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Rail Safety System

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ABSTRACT

We see that the rail connecting throughout the circuit has many difficulties in each and every step of the organization and in the rail traffic. Starting from the gates to the attach of coaches with the engine/locomotive, there are possibilities of running into some small errors resulting huge impact. Science has the capability to reduce the impact at a maximum level. It is always the methods that we use for the implementation of the existing things, matters. In this project/paper we are going to use the available technology in a different method in order to minimise the impact/accidents triggered due to errors in the functionality of railways. The technologies used are detection and display systems.

Keywords-Locomotives, Coaches, Rail Gates, Signals, Links, Simulation, Accidents

INTRODUCTION

Anything to be solved must be started with the study of possibilities that can happen/happened. The following are the list of places where there are possibilities of errors that might happen at various stages of rail proceedings.

1. Sudden break or malfunctioning of the links between the coaches of a train.
2. Unmanned/ automatic rail gates

Study of cases:

1) In India, on 07.04.18, Coaches of Ahmedabad-Puri express(Image 1) rolled down towards Kesinga side near Titlagarh which is almost 15km because skid-brakes were not applied. Due to less traffic on that day, the major accident got averted. But in case if there is a train coming in the opposite direction, there might be a huge impact on that error that cannot be estimated to an extent.

Image 1. Coaches of Ahmedabad-Puri express

2)The following are the cases of accidents caused due to the sudden fall of gates and less time duration for the reach of trains to the level crossings.

