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# Railway Track Crack Detector & Accident Prevention System

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***Abstract:*** *Using a range of sensors and an Arduino Uno microcontroller, the objective of this project is to build a robot that is capable of detecting accidents on railway tracks. The system's objective is to raise railway safety by identifying track anomalies and responding rapidly to accidents. The system's main components include an Arduino Uno board, an accelerometer, an IR sensor, an ultrasonic sensor, a vibration sensor, a GPS module, and buzzers and vibration sensors. By employing the ultrasonic sensor to find obstacles or barriers on the railway rails, the robot can anticipate potential hazards and respond appropriately. When trains or other vehicles are identified using the IR sensor as they approach the railway crossing, the robot can begin taking preventative measures like stopping or alerting the surrounding workers. A vibration sensor is also integrated to monitor the rails for any unexpected vibrations or anomalies that can indicate the presence of loose components or track defects. The technology can instantly warn the maintenance team in such circumstances, ensuring the railway network continues to function without a hitch.*

## 1. Introduction

By seeing possible accidents or dangers on rails, the Railway Track Detection and Accident Robot initiative aims to improve rail safety. By fusing sensors with a robotic system, this initiative aims to identify track irregularities and alert the appropriate authorities in real-time, preventing potential accidents.

**OBJECTIVE:**

1) Railway track detection: Create a system that uses IR and ultrasonic sensors to detect the existence of a railway track. This will assist the robot in locating the track and adjusting its navigation.
2) Implement a system to identify accidents or obstructions on the railway track. Utilising sensors like vibration sensors, which can detect unusual vibrations or collisions indicative of a potential mishap, makes this possible.
3) Alert system: Integrate a buzzer or other sound-producing device to generate audible alerts in case of an accident or any other hazardous situation. This will help notify nearby individuals or authorities about the incident.
4) GPS tracking is used to detect the robot's current location on the train track. In the event of an accident or emergency, this information can be utilised to track the robot's whereabouts and ascertain its exact location.

**PROBLEM STATEMENT:**

1) Implement a technique to identify obstructions on the railway tracks in order to prevent accidents. The robot should be able to recognise items, such as debris, animals, or other barriers, and avoid collisions by taking the necessary action.

2) Real-time Location Information: Include a GPS module to show the robot's current location. The robot's position may be tracked using this information, and it can be made sure it stays within the set track area.
3) Use a vibration sensor to look for unusual vibrations on the tracks that could be signs of a derailment or structural damage. Such scenarios should be easy for the system to recognise and react to.
4) Implement a buzzer or alarm system to alert local railway employees or other appropriate authorities in the event of any accidents or unusual occurrences. To notify people about potential risks, the system should emit auditory warnings.

## 2. Literature Survey

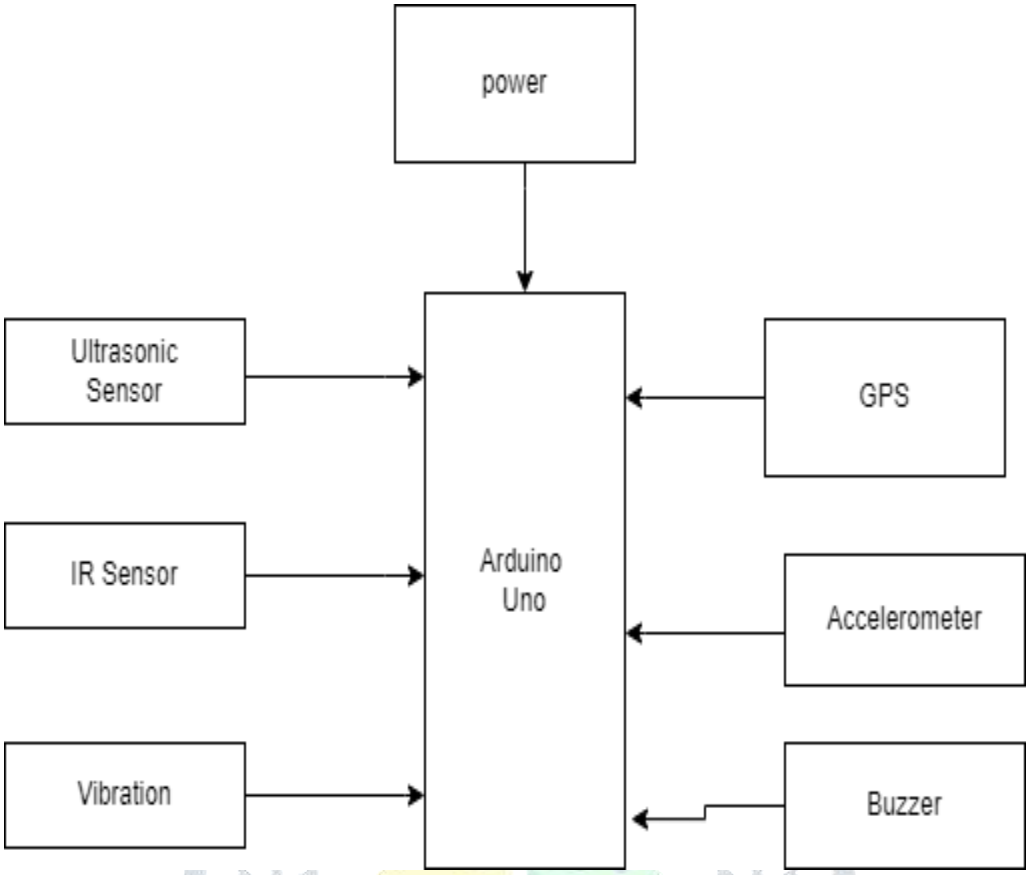
**Prevention of Railway Accident using Arduino Based Safety System: A case Study of Addis Ababa Light Rail Transit Adoh Lucky Ugochukwu1*, Akello Fiona Mercy2 , Nyangassa Faraja2 , Ishimwe Pascasie2.**
There is a need to look at various ways to prevent or reduce the frequency and severity of these accidents by using an Arduino-based safety system to mitigate this accidents. Obstacles in the train's right of way, smoke inside the train, and flooding on the track can all result in derailment, collision, injuries to train passengers, environmental damage, and loss of property. The purpose of this work is to simulate a programme in Proteus to find smoke in the train, flood on the railway track and obstructions in the path of trains. To identify obstacles on the track, fire in the trains, and floods in the railway track, Arduino code is created and Proteus simulations are performed.

