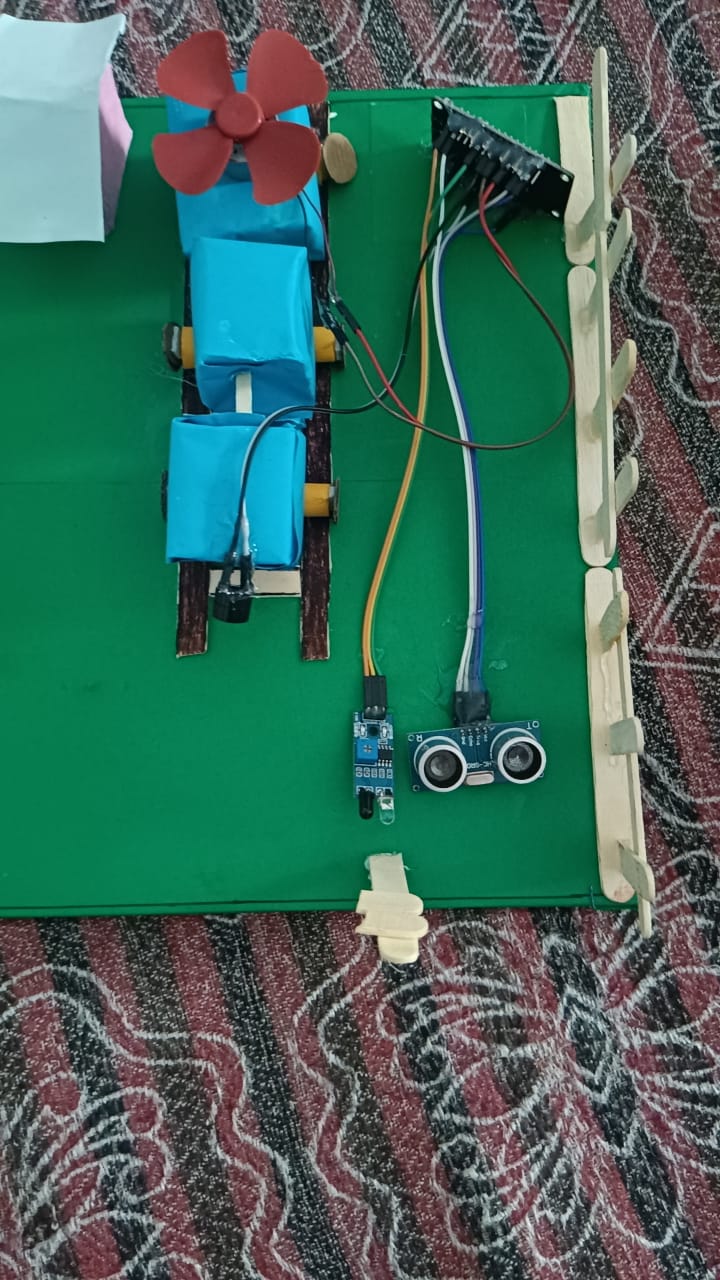
**5.1.6 Uploading**

After writing your code, click on the upload button which is above the window and the code will be directly uploaded into the Node MCU with a cable wire connector.

**CHAPTER - 6**

**RESULT**

This project has proposed to detect faults using IR, Piezo, and Reed sensors. The system has been stimulated using Proteus and a prototype is designed on the basis of the stimulation. The level crossing system is designed to reduce accidents to a very large extent by implanting an automatic gate closer system with new model of gate. This system is the cheapest and efficient of rest all. Furthermore, a prototype is presented, for practical applications the concept can be applied. Environment effects, temperature, and many other factors should be considered for practical application.



**Fig 6: Circuit Diagram**

**CONCLUSION**

In this project, railway track monitoring and accident avoidance. The simulation has been done using proteus and testing has been carried out using the established model. It has remained projected that if the system is applied in railways, trains accidently on the International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) Volume 4, Issue 1, January 2015 71 ISSN: 2278 – 909X All Rights Reserved © 2015 IJARECE track error notices automatically stops train, train collision can be barred and human life saved if this scheme is implemented. The automatic railway gate controller thus can be used in unmanned level crossings to reduce the occurrence of coincidences. Then the scheme is completely automatic it can be used in remote villages where no station master or line man is present. Also, it saves lot of times as it is automated whereas manual systems take time for the line man to inform the station master to close and open the gate which will consume a considerable amount of time. Also, since it is completely automated there are fewer chances for error to occur. Thus, this design is very useful in railway applications.

