

Railway Track Security System



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Declaration

Thesis Submission to the Department of Computer Science and Engineering BRAC University, Dhaka, submitted by the authors for the purpose of achieving the degree of Bachelor in Computer Science and Engineering. We, hereby announce that, this thesis is based on the results we have found by ourselves. Resources taken from any research done by other researchers are mentioned through reference. This Thesis, neither in whole nor in part has been previously submitted for any other degree or any other publication.

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Abstract

Transport plays a vital role to carry the passengers and goods from one place to another. Among all the forms of transportation, railway is the most significant one. Now-a-days the railway network has become highly prone to accidents. So, proper inspection is needed regarding this issue. Manual observation of the tracks is quite impossible and impractical. Hence to avoid this hindrance and improve the accuracy, we are proposing an automated inspection system. The proposed system will identify collision of two trains on the same track and also provide automated road crossing security using FSR (Force Sensitive Resistor) sensors. Moreover, the system will detect any kind of breakage using vibration sensor and obstacle using LDR and Laser sensors. In case of any kind of error, the microcontroller will get the signal and the system will convey the message through GSM module to the nearest control room for necessary aid.

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Chapter 1

Introduction

Railways provide the cheapest and most convenient mode of passenger for both distance and suburban traffic. It also plays an important role in the development and growth of industries. Railways help in supplying raw materials and other facilities to the factory sites and finished goods to the market. So, safety and reliability should be highly considered in the case of railway. As it is playing a vital role in growth of the economy, so the importance of having modern and improved railway system is increasing day by day. However, the present scenario of the railway is quite different. Railway mishap has become a common issue now-a-days. This become a daily news losing many lives by the train accidents.

Railway maintenance is very tough to manage through any kind of manual system. So, an automated system is an urgent need to stop all kinds of unwanted accidents of railway.

This kind of accident is basically occurs for the very little ignorance like small crack on the rail track or missing fishplate from the track but the consequence of those things is very acute. During the development of this system, mainly focuses on some important factors e.g. Reliability, Accuracy, Efficiency and cost effectiveness. Every year, losing a huge amount of lives due to the collision of two trains on the same track. There is no such technology to stop the train engine immediately to avoid the collision in our country. Moreover, there is no effective technology in the country to identify the crack or breakage. Besides these, in most of the cases, many accidents happen because of the miscommunication of rail level crossing and the passers -by. This system will also work to avoid this kind of

mismanagement of the track and have a systematic way of maintenance. Firstly, there will be FSR sensors to sense the train on the track and based on the data of FSRs it will avoid collision between trains. The system will send notification about collision. Secondly, a systematic way will be there to make the road crossing automated.

On the other hand, to detect the breakage of the track and obstacle the vibration sensors and LDR, Laser sensors will be used respectively. This project is cost effective and simple due to the low consumption electronic components.

1.1 Motivation

Railway is one of the most significant transportation mode of our country but it is a matter of great sorrow that, railway tracks of our country are very prone. That's why, a huge number of accidents are occurred every year due to this primitive type of rail tracks and as the consequences of those accidents we lose huge number of lives every year.

This types of incidents motivate us to think over the above mentioned issue and take necessary steps to protect those lives. Through our proposed system, we need to establish more modern and secure railway system. Besides this, there is no such type of technology or system in our country which can stop the collision between two trains coming from the opposite direction of each other on the same track. We actually think over this matter and motivated to do so.

Moreover natural disaster can throw any object on the rail track which cannot be removed very quickly in the remote area. We thought if our system can detect those object or barrier and inform to the control room then they can take necessary steps

to avoid accident. Our system will also reduce the maintenance costs of railway system.

Along with these things, as our railway system is too old, it does not have any modern system or way to make the level crossing automatic. We often see this thing is done manually by the authority of the rail tracks. We thought that, if we can make this thing, automatic it will make this job quite easier. Thus, we are motivated to do this job in our system.

1.2 Overview

Our system is a modern and automated solution to inspect the railway tracks. It will reduce the sufferings of inspecting the conditions of the rail tracks manually. Our proposed system has four modules to make the inspection system modern. Our system will detect two train on the same track to avoid collision between them. Including this, it will make the level crossing system automatic. Besides these it will detect heavy obstacle on the rail track and will detect the breakage and the missing rail on the tracks.

1.3 Objectives

- Stop the collision between the two trains on the same track. FSR (Force Sensitive Resistor) will be used for this purpose. The data will be taken from the Sensors and based on that data, the trains will be stopped at a safe distance. Message of the train locations and the chances of collision will be sent using GPS and GSM module to the control room.

- Make the level crossing automatic, in order to do so, FSRs will be set on both side of the crossing area. The line bar of the track will be open up or shut down using the microcontroller based on the data of the FSRs. The passing of trains or other vehicles will be quite easier due to this and accidents or unwanted events could be avoided.
- Detect the obstacle on the rail track. In order to detect the obstacle on the tracks, Microcontroller and sensors like vibration, LDR and laser will be used. Sensor will sense the obstacle on the track and microcontroller will take the decision to transmit and receive the signal of the sensors. GPS and GSM module will be sent the location and message to the control room about the incident.
- Detect the breakage on the rail track. Vibration sensor [5] will detect the fault on the tracks. If it finds any fault [9], then microcontroller will process the signal and an alert message will be sent to the control room through GSM module.

1.4 Thesis Outline

Chapter 1 is basically formal introduction of our thesis. We have discussed motivation, objectives, and overview of our thesis here.

Chapter 2 is about the background study and literature review which we studied before the implementation of our system.

Chapter 3 is focused on the design and working methodologies of our system.

Chapter 4 is about the data and result analysis about our research which we have done during the implementation period.

Chapter 5 here we conclude our project, we also discussed about the challenges we face while implementing our project. Moreover, here we discussed about the limitations and future plans of our system.

Chapter 6 is all about the references and citations.

Chapter 2

Literature Review and Background Study

2.1 Literature Review

Firstly, we had a survey of existing technologies of automatic track security. This survey helped us to understand which technologies are suitable for our system which will make more efficient and easy to use. From all the developed or established system worked only one or two parts of the whole system. Here, we give a short review of the technologies which are already developed.

Collision is one of the major issue of train accidents in every country. To make an anti-collision system, author provide a system by using DLSR (Digital Single-Lens Reflex) sensor [6]. This technology will identify the collision points and also send the distance of two train to the control room. It will monitor the system to slow down the speeds of trains. Author also used. LED and LCD panel to find if two trains are in same track or different track [6].

Obstacle detection is another important part of railway security system. For detecting obstacle system need to sense train arrival so author used vibration sensor [4]. To sense the obstacle in the path of trains obstacle sensor is used and send signal to microcontroller. Author divided the rails into several blocks and all blocks consisted of laser sensors and microcontroller. The laser sensor mainly send signal to train either to stop or continue to run [4].

Vision based method [7] is used for automatic railroad track inspection. In this system, camera plays a vital role to capture and collect the images and videos. Author used image processing and MUSIC algorithm in this system. Image

processing helped to process the frame image and MUSIC algorithm helped to detect number of signal in the presence of noise [7].

2.2 Background

Railway track security is the prime concern of our project. We think if we can give proper security to the railway tracks, it will be so helpful for the transportation system of our country and this will also help a lot in the economic development of our country. We are basically using the following components to build our project. As this is a hardware dominating project, so the components we are using are mainly hardware components.

2.3 Equipment and Components

The following devices are used to build our project.

- 1) Arduino Uno
- 2) Arduino Mega
- 3) GSM
- 4) Sonar Sensor
- 5) Servo Motor
- 6) FSR
- 7) LDR sensor
- 8) Laser
- 9) Vibration sensor

2.4 Description of the Hardware

○ Arduino Uno

The Uno is a microcontroller board based on the ATmega 328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, 16 MHz quartz crystal, 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 an AC-to-DC adapter or battery to get started. It needs 20 mA DC current which is very suitable for the board to control the sensors. The task of programming is hassle free here, because of the availability of the USB connection. We can easily use our personal computer for that purpose. The weight of arduino uno board is 25 g, so it is quite easy to carry.



Figure 1 Arduino Uno

○ Arduino Mega

Arduino Mega is a microcontroller board based on the ATmega 2560. It has 54 digital input/output pins. It has 16 analog input, 4 UARTs (Hardware Serial ports). It has 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller. Its clock speed is 16MHz, length is 101.52 mm, and width is 53.33 mm and weight 37 g. The mega is compatible with most shields designed for arduino.

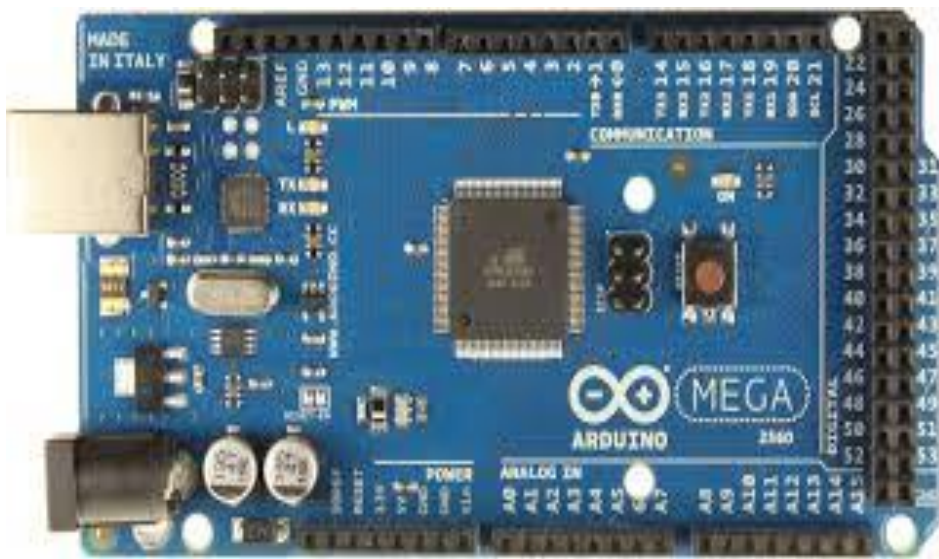


Figure 2 Arduino Mega

○ GSM Shield

The GSM shield by Arduino is used to send/ receive messages and make/receive calls just like a mobile phone by using a SIM card by a network provider. We can do this by plugging the GSM shield into the Arduino board and then plugging in a SIM card from an operator that offers GPS coverage. The shield uses a radio modem M10. It works under different frequencies. In GSM Shield it is possible to communicate with the board using AT commands. The GSM library has a huge no. of methods to communicate with the shield. The shield uses digital pins 2 and 3 for software communication with the shield. We have to connect the pin 2 with the TX and 3 with the RX. To interface with the cellular network, the board required a SIM.