**RAILWAY TRACK CRACK DETECTION SYSTEM BY USING ARDUINO MICROCONTROLLER N. L. Bhojwani, A.S. Ansari, S. S. Jirge, M. B. Baviskar, D. N. Pawar**.
The cheapest and most practical form of long-distance and suburban traffic as well as passenger transit in India is provided by railways. In India, the railway network handles around 80% of all transportation. Rail track crossings and undetected cracks in rail tracks are the primary causes of accidents that occur on trains. About 60% of accidents occur at railway crossings and are caused by a fracture in the rails, costing people their lives and their money. Therefore, there is a need for new technology that would be reliable, effective, and stable for both item recognition and crack detection in railway track.

**Detection of Crack in Railway Track using Ultrasonic Sensors Anushree B.S, 2Priyasha Purkayastha, 3Anjali Girgire, 4Anjana K, 5Ruma Sinha.**
If a break in a railway track is not discovered in the early stages in a country like India, where the majority of people depend on trains for transportation, it could result in a derailment and cause significant loss of human life and property. This research proposes a crack detection method that locates the defect using GSM and detects the crack without the need for human participation. By using this technology, cracks can be found both during the day and at night, and the precise location of the fault can be determined. Rail, ultrasonic sensor, and fracture detection are all index terms.

# 3. System Design

**SYSTEM ARCHITECTURE:**




# 4. Methodology

**Hardware setup:**

1) Connect the Arduino Uno to your computer and install the necessary drivers.
2) Connect the ultrasonic sensor to the Arduino Uno. This sensor will be used to detect obstacles or objects on the railway track.
3) Connect the IR sensor to the Arduino Uno. This sensor will help in detecting the presence of a train or any other obstruction on the track.
4) Connect the vibration sensor to the Arduino Uno. This sensor will detect abnormal vibrations, which could indicate an accident.
5) Connect the GPS module to the Arduino Uno. This module will provide the location information.
6) Connect the buzzer to the Arduino Uno. This will be used to sound an alarm in case of emergencies.
7) Connect the accelerometer to the Arduino Uno. This sensor will measure acceleration and help detect sudden changes or impacts.

**Arduino uno:**

An open-source microcontroller board called Arduino UNO is built around the ATmega328P. The Arduino LLC in Italy created and produced it. It has a 16 MHz quartz crystal, 6 analogue inputs, 14 digital input/output pins, a USB port, and a power jack. The board comes with a variety of sensors that can be expanded to meet project requirements, including a temperature sensor, light sensor, and humidity sensor. Arduino UNO is popular for a variety of do-it-yourself electronics projects, robotics, and Internet of Things applications thanks to its straightforward and approachable user interface.

A microcontroller board called Arduino Uno is based on the ATmega328P (datasheet). It has a 16 MHz quartz crystal, 6 analogue inputs, 14 digital input/output pins (of which 6 can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button.

**Working:**

The Arduino UNO board controls a number of sensors and actuators using the ATmega328P microprocessor. The Arduino Integrated Development Environment (IDE) is used to build a programme, or sketch, which is then uploaded to the board over USB to control the microcontroller. After the sketch is uploaded, the microcontroller executes the programming and interacts with the connected sensors and actuators in accordance with the logic outlined in the sketch. As an illustration, a sketch may be made to read the temperature reading from a temperature sensor and, if the temperature climbs beyond a predetermined threshold, to turn on an LED.

Analogue signals from sensors, such as those that detect temperature or light, can be measured using the board's analogue inputs, which then convert the analogue data into a digital signal that the microcontroller can process. A variety of actuators, including as LEDs and motors, as well as sensors, such as buttons and switches, can be connected to the digital I/O pins. In summary, the Arduino UNO board's ATmega328P microprocessor controls and communicates with a range of sensors and actuators in accordance with the logic laid out in a programme produced in the Arduino IDE.