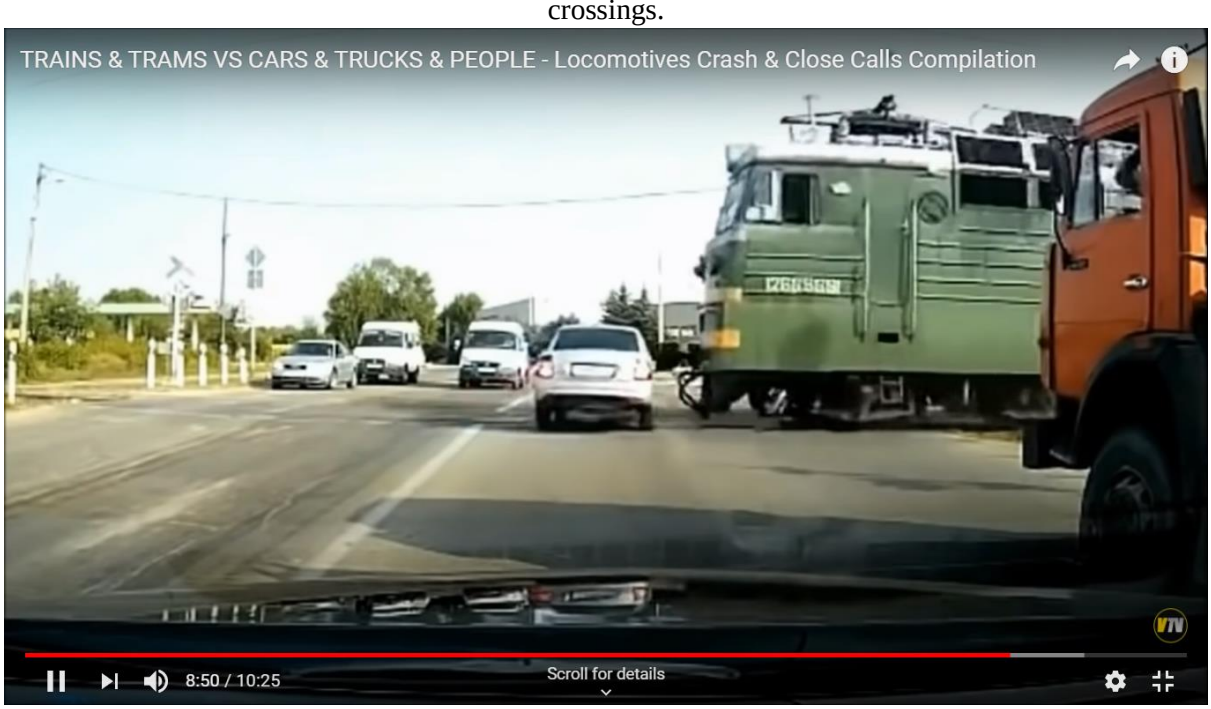

Image2: Train colliding with the car stopped on the track

Image3: Train colliding with the truck stopped on the track

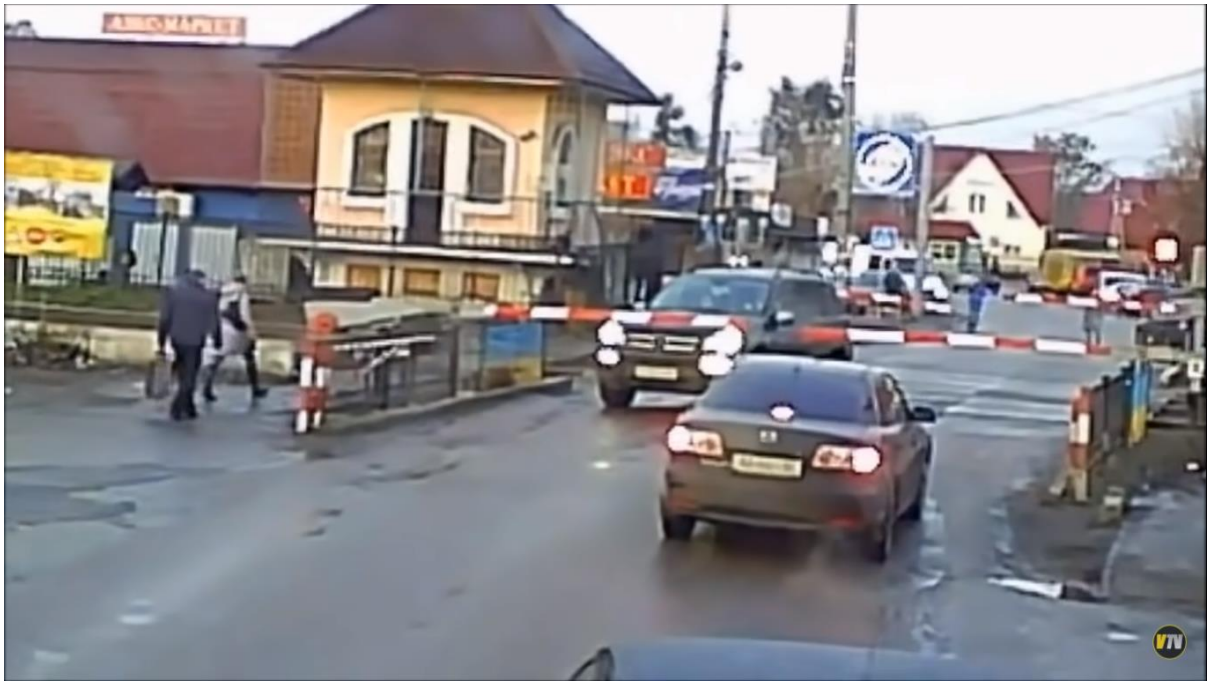

Image4: Car stopped on the track due to sudden fall of gates for the arrival of the train which reached in few seconds after the fall of gates.

There are many cases like these that happened very often which needs some modifications in the system followed by the automatic/unmanned gates.

PROCEDURE

a) Sudden break or malfunctioning of the links between the coaches of a train:

The locomotive and the coaches are given with the technology that they give continuous input of the numbering assigned to the system which forms a string of one single input.

For example a train has a locomotive and 6 coaches. The locomotive gives the input ‘1’ and the coaches gives 2,3,4,5,6,7 as their input according to the sequence placed. Now all these inputs are combined and taken as one string by the system proposed in this project as ‘1234567’ and sends this input for the processing.

Input and technology types:

When the link is active: the locomotive sends the input of Natural numbers based on its sequence.

When the link is inactive: the coach/locomotive sends the input ‘0’ or ‘00’ or ‘000’ based on the total number, which indicates the break of link.

Technology type: wireless and link communication/passage of code between the locomotive and the coaches.

Note: All the coaches having the number which is the multiple of 10 gets the replacement of ‘0’ with ‘O’.

Expected output of the system:

When the train has sequence is ‘1234567891O1112131415’, the output will be ‘Safe’.

When the train has sequence is ‘1234567891O1100131415’, the output will be ‘link break at/near the coach 13, emergency brakes on’.

b) Unmanned/ automatic rail gates:
The rail gates are modified according to the image5 adding the sensors at A^, B^, C^, D^ that detects the presence of vehicles in the middle of the gates and feeds the information to the system of this project.