**FUTURE SCOPE**

In conclusion, the proposed accident prevention system has the potential to improve railway safety by automatically detecting issues and notifying authorities to take timely action. It can also b e implemented for other vehicles to reduce accidents. The future of accident prevention systems in railways entails advanced technologies like AIdriven predictive maintenance, real-time monitoring through IoT sensors, and autonomous train control. Integrating machine learning algorithms for anomaly detection and risk assessment, coupled with robust communication systems, will enhance safety measures. Predictive analytics will forecast potential hazards, allowing proactive measures. Implementing drones for aerial surveillance and deploying smart sensors along tracks will enable swift response to emergencies. Additionally, fostering collaboration with research institutions and industry experts for continuous innovation will be pivotal. Ultimately, these advancements will revolutionize railway safety, ensuring passenger security and operational efficiency.

**SOURCE CODE**

const int trigpin=D1;

const int echopin=D2;

const int b=D5;

const int dc=D4;

const int pir=D7;

void setup() {

pinMode(trigpin, OUTPUT);

pinMode(dc, OUTPUT);

pinMode(b,OUTPUT);

pinMode(echopin, INPUT);

pinMode(pir,INPUT);

Serial.begin(9600);

// put your setup code here, to run once:

}

void loop() {

int PIR=digitalRead(pir);

digitalWrite(trigpin, LOW);

delayMicroseconds(2);

digitalWrite(trigpin, HIGH);

delayMicroseconds(10);

digitalWrite(trigpin, LOW);

long duration=pulseIn(echopin,HIGH);

int distance=duration\*0.034/2;

Serial.print("distance");

Serial.println(distance);

if(distance<10){

analogWrite(dc,0);

}

if(distance>10&&distance==20){

analogWrite(dc,75);

}

if(distance>20){

analogWrite(dc,255);

}

if(PIR==0)

{

digitalWrite(D5, HIGH);

}

else{

digitalWrite(D5, LOW);

}

// put your main code here, to run repeatedly:

}

**THINGSPEAK CODE**

/\*

WriteMultipleFields

Description: Writes values to fields 1,2,3,4 and status in a single ThingSpeak update every 20 seconds.

Hardware: ESP8266 based boards

!!! IMPORTANT - Modify the secrets.h file for this project with your network connection and ThingSpeak channel details. !!!

Note:

- Requires ESP8266WiFi library and ESP8622 board add-on. See https://github.com/esp8266/Arduino for details.

- Select the target hardware from the Tools->Board menu

- This example is written for a network using WPA encryption. For WEP or WPA, change the WiFi.begin() call accordingly.

ThingSpeak ( https://www.thingspeak.com ) is an analytic IoT platform service that allows you to aggregate, visualize, and

analyze live data streams in the cloud. Visit https://www.thingspeak.com to sign up for a free account and create a channel.

Documentation for the ThingSpeak Communication Library for Arduino is in the README.md folder where the library was installed.

See https://www.mathworks.com/help/thingspeak/index.html for the full ThingSpeak documentation.

For licensing information, see the accompanying license file.

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\*/

#include <ESP8266WiFi.h>

#include "secrets.h"

#include "ThingSpeak.h" // always include thingspeak header file after other header files and custom macros

const int trigpin=D1;

const int echopin=D2;

const int b=D5;

const int dc=D4;

const int pir=D7;

char ssid[] = "AIML\_7"; // your network SSID (name)

char pass[] = "KIRANMAI2005"; // your network password

int keyIndex = 0; // your network key Index number (needed only for WEP)

WiFiClient client;

unsigned long myChannelNumber = 2602887;

const char \* myWriteAPIKey = "L112YDI35NNXH7SO";

// Initialize our values

int number1 = 0;

int number2 = random(0,100);

int number3 = random(0,100);

int number4 = random(0,100);

String myStatus = "";

void setup() {

Serial.begin(115200); // Initialize serial

pinMode(trigpin, OUTPUT);

pinMode(dc, OUTPUT);

pinMode(b,OUTPUT);

pinMode(echopin, INPUT);

pinMode(pir,INPUT);

while (!Serial) {

; // wait for serial port to connect. Needed for Leonardo native USB port only

}

WiFi.mode(WIFI\_STA);