**SIM 800L GSM/GPRS Sensor with module:**

The SIM800L is a compact, quad-band GSM/GPRS module with a large market. It is designed to be used with GSM-required apps, such as those that need GPRS Internet connectivity, SMS sending, and phone calls. Some of the main features of the SIM800L include low power consumption, a small physical dimension, and an industry-standard interface for easy integration into a range of applications. Because it is compatible with the AT command set, the module is easy to use and incorporate into an existing system.


Powering up : The SIM800L is powered up by providing a voltage supply of 3.4V to 4.5V to the VCC pin. Once powered up, the module performs a self-check and initializes itself.

Inserting a SIM card : The module requires a SIM card to be inserted into the SIM card interface in order to connect to a mobile network.

The SIM800L searches for available mobile networks and tries to connect to the one with the strongest signal before connecting to the network. After establishing a connection, the module issues an AT command to join the network and request an IP address.

SMS messaging: Using the AT command interface, the module facilitates sending and receiving SMS messages. By sending an AT command to the module, the user can send SMS messages, and the module will deliver the message through the mobile network.

Making voice calls: Using the AT command interface, the module facilitates making voice calls. By giving the module an AT command, the user can start a call, and the module will connect the call over the mobile network.

Internet connectivity: The SIM800L enables GPRS-based Internet access. By giving the module an AT command, the user can start a GPRS connection, at which point the module will use the mobile network to establish a connection to the Internet.

## 5. Conclusion

We were able to develop a system that integrates a number of sensors and technologies to increase railway safety during the life of the project. The ultrasonic sensors help identify the presence of obstacles or objects on the rails, while the IR sensors help determine where the train is on the track. The vibration sensor is crucial for identifying unexpected vibrations or derailments and for quickly alerting users to prevent accidents. The GPS module helps to locate the train precisely and provides the system with up-to-date data.

The buzzer warns the train driver and nearby staff of any possible hazards as they are discovered, enabling them to take the necessary action right away. The accelerometer also helps the system determine the train's stability by sensing the train's tilt and acceleration. The initiative intends to reduce accidents and increase railway safety by integrating these parts and sensors and sending out alerts and early warnings. The Arduino Uno serves as the main control component, processing data from various sensors and carrying out the necessary operations in accordance with predetermined algorithms.

The Railway Track Detection and Accident Robot project, in its entirety, offers a creative and effective technique to improve safety protocols in railway systems. Through the integration of numerous sensors and technologies, possible risks can be identified early, allowing for the prompt application of preventive measures to reduce accidents and protect the safety of both passengers and railway workers.

## 6. References


1) RAILWAY TRACK – CRACK DETECTION SYSTEM BY USING ARDUINO MICROCONTROLLER N. L. Bhojwani, A.S. Ansari, S. S. Jirge, M. B. Baviskar, D. N. Pawar, International Journal of Engineering Applied Sciences and Technology, 2021 Vol. 6, Issue 5, ISSN No. 2455-2143, Pages 288-292
2) CHETHAN S,VIVEK PURUSHOTHAM,RAGHU J, VINEETH V "Railway Track Crack and Break Detection System with Onboard Signalling" JETIRCD06001 Journal of Emerging Technologies and Innovative Research (JETIR) www.jetir.org
3) "Prevention of Railway Accident using Arduino Based Safety System: A case Study of Addis Ababa Light Rail Transit: Adoh Lucky Ugochukwu1*, Akello Fiona Mercy2 , Nyangassa Faraja2 , Ishimwe Pascasie2 International Journal of Engineering Research & Technology (IJERT) Vol. 8 Issue 09, September-2019
4) Akash Jaina, David W. Grevea, Irving J. Oppenheimb, "Experiments in Ultrasonic Flaw Detection using a MEMS Transducer", Department of Civil and Environmental Engineering Carnegie Mellon University.
5) K. Steell, G. Benny, A. McNab, G. Hayward, "A WIRELESS ULTRASONIC NDT SENOR SYSTEM" in UKRCNDE Center for Ultrasonic Engineering, Glasgow, UK:Strathclyde University.
6) Leandro A Villas, Daniel L. Guidoni, Jo Ueyama, "3D Localization in Wireless Sensor Networks Using Unmanned Aerial Vehicle", 2013 IEEE 12th International Symposium on Network Computing and Applications.
7) Lukas Krasula, Milos Klima, Eric Rogard, Edward Jeanblanc, "MATLAB - Based applications for Image Processing and Image Quality Assessment", Dept. of Radioelectronics Czech Technical university in Prague Technicka 2 166 27 Prague 6 Czech Republic.
8) J. W. Kim, S. B Kim, J. C. Park, J. W. Nam, "Development of Crack Detection with Unmanned Aerial Vehicles and Image Processing", The 2015 World Congress on Advances in Structural Engineering and Mechanics (ASEM'15), August 2015.
9) K.N.Sreekumar, G.Sankar, M.Kumaresan,"Robust Railway Crack Detection Scheme Using ARM IRTRDS Algorithm", Journal of NanoScience and NanoTechnology, Vol. 2, Issue 5, Spring Edition.