Figure 3 GSM SIM900A Shield

○ Sonar Sensor

Sonar sensor is an ultrasonic ranging module. It consists of transmitter, receiver and control circuit. It has four pins, such as- VCC, GND, Trigger and Echo. It can measure distance of 2-400 cm using sound waves in the range of 40 kHz which is above the range of human audibility. Whenever the ultrasonic encounters an obstacle ahead it reflects back to the sensor. It uses IO trigger for at least 10µs high level signal. For this sensor Trigger is the pulse input, Echo is the pulse output. 0V is for the ground. Its working voltage is 5V. Anyone can easily interface it with microcontroller and Arduino board.



Figure 4 Sonar sensor

○ LDR Sensor

An LDR or light dependent resistor is also known as photo resistor, photocell and photoconductor. It is a one type of resistor whose resistance varies depending on the amount of light falling on its surface. When the light falls on the resistor, then the resistance changes. These resistors are often used in many circuits where it is required to sense the presence of light. These resistors have a variety of functions and resistance. For instance, when the LDR is in darkness, then it can be used to turn ON a light or to turn OFF a light when it is in the light. A typical light dependent resistor has a resistance in the darkness of 1M Ω , and in the brightness a resistance of a couple of K Ω .

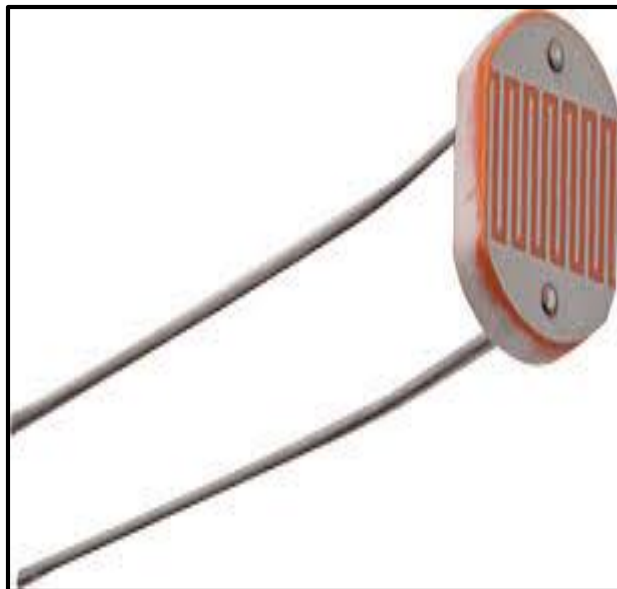


Figure 5 LDR sensor

○ Laser

A laser is a device that emits light through a process of optical amplification based on the stimulated emission of electromagnetic radiation. The term "laser" originated as an acronym for "light amplification by stimulated emission of radiation". The red light laser has output corresponding to the red region of the spectrum. Red is considered the wavelength range from 622 nm to 780 nm.

○ Servo Motor

Servo motor is one kind of device, which is used to receive a control signal that represents a desired output position of the servo. It consumes power as it rotates to the commanded position. It is a close loop servo mechanism, it uses its position feedback to control its motion and final position. In the simplest case only the position is measured. The measured position of the output is compared to the command position if it differs from that, an error is generated which can cause to rotate the motor in any direction. It is generally used as a high performance alternate of stepper motors. It is a coreless motor. It has a connector of length 150 mm.



Figure 6 Servo Motor

○ FSR (Force Sensitive Resistor)

FSR (Force Sensitive Resistor) is one kind of resistor which vary its resistance on the amount of how much pressure it is getting from its sensing area. It is basically work on the principle that, the harder the force it receives, the lower the resistance it gives. The two pins extend from the bottom of the sensor 0.1 pitch make its breadboard friendly. There is a peel and stick rubber backing on the other side on the sensing area to mount the FSR. Overall, this sensor is easy to set up and great for sensing pressure.

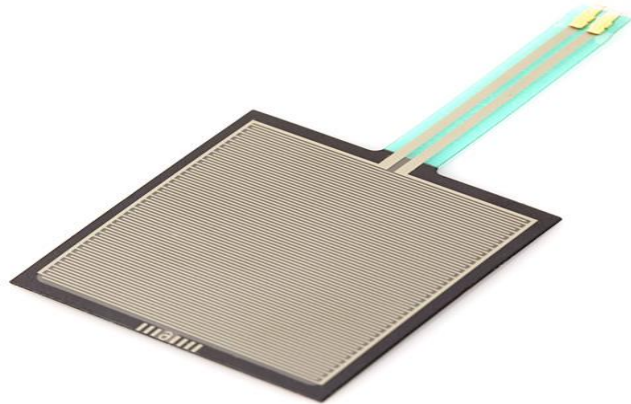


Figure 7 FSR (Force Sensitive Resistor)

○ Vibration Sensor:

The basic piezo sensor works through flex and touch. When it moves back and forth, it creates a voltage of upto ± 90 v. A simple resistor is used to get down the voltage to ADC level. It has solderable crimp pins. It has wide dynamic range .It is laminated for higher voltage output. It is friendly with 0.1" breadboard.



Figure 8 Vibration sensor

Chapter 3

Working Methodology

There will be Arduino as a microcontroller, GPS, GSM shield [13] and FSR sensors to build our system. In our system implementation, FSR is used very vastly. Firstly we have used FSR sensors to detect two trains on the same track to avoid collision. Secondly it is also used to make the level crossing system automated. In implementation section we have used GPS to detect the location of the trains and GSM shield to convey the alert messages about the possible risk. Moreover, we have used some other components such as, Sonar, sensor, buzzer, servo motor to make our system more efficient.

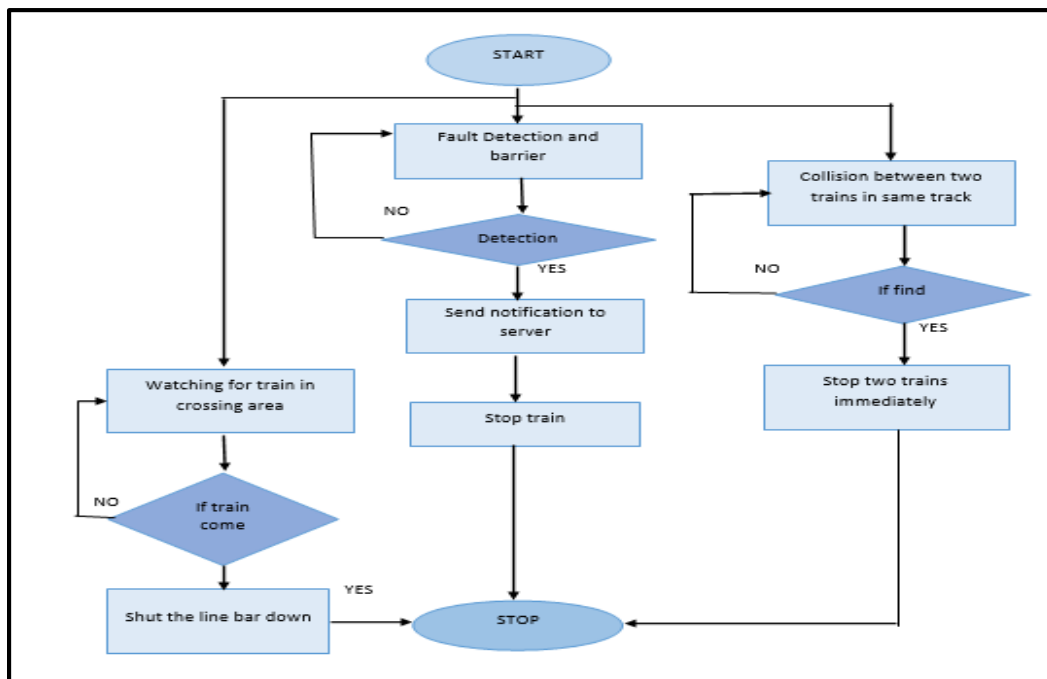


Figure 9 Flowchart of Whole System

3.1 System Model

3.1.1 Collision Detection

In this system, FSR sensors will set after every 500m. Every FSR location and every train's unique identity number and phone number will set in system database. Every train has GPS which will give exact train location [13] and save it in database. When the train starts running, the location of it will up-to-date after 500m. GSM will send a message that is online when system starts working. FSR sensor senses the force and identifies the train on track.