ThingSpeak.begin(client); // Initialize ThingSpeak

}

void loop() {

int PIR=digitalRead(pir);

digitalWrite(trigpin, LOW);

delayMicroseconds(2);

digitalWrite(trigpin, HIGH);

delayMicroseconds(10);

digitalWrite(trigpin, LOW);

long duration=pulseIn(echopin,HIGH);

int distance=duration\*0.034/2;

Serial.print("distance");

Serial.println(distance);

if(distance<10){

analogWrite(dc,0);

}

if(distance>10&&distance==20){

analogWrite(dc,75);

}

if(distance>20){

analogWrite(dc,255);

}

if(PIR==0)

{

digitalWrite(D5, HIGH);

}

else{

digitalWrite(D5, LOW);

}

// Connect or reconnect to WiFi

if(WiFi.status() != WL\_CONNECTED){

Serial.print("Attempting to connect to SSID: ");

Serial.println(SECRET\_SSID);

while(WiFi.status() != WL\_CONNECTED){

WiFi.begin(ssid, pass); // Connect to WPA/WPA2 network. Change this line if using open or WEP network

Serial.print(".");

delay(5000);

}

Serial.println("\nConnected.");

}

// set the fields with the values

ThingSpeak.setField(1, distance);

ThingSpeak.setField(2, PIR);

ThingSpeak.setField(3, number3);

ThingSpeak.setField(4, number4);

// figure out the status message

if(number1 > number2){

myStatus = String("field1 is greater than field2");

}

else if(number1 < number2){

myStatus = String("field1 is less than field2");

}

else{

myStatus = String("field1 equals field2");

}

// set the status

ThingSpeak.setStatus(myStatus);

// write to the ThingSpeak channel

int x = ThingSpeak.writeFields(myChannelNumber, myWriteAPIKey);

if(x == 200){

Serial.println("Channel update successful.");

}

else{

Serial.println("Problem updating channel. HTTP error code " + String(x));

}

// change the values

number1++;

if(number1 > 99){

number1 = 0;

}

number2 = random(0,100);

number3 = random(0,100);

number4 = random(0,100);

delay(20000); // Wait 20 seconds to update the channel again

}

**REFERENCES**

[1] Oke Alice O., Adigun Adebisi A., Falohun Adeleye S., and Alamu F. O. , “DEVELOPMENT OF A PROGRAMMABLE ELECTRONIC DIGITAL CODE LOCK SYSTEM” , International Journal of Computer and Information Technology (ISSN: 2279 – 0764) Volume 02– Issue 01, January 2013.

[2] Mohammad Amanullah “MICROCONTROLLER BASED REPROGRAMMABLE DIGITAL DOOR LOCK SECURITY SYSTEM BY USING KEYPAD TECHNOLOGY”, IOSR Journal of Electrical and Electronics Engineering (IOSR - JEEE), Volume 4, Issue 6 (Mar. - Apr. 2013).

[3] Ashish Jadhav, Mahesh Kumbhar, Mahesh Walunjkar, “, PASSWORD PROTECTED DOOR LOCKING SYSTEM” , International Journal of Innovative Research in Computer and Communication Engineering, Vol. 1, Issue 6, August 2013.

[4] P. K. Gaikwad, “DEVELOPMENT OF FPGA AND GSM BASED ADVANCED DIGITAL LOCKER SYSTEM”, International Journal of Computer Science and Mobile Applications, Vol.1 Issue. 3, September2013.

[5] Annie P. Oommen, Rahul A P, Pranav V, Ponni S, Renjith Nadeshan,

[6] Arpita Mishra, Siddharth Sharma, Sachin Dubey, S.K.Dubey, “PASSWORD BASED SECURITY LOCK SYSTEM”, International Journal of Advanced Technology in Engineering and Science, Volume No.02, Issue No. 05, May 2014.

[7] E.Supraja, K.V.Goutham, N.Subramanyam, A.Dasthagiraiah, Dr.H.K.P.Prasad, “ENHANCED WIRELESS SECURITY SYSTEM WITH DIGITAL CODE LOCK USING RF &GSM TECHNOLOGY”, International Journal of Computational Engineering Research, Vol 04, Issue 7, July – 2014.