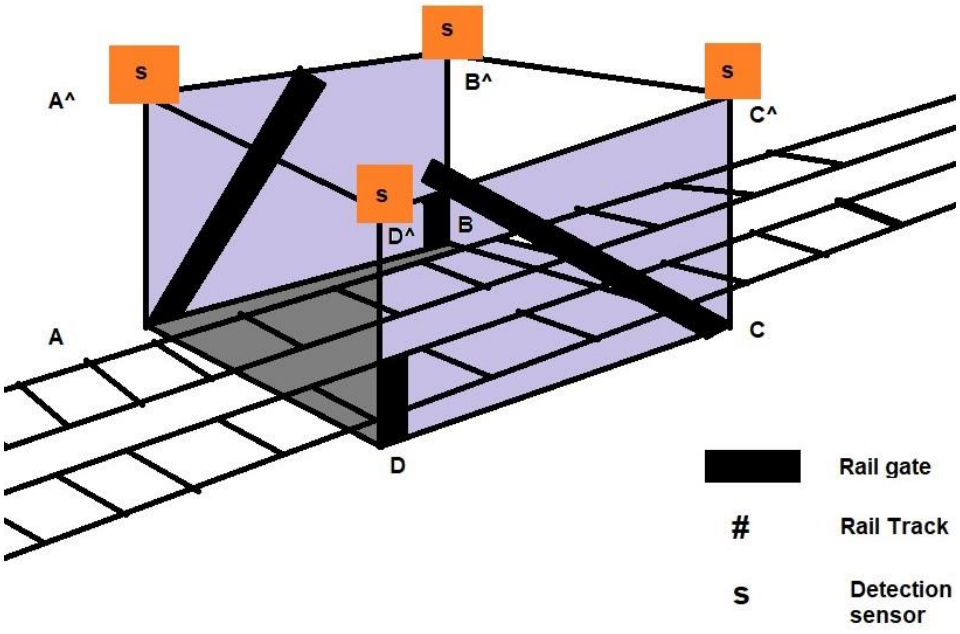

Image5: image showing the new design of rail gates.

Block diagram of the system:

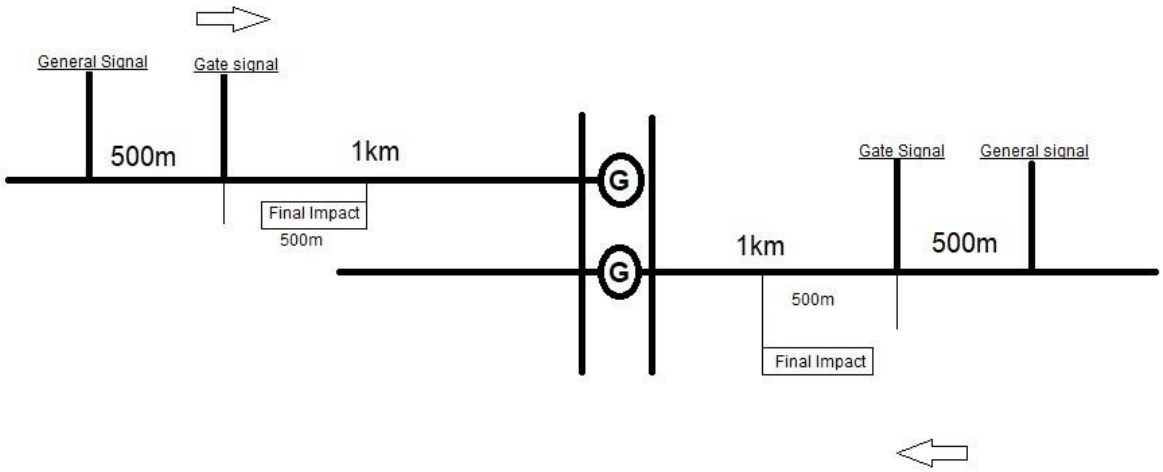

Image6: Diagram of the layout of the system to be followed.

Nomenclature of the block diagram(image6):

1. General Signal= Main line signal which is a caution signal for the upcoming gate signal.

2. Gate Signal= The main line signal which gives the status of the upcoming gate to the Loco-Pilots.

3. Distance between the general signal to the gate signal must be a minimum of 500m.

4. G= Railway Gates.

5. Final Impact= It is the maximum possible distance where the train stops due to sudden stop of train from the Gate Signal (very rare cases).

Process and the expected outputs of the system:

1. For the train to be allowed to pass through the gate, the routing authority must initiate a green signal. This will turn on the alarm at the gates and the detection process goes on. When there is no detection of vehicle between the gates and the gates are closed, both Gate Signal and the General Signal turns to green while the signal to the vehicles shows red.

2. When the detection of the vehicle is true or the gates are not closed, the initiation of the green signal by the routing authority is denied i.e., the Gate Signal turns to red and the General Signal turns to yellow(indication of caution to the driver to stop at the next signal) which leads to the initiation of legal implementations and on the reset of this system the train gets approval to pass by, with a registered case to be investigated.

3. Only on the approval of the higher authority with the valid proofs, this procedure can be overruled.

WORKING

Building the Algorithm:

Algorithm for the link of the train:

Start

Step1: collect the final string from the locomotive and read the string

Step2: Detection of ‘0’

Step3: if true, turn on the emergency brakes with a notification

Step4: else display that the train is safe

Stop

Algorithm for the unmanned/automatic rail gates system:

Start

Step1: set the signals in their default value

Step2: initiate green signal for the passage of the train

Step3: Alarm/ notification at the gates as the indication of routing

Step4: detection of vehicles in between the gates and the fall of gates

Step5: if the detection is true or the fall of gates is false

Step5.1: the initiation of green signal is denied which turns the trains signals to red with caution and vehicle’s signal to green and open of gates.

Step6: else the signal for the vehicles turns red and the route for the train gets clearance after the passage of the train gates are open.

Stop

Note: For Red=rgb(255,0,0), Green=rgb(0,255,0)) only.