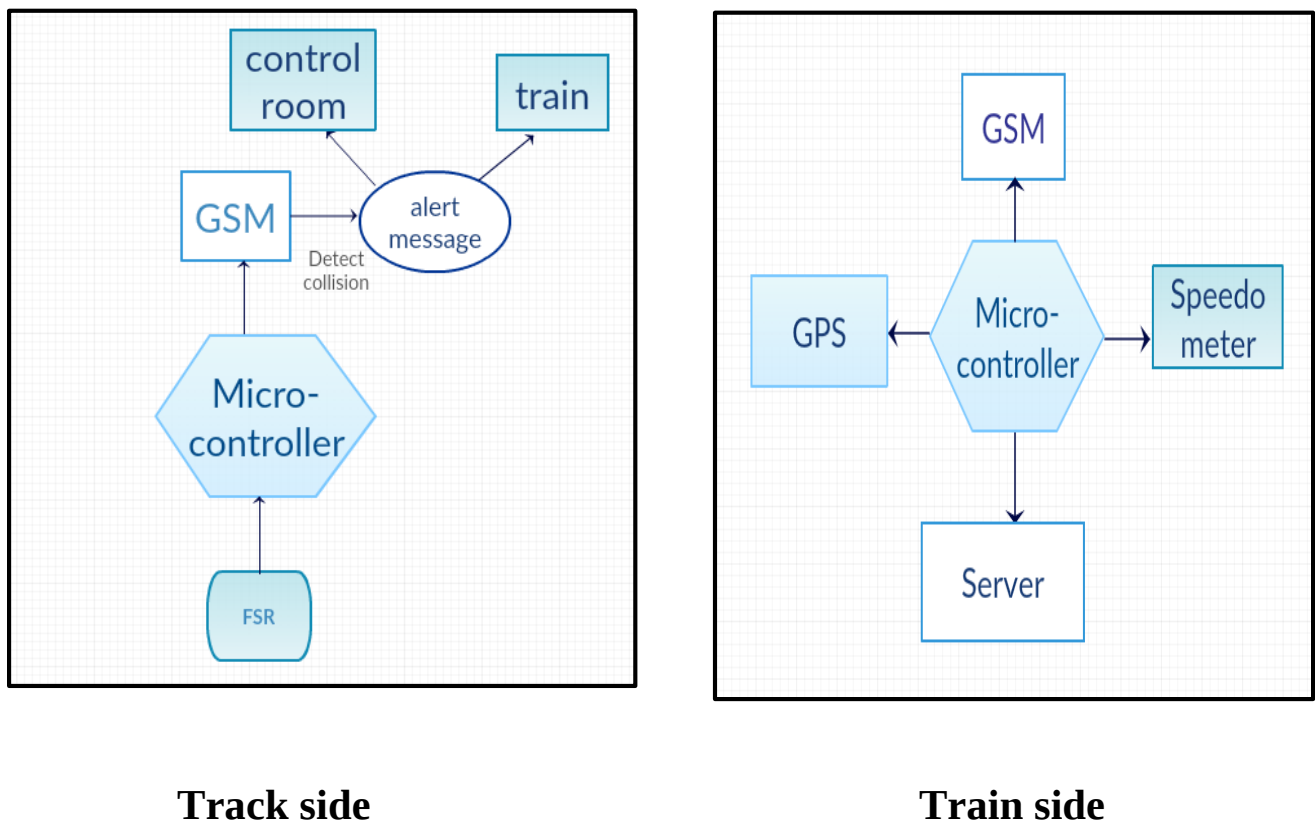


Figure 10 System model of Collision detection

Collision detection is one of the core objectives of this system. FSR sensors will detect collision to stop the trains. When FSR detects collision, system will search all the trains within 5km from the collided area. System will analyze which train's locations are equal to collided FSR's location from the database. After that, GSM shield will notify all the trains within 5 km from collided FSR to slow down the speed. Moreover, GSM will alert that exact two trains and control room by message. FSR will stop the particular two trains of the collided track to stop the collision and distance between them will be 1km.

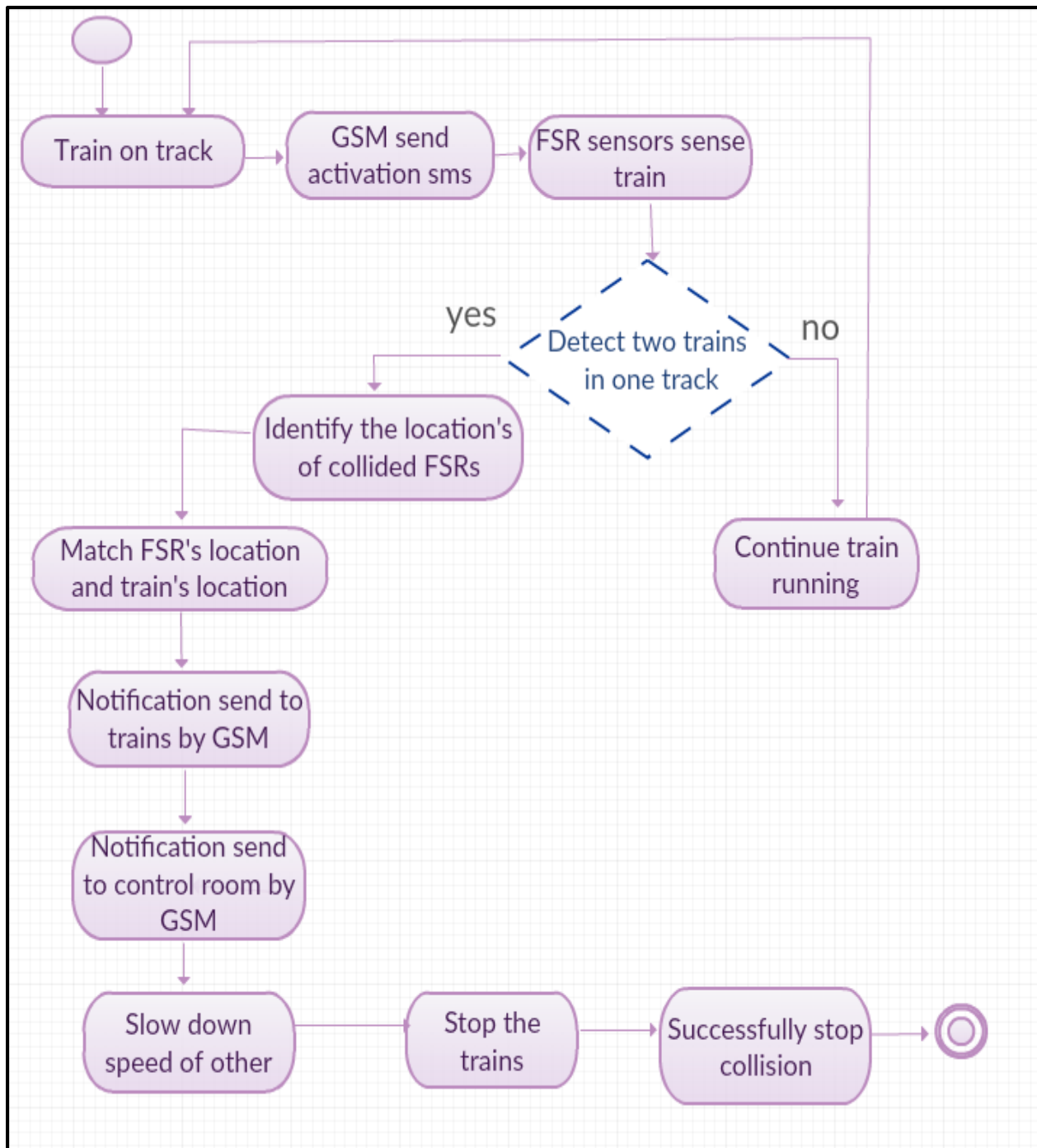


Figure 11 Collision Detection Activity diagram

3.1.2 Automated Road Crossing

In this system, FSR sensor will sense the train and the microcontroller will shut the line bar down automatically. After train cross the track, the line bar will be up for the vehicles. We will use the GSM shield here to make the system more efficient as no internet connection will be needed. This system will reduce the pressure of handling the line bar manually. When the FSR sensor will sense the train, the buzzer will be rung, after that, the liner bar will automatically get down and no vehicle can pass through the track. On the other hand, when the train will go away, then the line bar will be up for the other vehicles to pass through the rail track.

Track side

Train side

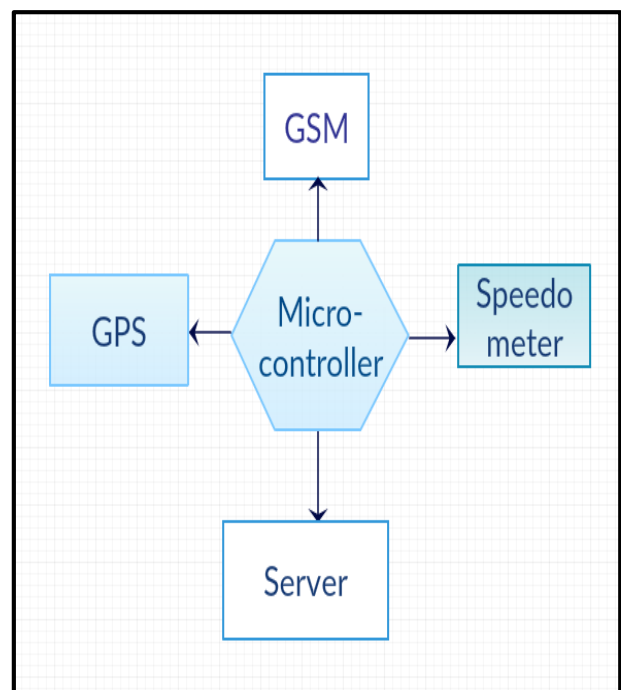
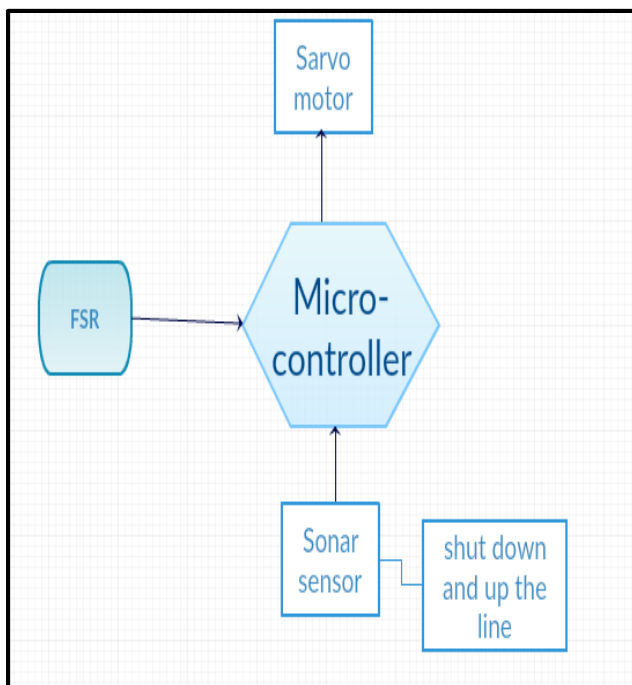


Figure 12 System model of automated rail crossing

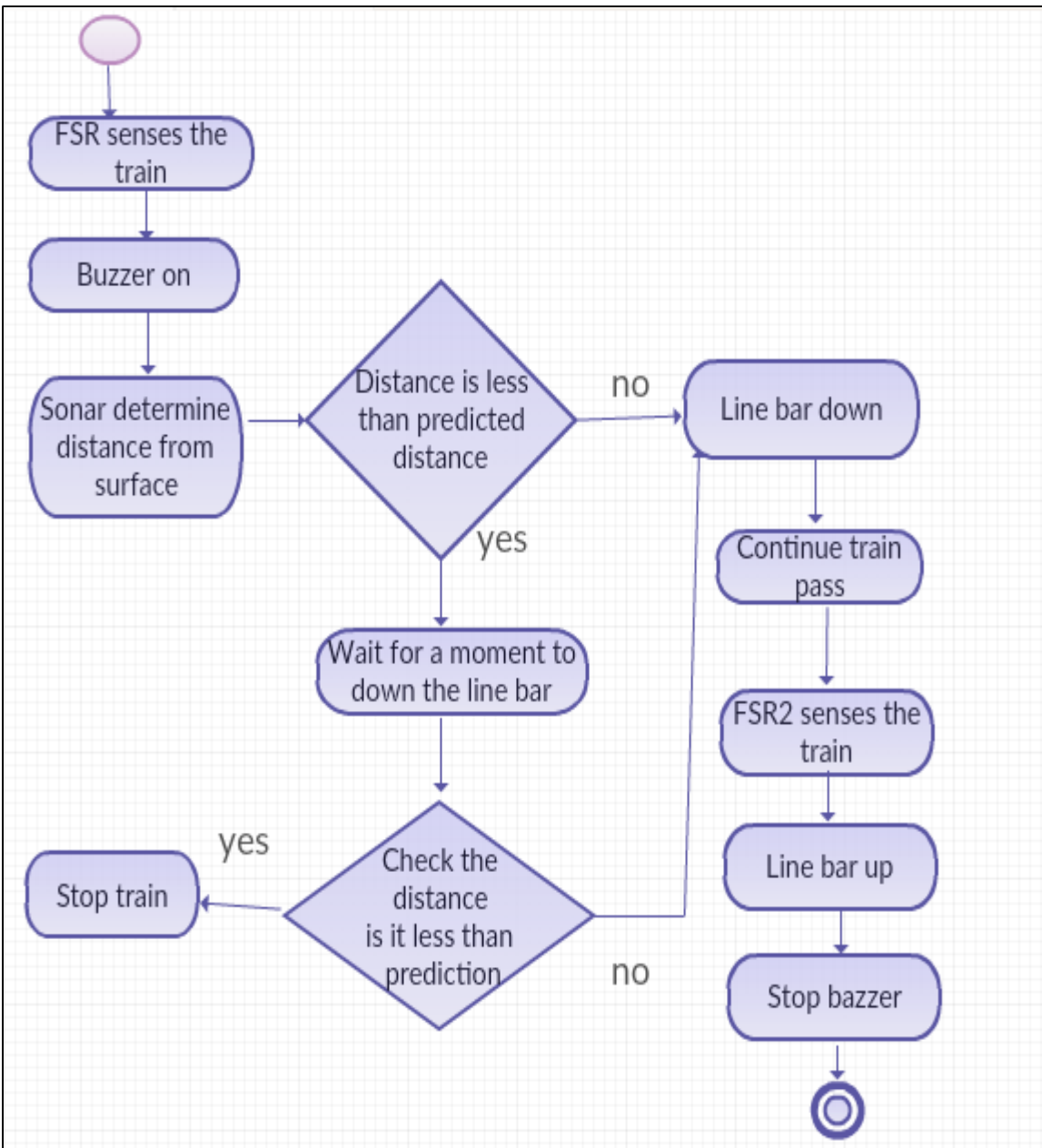


Figure 13 Automated rail crossing Activity diagram

3.1.3 Breakage Detection

Breakage and crack as well as missing rail on the railway track is a common reason for train accident. The proposed system can detect any crack and missing rail on the railway track and alert the control room with the location where breakage is detected. Piezo vibration sensors will be used to detect faults on the railway track and GSM shield will be used to convey the message with the help of a microcontroller. There will have some predefined data sets of probable graph based on the input of piezo vibration sensors and the mass and velocity of train, the value of different train's velocity and different mass versus vibration sensor in the database will be stored.

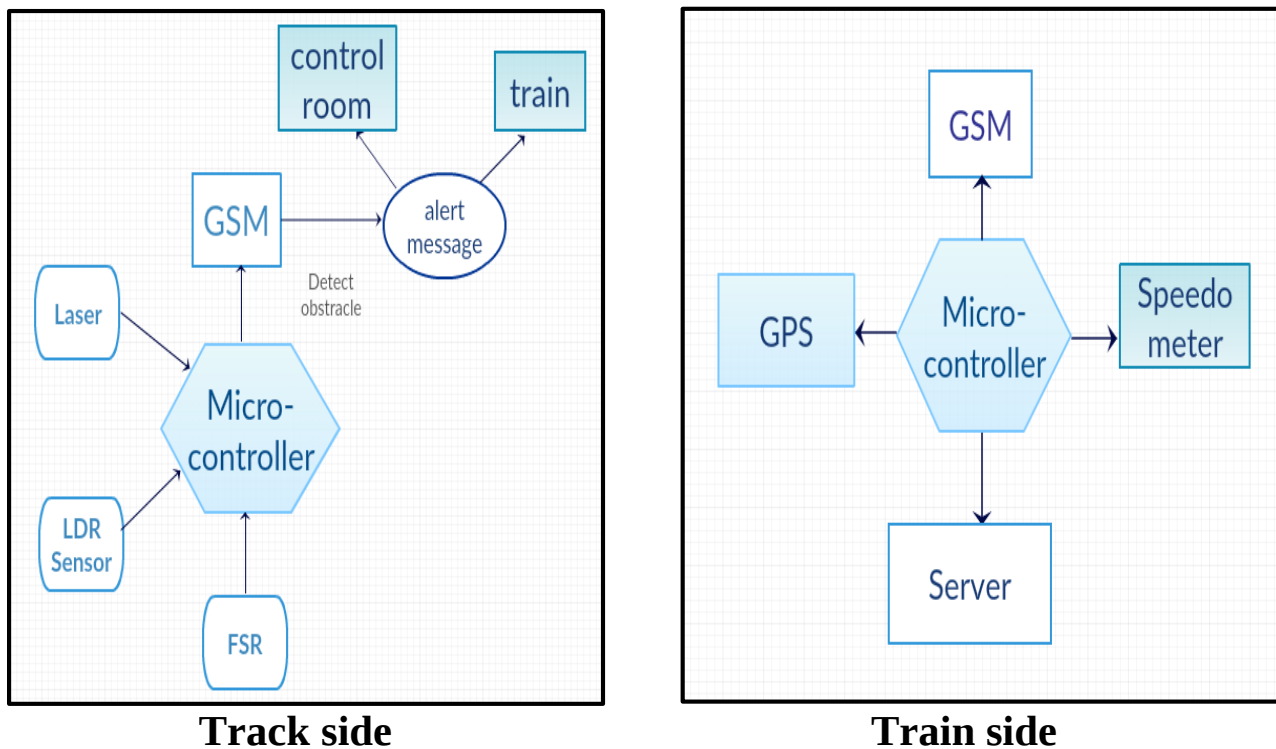


Figure 14 System model of breakage detection

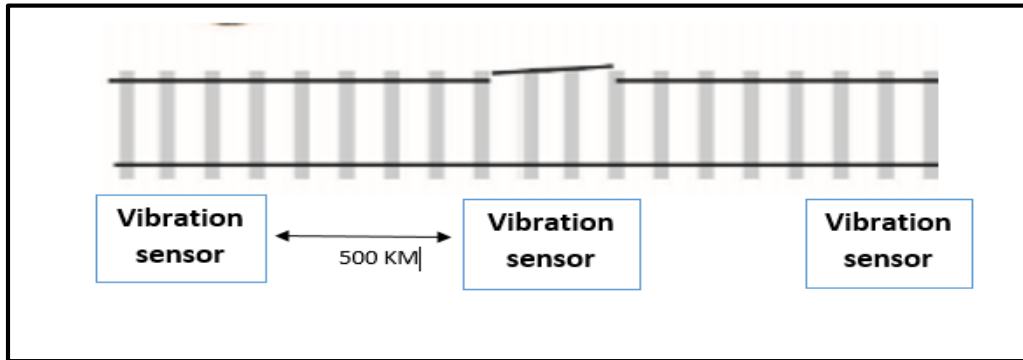


Figure 15 Breakage detection

Sensor will be placed after every 500m in the track. In normal case if a train runs in V mph and the wait is M kg then based on the input of sensor microcontroller will generate a graph considering train's velocity and mass after that the microcontroller will match this graph with the each probable graphs in database, if it matches or is close enough with probable graph then there is no problem in the track. But if does not match that means there is a breakage or something wrong in the track.

$$P_{\text{value}} \propto \frac{1}{MV} \dots\dots\dots (3.1.3)$$

Where,

P_{value} = Peizo vibration sensor analogue value

M = Mass of the train

V = Velocity of train

Vibration sensor value is inverse proportional to mass * velocity of the train. The graphs follow this equation.