Translating Algorithm to code:

HTML Code:

```
<!DOCTYPE html>
<html>
  <title>
    <p> Rail Safety System  </p>
  </title>
<head>
  <h1 id="heading"> RAIL SAFETY SYSTEM</h1>
  </head>
  <body>
 <div id="intro">
   <h3>We see that the rail connecting throughout the circuit has many difficulties in each and every step of the organization and in the rail traffic. Starting from the gates to the attach of coaches with the engine/locomotive, there are possibilities of running into some small errors resulting huge impact.
```

Science has the capability to reduce the impact at a maximum level. It is always the methods that we use for the implementation of the existing things, always matters. In this project/paper we are going to use the available technology in a different method in order to minimise the impact/accidents triggered due to errors in the functionality of railways. The technologies used are detection and display systems. </h3>

<h3>

Anything to be solved must be started with the study of possibilities that can happen/happened. The following are the list of places where there are possibilities of errors that might happen at various stages of rail proceedings.

</h3>

<h3>

1. Sudden break or malfunctioning of the links between the coaches of a train. </h3>

<h3>

2. Unmanned/ automatic rail gates

</h3>

<h2 id="heading"> 1. Sudden break or malfunctioning of the links between the coaches of a train.</h2>

<input id="raillink" type ="text">

<input type="button" value="upload" onclick="RailLink()"

<canvas id="CL">

<h2 id="heading"> 2. Unmanned/ automatic rail gates </h2>

<img src="https://drive.google.com/uc?id=17x9u8zP7e9F3OV0DJWt-TKuU1jm77nmQ" width="700">

The following one is the circuit of the above figure.

------<input id="GenS" type="color" value="#FF0000" onchange="RailGate()">----------<input id="GaS" type="color" value="#FF0000" onchange="RailGate()">----------<input id="Gate1" type="color" value="#00FF00" onchange="RailGate()">----------

----------<input id="Gate2" type="color" value="#00FF00" onchange="RailGate()">----------<input id="GaS2" type="color" value="#FF0000" onchange="RailGate()">----------<input id="GenS2" type="color" value="#FF0000" onchange="RailGate()">

<h1 id="denied"> </h1>

<input type="button" value="gates closed" onclick="GatesRed()">

<input type="button" value="open gates" onclick="GatesGreen()">

<input type="button" value="Reset" onclick="Reset()">

<h3>TERMS AND THEIR MEANINGS: (Red=rgb(255,0,0), Green=rgb(0,255,0)) only</h3>

<h5>1. General Signal= Main line signal which is a caution signal for the upcoming gate signal</h5>

<h5>2. Gate Signal= The main line signal which gives the status of the upcoming gate to the Loco-Pilots</h5>

<h5>3. Distance between the general signal to the gate signal must be a minimum of 500m </h5>

<h5>4. G= Railway Gates</h5>

<h5>5. Final Impact= It is the maximum possible distance where the train stops due to sudden stop of train from the Gate Signal (very rare cases)</h5>

```
</body>
</html>
```

CSS Code:

```
<style>
#heading {
  text-align: center;
  background-color: #FFFFFF;

}
canvas {
  border: solid red;
}
body {
background-image : url("https://images.pexels.com/photos/258510/pexels-photo-258510.jpeg?cs=srgb&dl=pexels-pixabay-258510.jpg&fm=jpg");
background-position: center top;
}
div.template1 {
color : #f89a03;
background-color: #255B;
width: 600px;
border: 3px solid #100D;
position: relative;
  left: 350px;
}
div.template2 {
color : #f89a03;
background-color: #255B;
width: 1200px;
border: 3px solid #100D;
position: relative;
left: 50px;
```

```
}
div.template3 {
color : #f89a03;
background-color: #255B;
width: 700px;
height: 335px;
border: 3px solid #100D;
position: relative;
  left: 300px;
}
</style>
```