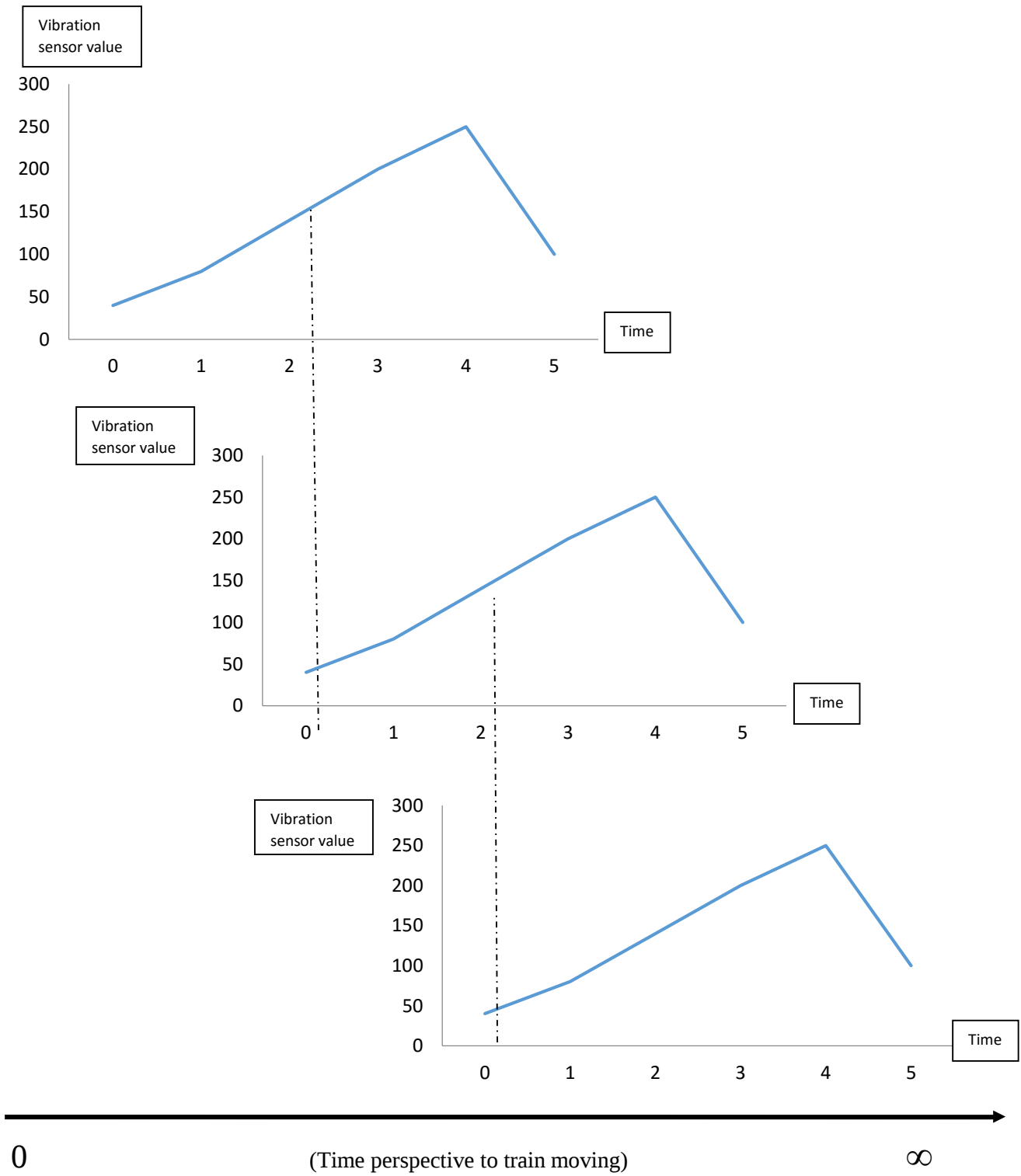


Figure 16 Graph of Vibration Sensors

In Figure -16 there are three active vibration sensor's graph are shown. The straight line below the graph is time perspective to train moving. It is assumed that each train starts from 0 and run up to infinity that means until the road has finished train will move on. Though the sensors can sense the appearance of train almost from 1km away, but still for better security each sensors will be placed after 500m. Considering Figure -16 the 1st sensor will start getting input for creating the graph when the train will be 500m away from the sensor it won't be 0 because it actually start sensing when the train is 1km far away from the sensor. Then as much as the train come closer to sensor the frequency will be getting higher and the analogue value of the sensor will be getting larger. When the train will be exactly on the sensor the value of sensor will be highest, after then value will start decreasing. Each sensor will work in the same manner. If a train cross over that three sensors system will generate three graphs like Figure-16. Here each graph will be checked to be matched with the probable graphs. If it does not match or not even close enough with the probable graphs then system will send notification to the nearest control room and notify the train to stop before reaching the next sensor.

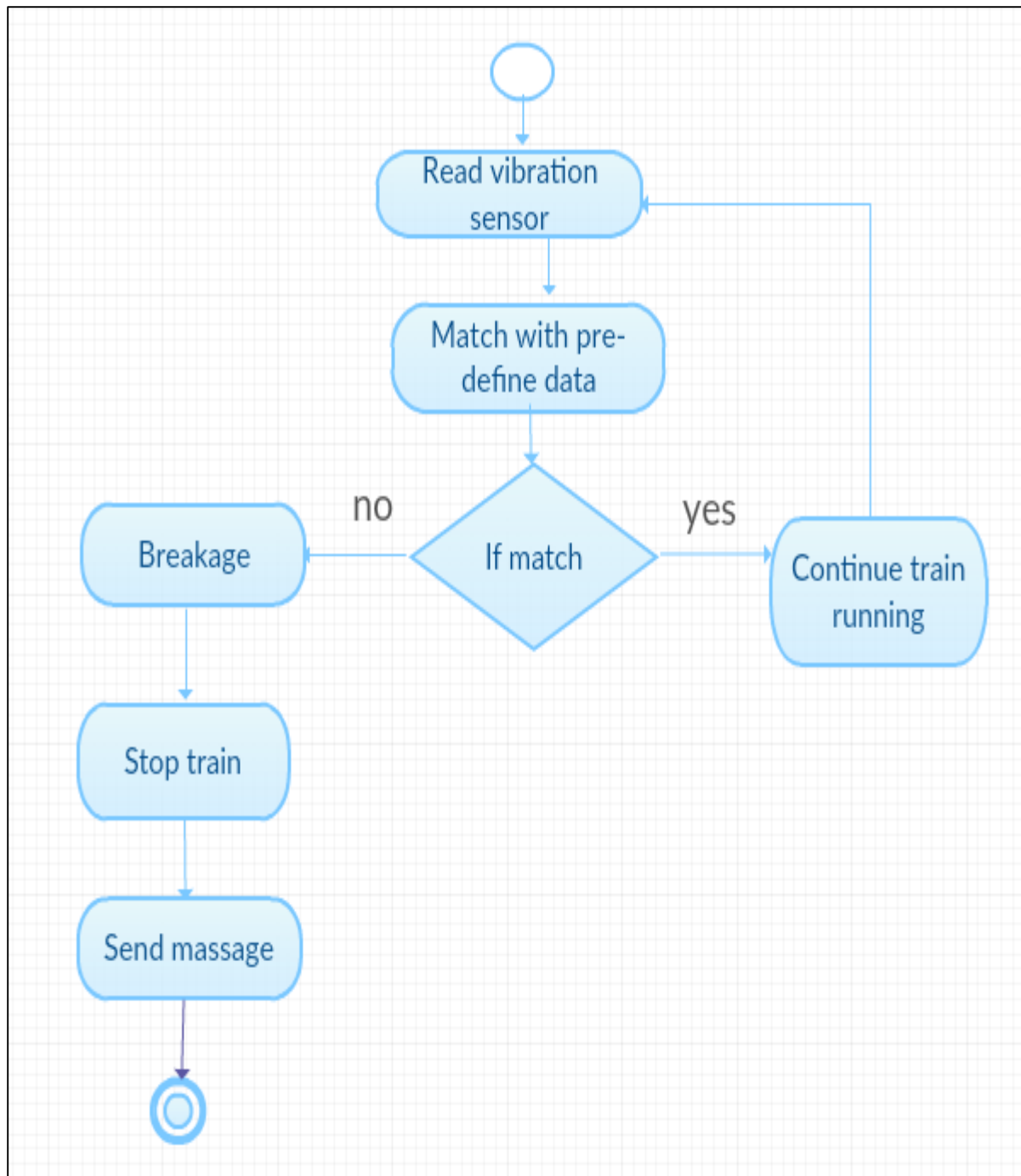


Figure 17 Breakage detection activity diagram

3.1.4 Obstacle Detection

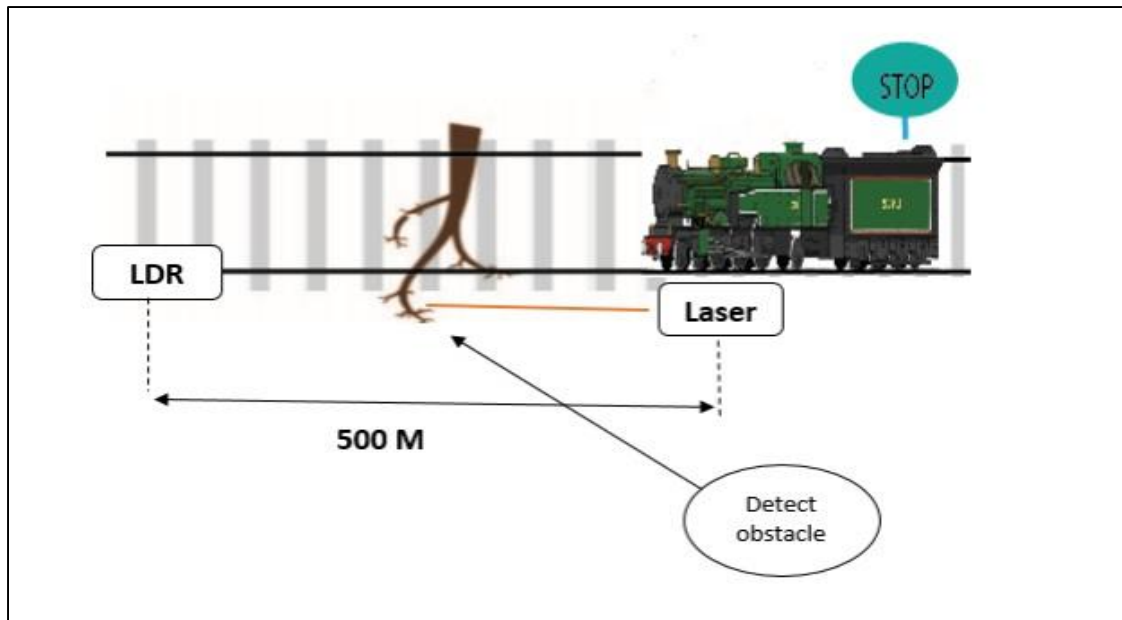


Figure 18 Obstacle detection

A theoretical system model which consists of LDR and Laser utilizing the data of peizo vibration sensor to detect any sudden obstacle on the track. After every 500m along with the vibration sensor a LDR and a laser will be set up. Assuming that all will be set up in a box like the Figure-17. In each box at the right side there will be laser and at the left side there will be a LDR. When a train start running on the track then in normal case there will be found a graph like Figure-16. But if any heavy obstacle keep falling on the track then the graph which will be generated by the system that time, it will not match with the probable graph or won't even close enough to the probable graph.

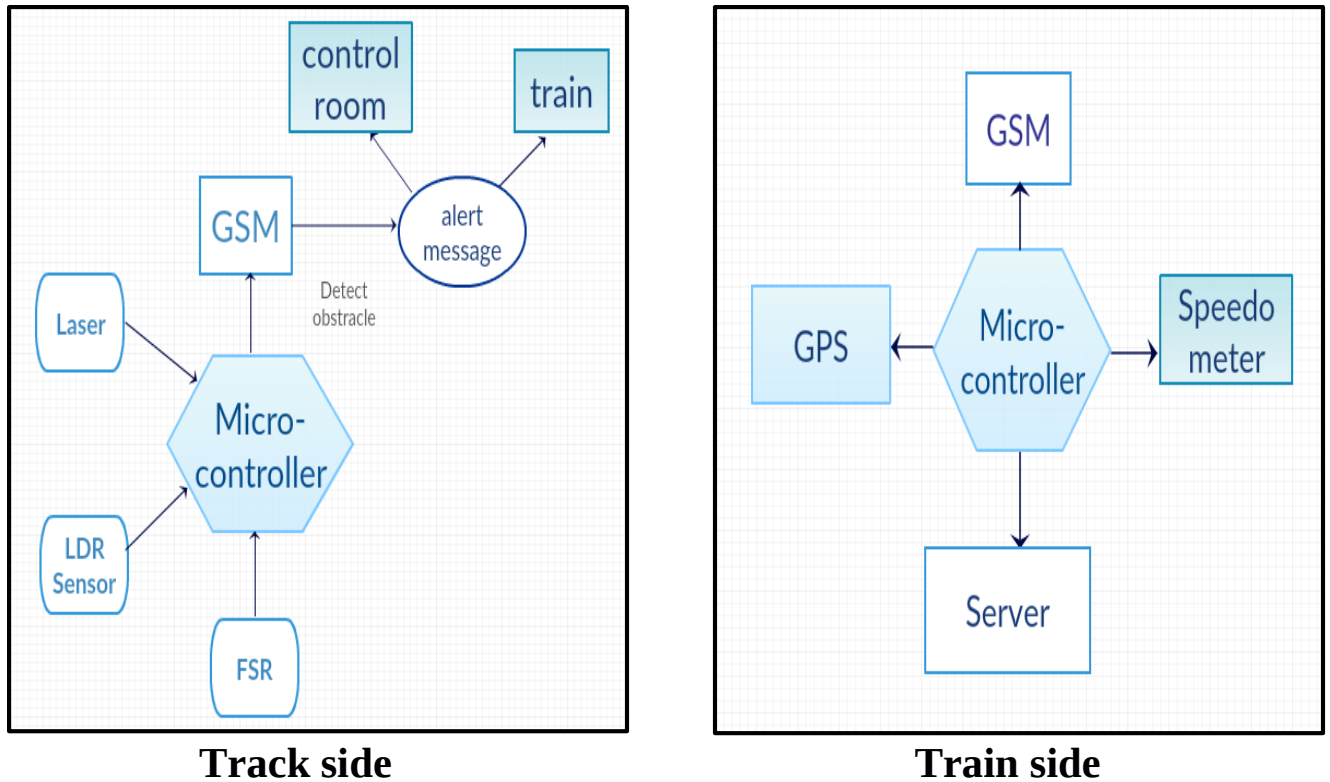


Figure 19 System model of obstacle detection

Then the light rays of left laser will fall on the right LDR. If then LDR cannot get the laser which it supposed to get that means there is something heavy obstacle on the track and then the system will notify the nearest control room and the train which is on the track to stop the train.

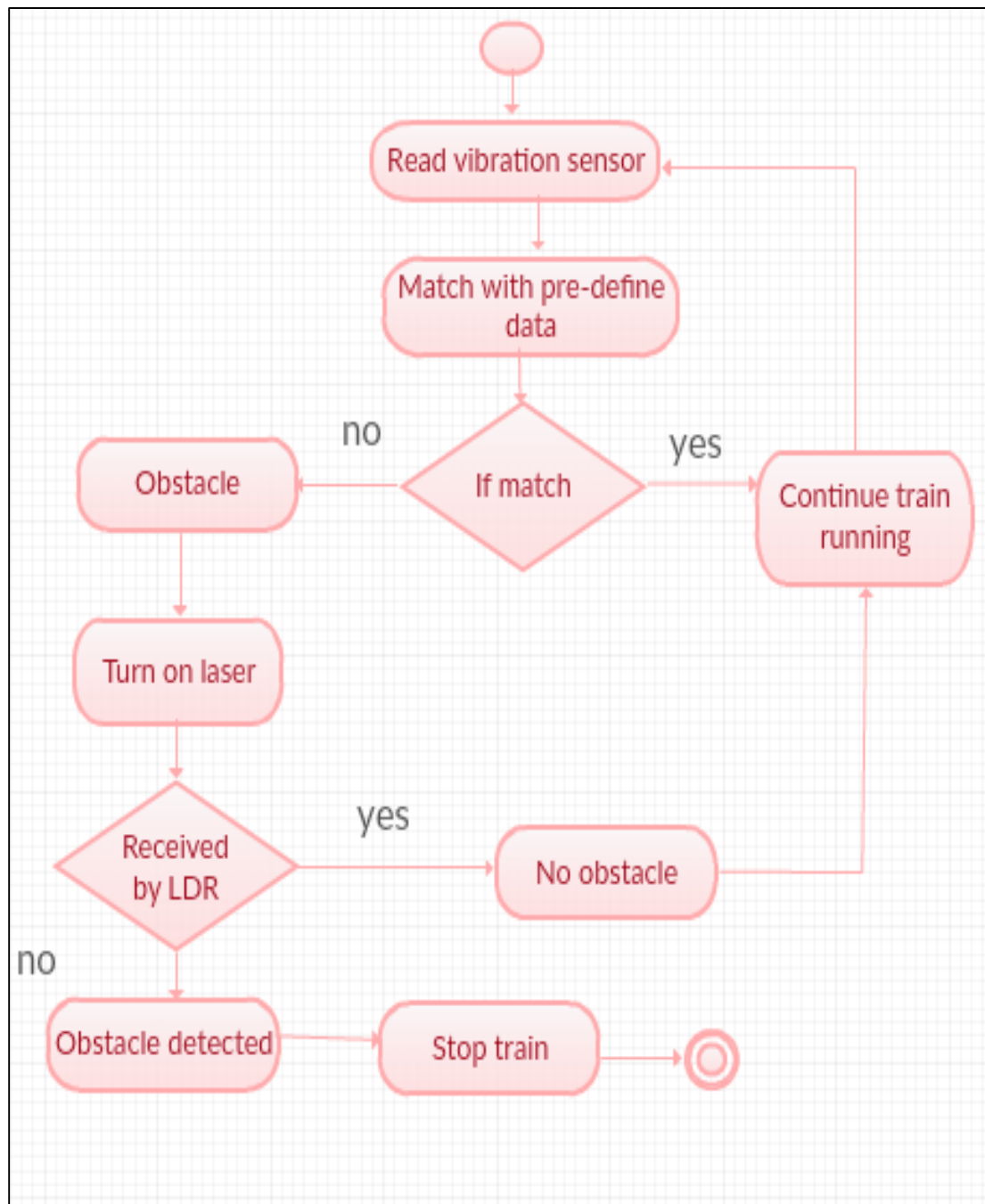


Figure 20 Obstacle detection activity diagram

3.2 Hardware implementation

3.2.1 Collision detection

Firstly, GSM will send an activation message to the system. Depend on FSR data, collision will be detected. Every FSR will check the track and update the data continuously. When a FSR gets high data or force from train, immediately it will check 1km distance FSR's data. For instance, FSR_i receives high data and it will observe the data of $FSR_{(i-2)}$ or $FSR_{(i+2)}$. Whenever, both FSR_i and $FSR_{(i-2)}$ or $FSR_{(i+2)}$ receive high data FSR_i will notice collision.

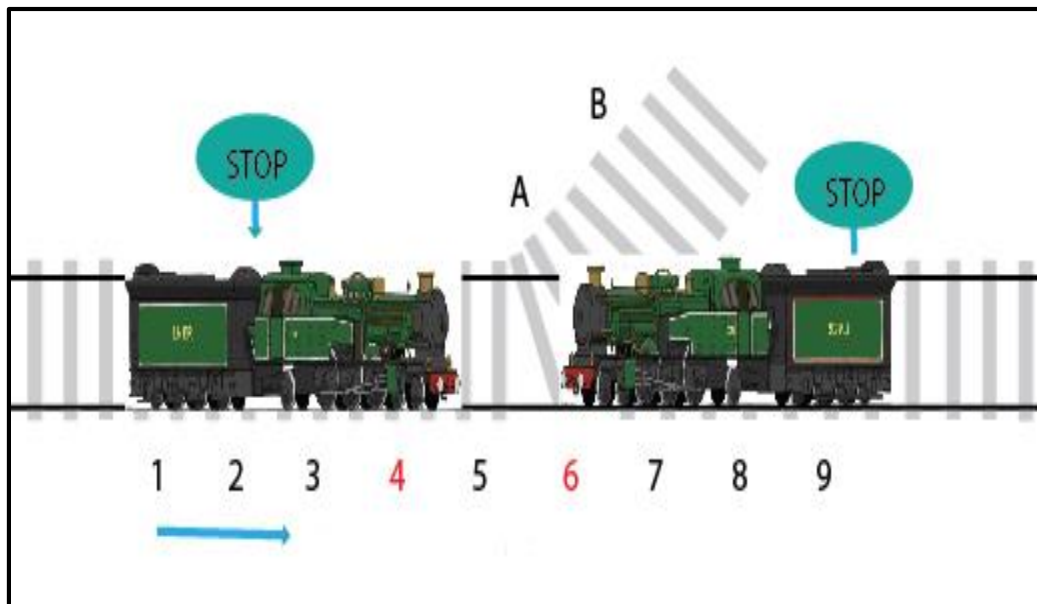


Figure 21 Stop collision of two trains

FSR sensors will send data to arduino and controllers. Arduino will give signal to GSM shield. Furthermore, GSM will send notification urgently to the control room

and appropriate two trains. FSR will stop the running trains to control the detected collision.

However, one of the FSR's data is high means there is no collision in the track. As a result, train will run on the track properly. FSR sensors will update their data. Along with, train's location will be updated in database.