JavaScript Code:

```
<script>
//global variable for signals
var gens=document.getElementById("GenS");
var gas=document.getElementById("GaS");
var gate1=document.getElementById("Gate1");
var gate2=document.getElementById("Gate2");
var gens2=document.getElementById("GenS2");
var gas2=document.getElementById("GaS2");
var Sgens=gens.value;
var Sgas=gas.value;
var Sgate1=gate1.value;
var Sgate2=gate2.value;
var Sgens2=gens2.value;
var Sgas2=gas2.value;

function RailLink() {
  var link=document.getElementById("raillink");
 var L1=link.value;
  var L2=L1.indexOf("0");
  var L3=L1.indexOf("O");
```

```
 var dispL=document.getElementById("CL");
 dispL.style.backgroundColor="white"
var dispL1=dispL.getContext("2d");
dispL1.font="14px TimesNewRoman";
dispL1.fillStyle="black";
dispL1.clearRect(0,0,dispL.width,dispL.height);
 if (L2==-1) {
   dispL1.fillText("The train link is safe",10,30);
 }
else if (L2>-1) {
  dispL1.fillText("Emergency brakes on as the",10,15);
  dispL1.fillText("Coaches got seperated with",10,30);
 dispL1.fillText("the locomotive from/ near the coach" +L2,10,45);
}
  else {
   dispL1.fillText("Please enter a valid input",10,30);

  }
}

function RailGate() {
if (Sgas2="#00FF00")
  {
    var a=confirm("sensor feed after certain timer setting done(if gates closed press ok else press cancel
)");
    if (a==true) {
  GatesRed();
    }
     else { GatesGreen();document.getElementById("denied").innerHTML = "ROUTE DENIED";}
  }
  if ((Sgas="#00FF00"))
  {
```

```
   var b=confirm("sensor feed after certain timer setting done(if gates closed press ok else press cancel )");
    if (b==true) {
  GatesRed();
    }
    else { GatesGreen();document.getElementById("denied").innerHTML = "ROUTE DENIED";}

  }
}
function GatesRed()
{
 Sgate1="#FF0000";
 Sgate2="#FF0000";
  if ((Sgate1="#FF0000") && (Sgate2="#FF0000"))
    {
      gate1.value="#FF0000";
      gate2.value="#FF0000";
      gas.value="#00FF00";
      gens.value="#00FF00";
      gas2.value="#00FF00";
      gens2.value="#00FF00";

    }
}

function GatesGreen() {
  gate1.value="#00FF00";
  gate2.value="#00FF00";
  if ((Sgate1="#00FF00") && (Sgate2="#00FF00"))
  {
    gas.value="#FF0000";
    gas2.value="#FF0000";
  }
```

```
 if ((Sgas="#FF0000") )
 {
   gens.value="#FFFF00";
 }
if  (Sgas2="#FF0000") {
 gens2.value="#FFFF00";
}
}
function Reset(){
document.getElementById("denied").innerHTML = " "; GatesGreen();
}
</script>
```

SIMULATION and RESULTS

Algorithm to simulation results:

1) For link algorithm:

a) Step 2&4

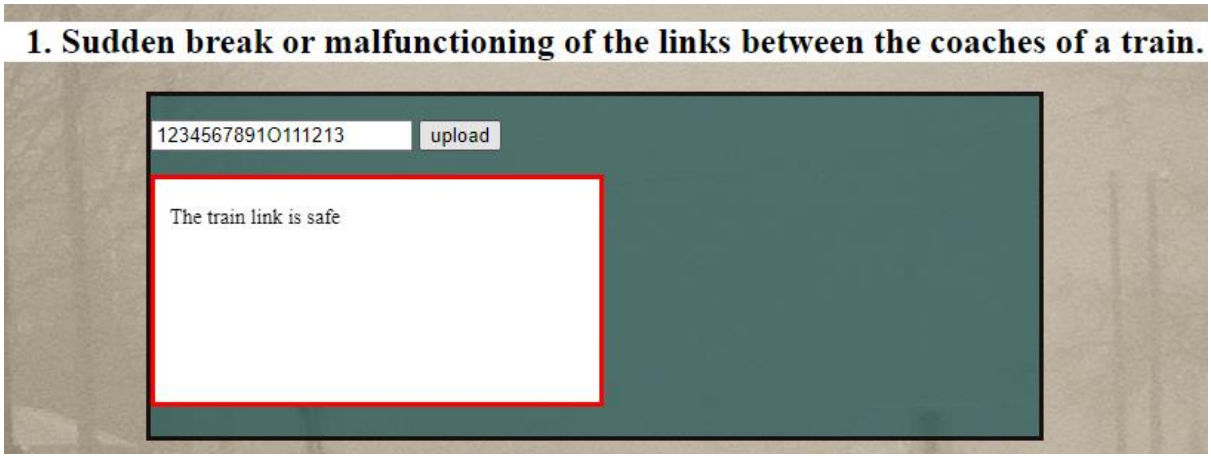

Image7: Simulation and its result when the train link is safe

b) Step 2&3

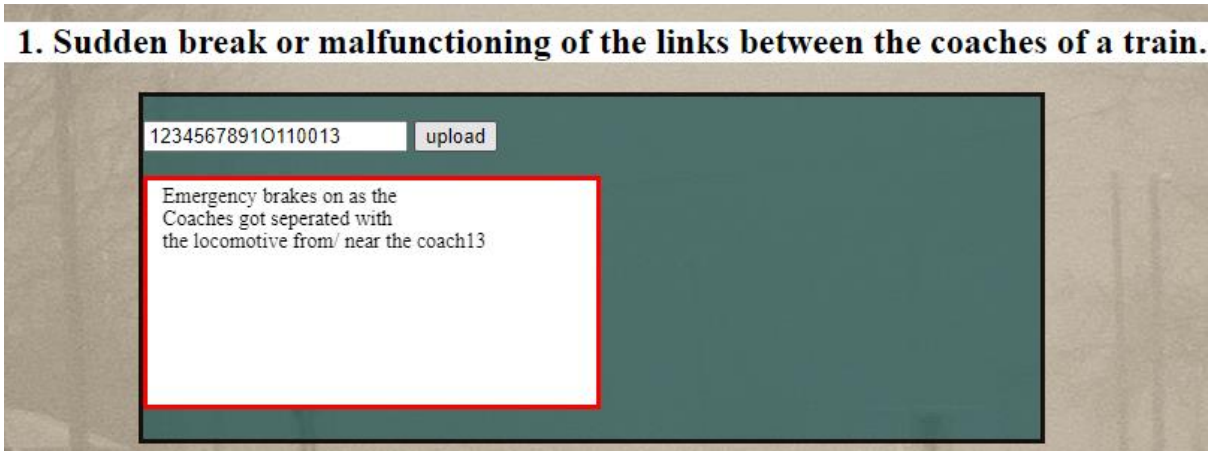

Image8: Simulation and its result when the train link is damaged

2) For the unmanned/automatic rail gates algorithm:

a) Step 1

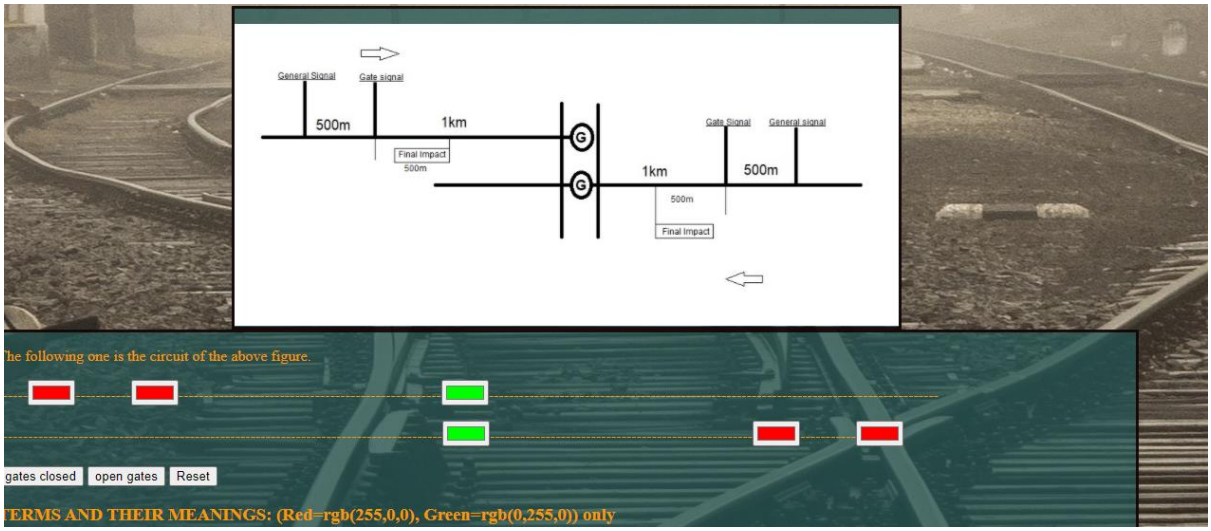

Image9: Default/Initial stage of signalling

b) Step 2

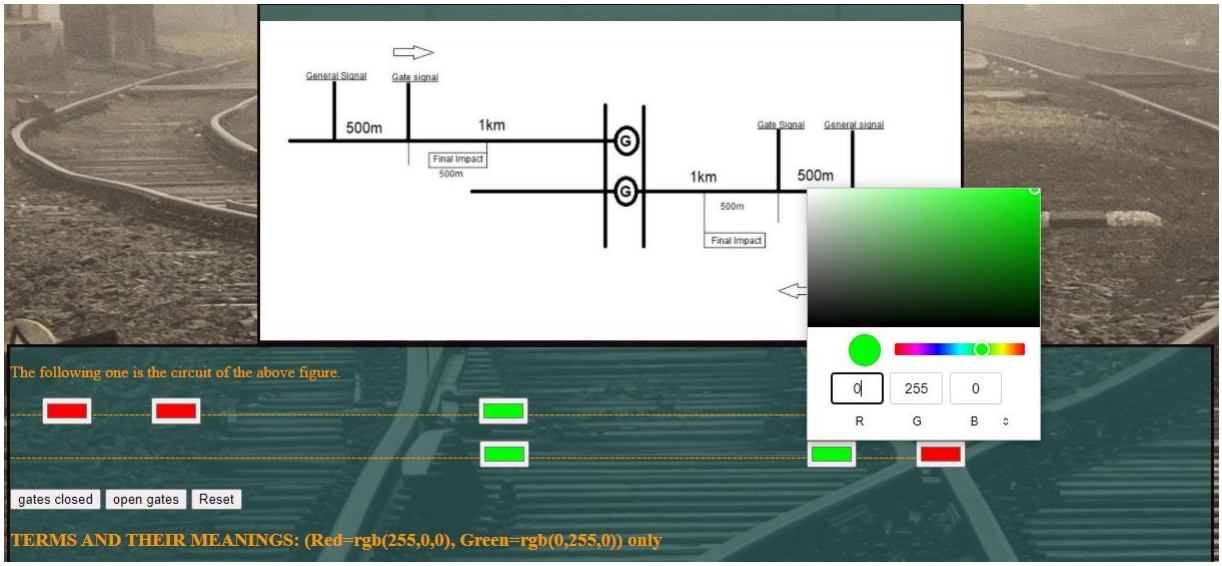

Image10: Simulation of initiating a route for the train to pass

c) Step 3

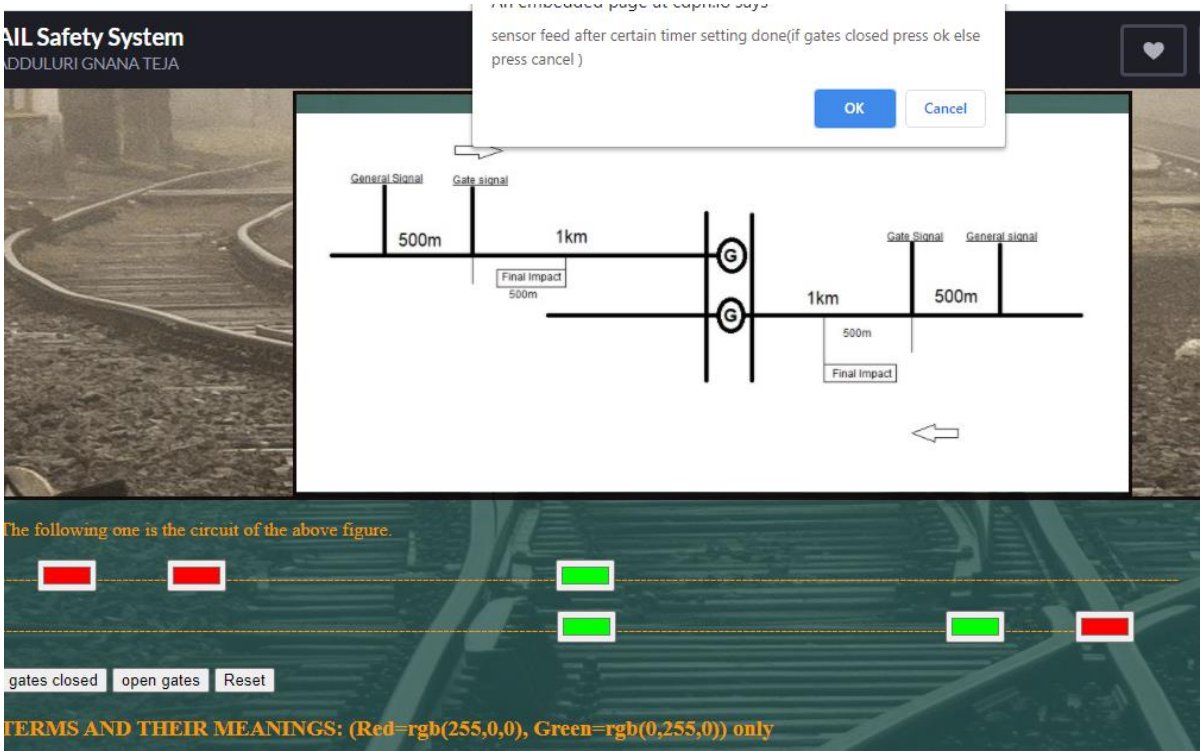

Image11: Simulation result of detection of vehicles or the close of gates happening