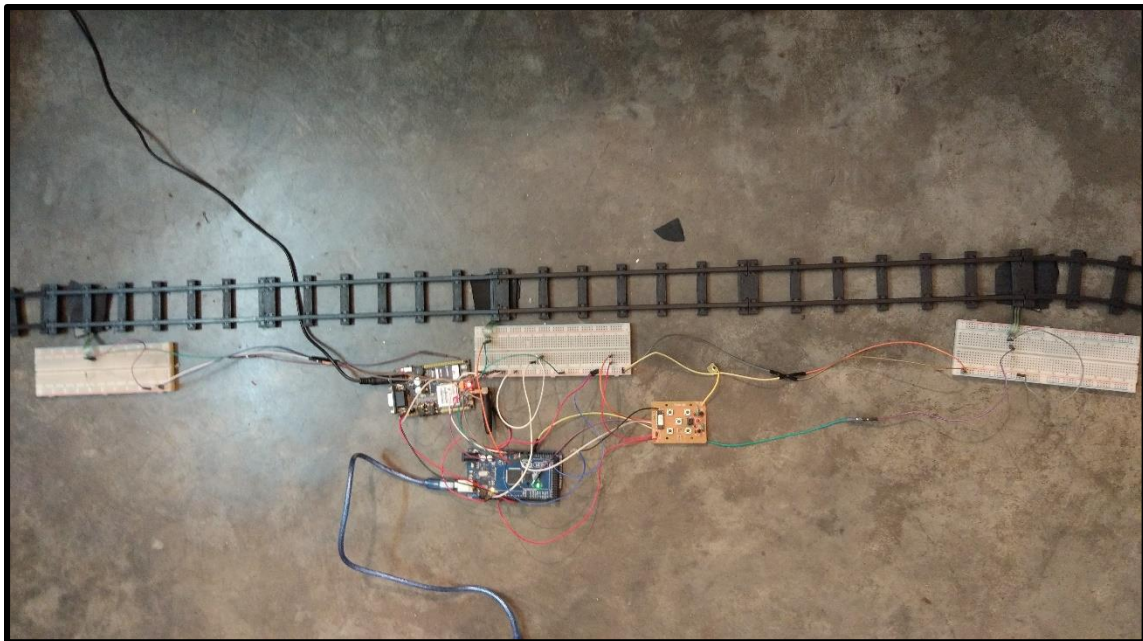


Figure 22 Implementation of Collision Detection

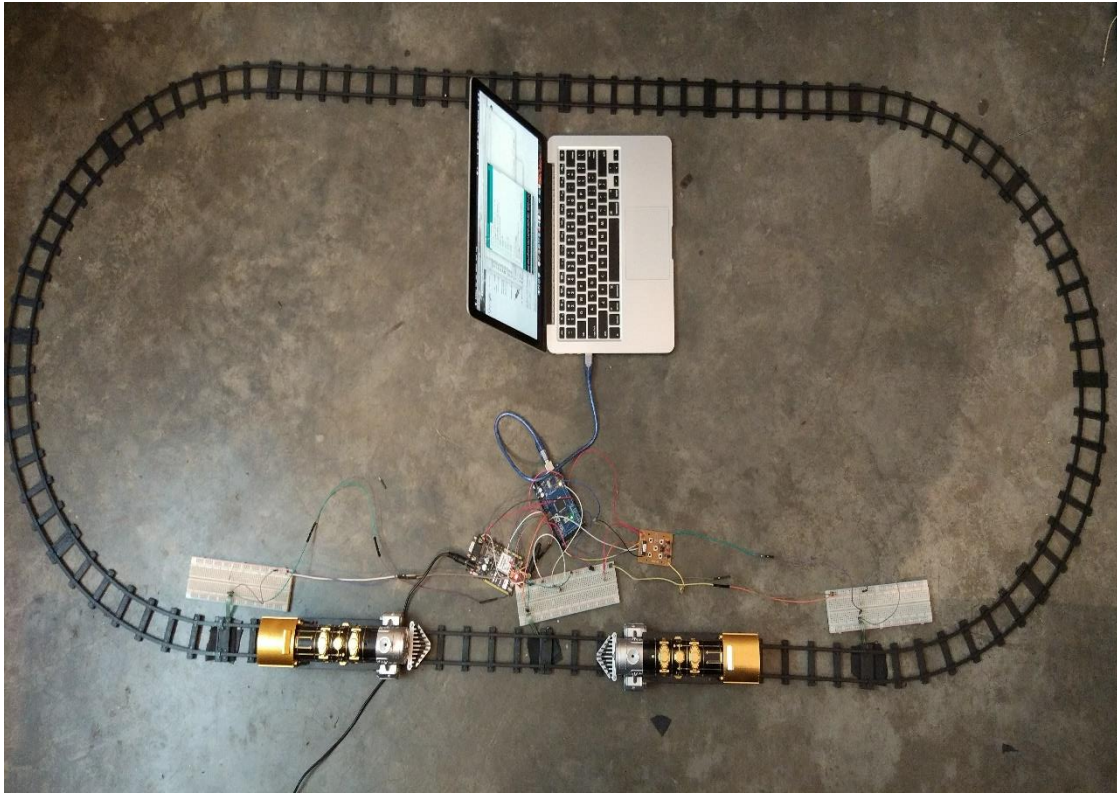


Figure 23 Implementation of Collision Detection

3.2.2 Automated Road Crossing

Firstly, there are two FSR sensors, servo motors and sonar sensors. When FSR_i senses the train it will send data to microcontroller. Microcontroller will send signal to servo motors of both side to shut the line bar. Here, servo motor will rotate from 0° to 90° to give safety indication. The buzzer will rang to alert people of the certain area.

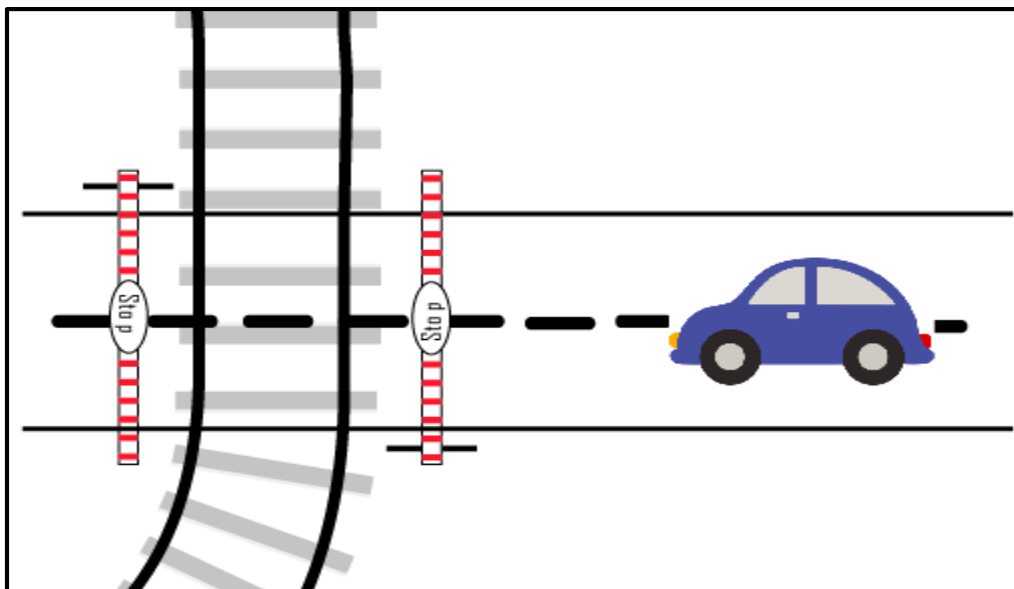


Figure 24 Automated Rail Crossing

After that, when train pass the rail crossing area $FSR_{(i+1)}$ will sense the train and send data to microcontroller. Microcontroller will check data and notify servo motors to take action. Servo motor will rotate from 90° to 0° and turn the line bar vertically.

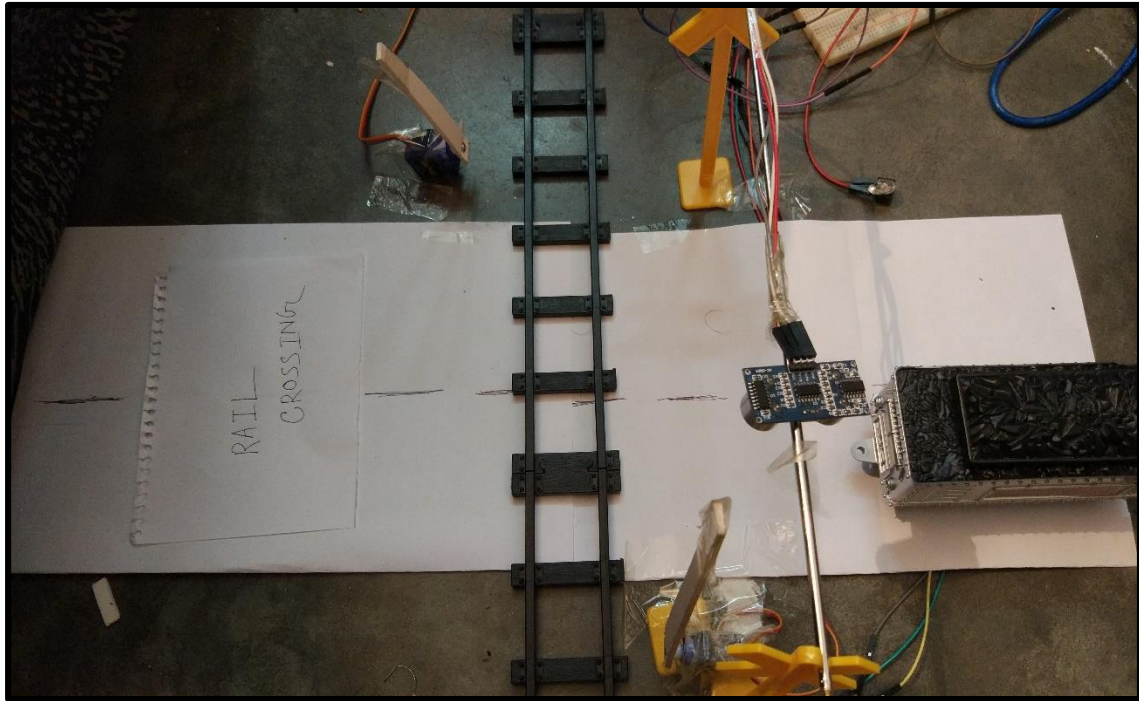


Figure 25 Implementation of Automated Rail Crossing

There are sonar sensors to measure the length from surface. There is fixed measurement of the length save in microcontroller. *However*, the situation comes like that a bus/car is on the track of rail line crossing. System will compare the current distance with the fixed distance.

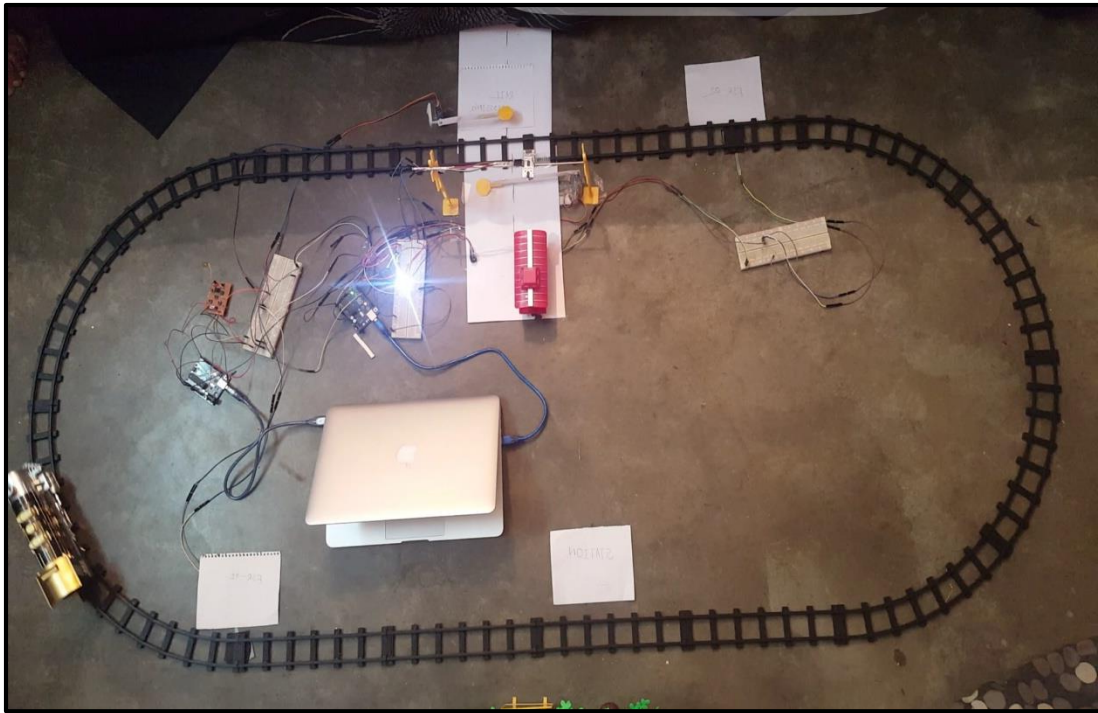


Figure 26 Implementation of Automated Rail Crossing

System detect the distance is less than the fixed measurement. In that case, the line bar will rotate less than 90° and give opportunity to cross the area. System will notify the train of the track to control the speed.

3.3 Connection Set-up

3.3.1 Collision detection

The design of our system is accessible and efficient. FSR sensor, GSM shield and train controllers are configured with Arduino Mega board. FSR sensor has two pins; one pin is connected with 5Volt or high voltage. Another pin is connected with input pin of arduino board. FSR need to set with the track to get the appropriate force of train. GSM SIM900A shield is configured with arduino so that it can easily send message to control room and trains. It works almost like typical mobile phone. For activation, we have inserted a sim card. Our GSM SIM900A comes with GPS enable, so it will store all the data to a database. The ground pin is connected with ground, TX and RX pins of GSM are connected with arduino output pins. Each train will associate with individual GPS to send its current location to system. The arduino and GSM shield need power supply which can be given by using adapters.

3.3.2 Automated Road Crossing

In our connection set up, we have used arduino uno. The first FSR is connected to the analog pin in the arduino uno. The second FSR is connected to the analog pin in the arduino uno. In this feature we have used two servo motors. The first one is connected to the 08 no. digital pin in the arduino uno and the second servo motor is connected to the 09 no. digital pin in the arduino uno. The echo of the sonar sensor is connected to the 04 no. digital pin in the arduino and the Trigger is connected to the 07 digital pin in the arduino uno. In order to get the values of FSRs in an appropriate way, we have used two resistors of 1K each in parallel connection with the two FSRs.

3.4 Pseudocode

Algorithm 1: Collision detection

```
outMessage ← "I'm Online!!!"  
outMessage1 ← "collision detected!!!"  
destinationNumber ← "+8801752337646"  
setup(){  
    Activate serial connection with Arduino  
    Activate PinMode for all INPUT and OUTPUT  
    Print outMessage  
}  
function(){  
    for all FSR sensor i  
        Array[i] ← FSR OUTPUT value  
        delay for 1.2 sec  
    for all FSR sensor i  
        if Array [i] greater than 1           //If a possible collusion detected  
            if ( Array[i – 2] or Array [i + 2] ) greater than 1  
                Turn on Light and stop both Trains  
                Activate GSM serial port  
                Send message to destinationNumber  
        else                                     // If no possible collusion detected  
            Light stays off  
            Train run without any intervals  
}
```

Algorithm 2: Automated Rail Crossing

```
Sonar_distance( ){  
    distance ← from sonar sensor to Object below it  
    duration ← as long as echo pin remain HIGH  
    trig pin set as LOW  
    trig pin set as HIGH  
    trig pin set as LOW  
    use pulseIn method to get duration from echo pin  
    distance is duration/2  
}  
setup(){  
    Activate serial connection with Arduino  
    Activate PinMode for all INPUT and OUTPUT  
}  
function(){  
    set both servo to 0 degree  
    Get distance value from sonar_distance()  
    Delay for half second  
    Read FSR1 and FSR2 values  
    If FSR1 greater and equal to 3  
        Turn buzzer on  
        turn both servo motor to 90 degree angle  
        while distance is less than 8  
            call Sonar_distance function  
            Get duration and distance from sonar value  
        While FSR2 is less than equal 70  
            Wait in the loop  
            Read the value of FSR2  
        Turn both servo to 0 degree  
    else if FSR2 value greater and equal to 20  
        Turn buzzer on
```

```
        turn both servo motor to 90 degree angle
    while distance is less than 8
        call Sonar_distance function
        Get duration and distance from sonar value
    While FSR1 is less than equal 3
        Wait in the loop
        Read the value of FSR1
    Turn both servo to 0 degree
}
```

3.5 Technical Specification

1) Arduino Uno:

- A. ATmega 328
- B. Operating voltage 5v.
- C. Input voltage(Recommended) 7-12 volts.

2) Servo Motor:

- A. Operating voltage 4.8 v.
- B. Temperature range 0-55 c
- C. Operating speed 0.1 sec/60 degree

3) Sonar Sensor:

- A. Operating voltage 5 v
- B. Operating Current 15mA.
- C. Max range 4m.

4) FSR Sensor:

- A. Overall length 3.5"
- B. Overall width 1.75"

3.6 Feasibility analysis

Feasibility analysis helps to decide whether or not to proceed with the proposed system. Our system is efficient, independent and helpful for the railway service. If the government of our country uses our proposed system it will develop our railway service.

3.6.1 Technical Feasibility:

In our system, we used Arduino Uno and Mega, FSR sensor, GSM SIM900A shield, GPS and sonar sensor. Arduino consists of a processor core, memory and several input and output peripherals. It is comfortable to use as microcontroller. GSM shield needs no internet and easily uses mobile network service to send alert messages to destination. All the devices are modern and will make the system simplified. Therefore, all components gave accurate outputs.

3.6.2 Economic Feasibility:

The components which need to build the system are profitable. The cost of elements are low. In total, the establishment makes a fast and efficient solution against any unwanted incident occurred in rail.

3.6.3 Industry/ Market Feasibility:

Current world is improving its every aspects to sustain in the industry. Transport industry is important. On the other side, to enhance the industry each transportation needs to be active enough to generate maximum profit. Therefore, this project comes with the motive to enhance the railway facilities taking the safety issues in mind.

Chapter 4

Result Analysis

- The force resistive register (FSR) sense the input and send it to the microcontroller (Arduino). The microcontroller send command successfully by using predefined algorithm. The GSM module receive the command and notify the required location. The value from FSR was very low range and the weight adjustment was required to get the expected value. The resister was crucial to get the prefect outcome.

FSR output without resistor: Analog Value 01 to 10

FSR output after 100k resistor: Analog Value 50 to 1023

- IR sensor was used to stop the train in our demonstration and the distance from train to IR plays a vital role here. Microcontroller was sending command very efficiently and can able to stop the train immediately to avoid collision.
- The servo motor was using to control the line-bar in the crossing. It was getting the expected input from the FSR and perform accordingly.

- The sonar sensor was working well and giving the distance correctly so that the servo stopped to fall if there were any object below it. It was also effectively fell down the line bar as soon as the object removed.

Distance from sonar to floor: 6.67cm

- The output from pizeo vibration sensor was fluctuating and it was giving asmall value against very high vibration.

Overall demonstration gives expected outcome though the vibration of the train was insufficient so that it cannot detect from desired distance by vibration sensor. On the hand the FSR, Servo, Sonar was very much compatible with microcontroller and the GSM module 900A which is used there to send massage was quite responsive. In demonstration GPS could not able to distinguish the different location of trains as it was a very small set up. Therefore, it was ignored to use GPS and work with IR to stop train and sent massage only to the control room which was working well.

Chapter 5

Conclusion

Before summing up, we can say accidents occurring in the railway transportation system cost a huge number of lives. So, an advanced and dependable system is needed to avert these types of accidents and also find out the possibilities of their occurrence. The proposed model is a simple prototype which will work as an independent inspector for the railway network. This system is highly reliable and cost effective at any traffic area, sub urban area and the routes. Furthermore, this is small in size and low power consumption which is in fact a simple solution of all the problems for a railway mishap in one system. This system will work all the modules at a time to lessen accidents.

5.1 Future work

In future, software will be integrated to this system, by using which the authority of the control room will be able to see the location of trains live, and they will be able to notify the drivers about any kind of unwanted event through this app if necessary. In this way the proposed system will be able to inspect the rail tracks and trains more easily and effectively, and the railway tracks will be more secure and safe.

Moreover, we have future plan to implement the other two features of our projects. Such as, detecting the breakage of the rail tracks and detecting the obstacle on the rail track. We have theoretical specifications and algorithms for these two features, in future we will do the hardware implementations of this two features, so that we

can give a proper package system, for a new improved and secure railway track monitoring system, which will reduce the sufferings of manual monitoring of the railway tracks.

5.2 Challenges

While building the entire system we had to face some challenges. When we were working on the feature of collision detection, we were facing the difficulties of maintaining the values of FSR. In order to get the appropriate value, we have to give the exact force for the data. Moreover, it was a little bit tough for us to identify the appropriate resistor for the FSRs, because if you do not place the appropriate resistor for the FSR, then you will not get the appropriate value of it. Furthermore, when we were using GSM Shield we faced it so tough to maintain its power management, because without proper power management, it does not work properly. To overcome this issue we use adapter. We also faced some difficulties while sending and receiving the confirmation message about the collision. Besides these, while working on the feature of automated road crossing, we faced some more challenges. For example, while using the servo motor for the automatic up and down of the line bar, we faced a little bit trouble to get the proper power supply for servo motor. In order to solve this issue we use external power supply. Moreover, we faced it a little bit problematic to maintain the proper delay for the up and down of line bar.

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