d) Step 4&6

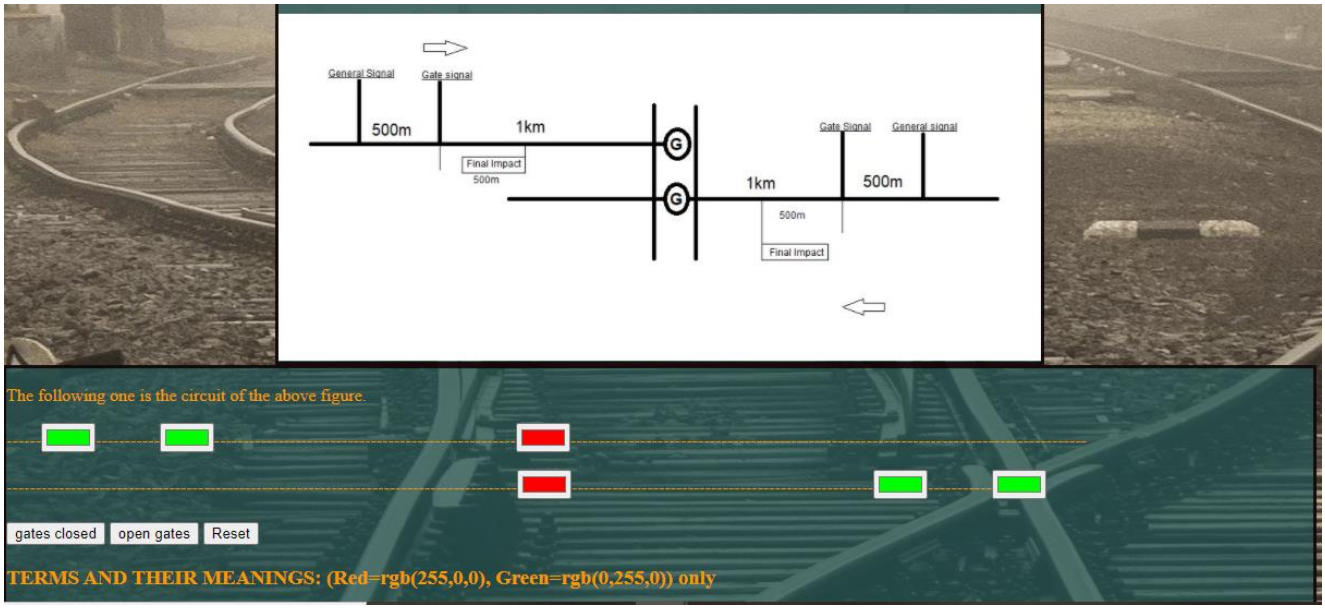

Image12: Simulation result of the situation when the detection of vehicles is false resulting the clearance of the route

e) Step 4,5& 5.1

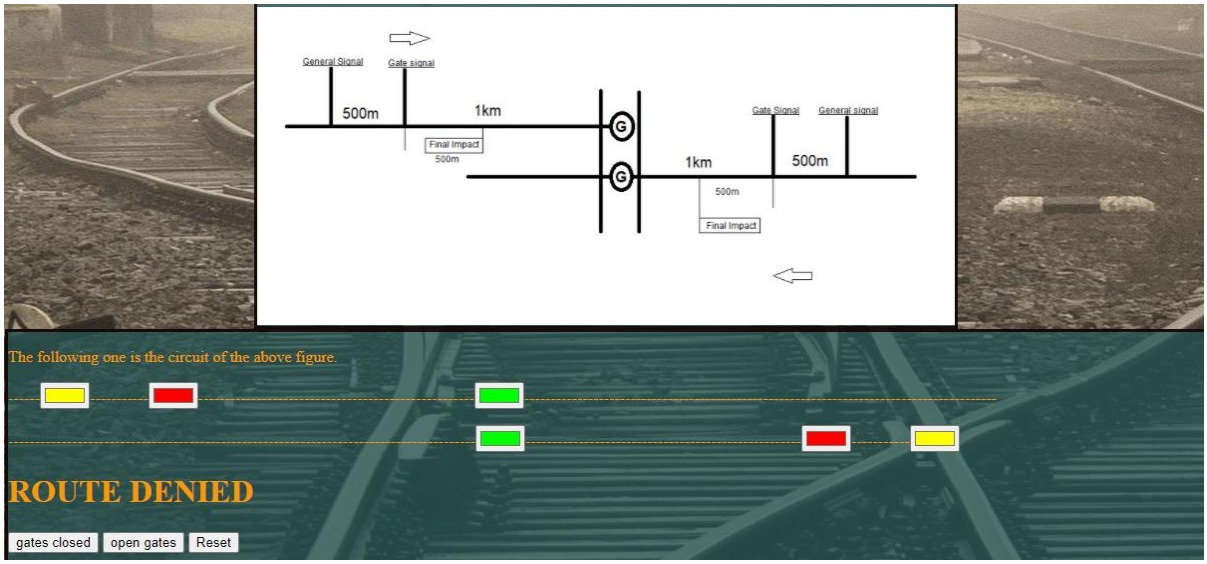

Image13: Simulation result of the situation when the detection of vehicles is true or the fall pf the gates is false, resulting the clearance of the route denied.

RULES AMD IMPLEMENTATIONS

1) All the protocols for the link segment are same that are followed now.

2) Each and every rail crossings must have the detection sensors only that are approved by the head of the project.

3) The denial of the route must be recorded at the office level as well as through CC Cameras at the rail gates for the further investigation of the situation.

4) Emergency vehicles are given entry even the gates are closed when the train doesn't pass the General signal using a chip technology like fast-tags which resets the signal routes and intimates the authority to reroute and the CC Cameras at the situation records everything to be an evidence of the proceedings.

CONCLUSION

By using this system the accidents occur due to the break of links or malfunction of links between the coaches are averted and the accidents of rail dashing the vehicles at the rail gates/crossings are stopped. The technology is very easy and cheap to implement. This further can be developed to avoid the derail of the trains with the detection technology as well.

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