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Railway Passenger Safety: A new approach

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Abstract: Railway is the most important and efficient mode of public transport in India. This is the most commonly used and cost effective long distance transport system all over the country. The frequency of accidents has increased rapidly along with the rapid increase of population.This led to serious doubts in the public mind about the safetyof travelling by trainand the general care of the railway networks. There are number of factors which are responsible for increasing number of railway accidents; some of them are listed here as; overaged tracks, wagons, coaches, bridges and signaling system.Railway system already have the functionality of providing announcements on railway station about various problemsobserved on railway track, the passengers travelling in train or thedriver who is driving the train are unaware about the problems. There is need to provide instant message or alert notification to the passengers and the driver about the railway accidents so as toavoid further problems. This problem gave rise to developan automated system which will allow passengers to subscribe themselves to get instant alerts about the railway problems.Such a system will help in broadcasting alerts toall the subscribed passengers and also the drivers.Informing about the train accidents will help thetravelling passengers to change their decision by getting down on some other station and changing their route.
The proposed system has the main goal of informing the driver of the train about the accidents. This will help to avoid train collisions and many other major accidents. In second scenario, the information of the accident is provided in the form of announcement within the train. The existing system announces only about the next upcoming trainsbut the proposed system will also provide announcements regarding railway accidents.

Keywords: Monitoring and early warning, sensors, Human computer interaction.

Introduction :

In India ,most of the transportation is carried out through railway system ,and hence ,if any problems are occurred during transportation ,the major victim of that effect is upon the social life. There are various accident tracking systems which exist today that provide information about train accidents, but they lack in various aspects of security and safety.

2. How the existing alert system work ?

There is an existing application named 'm-indicator' which provides an updated railway time table and information about themega blocks .This paper is about the research we did for an automated system which will help in broadcasting alerts to all the subscribed passengers and also the drivers. Here,we come up with a new approach of integrating alert system of railway accident tracking with the existing system to enhance the safety of passengers travelling within train and who are about to travel through trains. This system will also help to send alerts through announcements which are made on the railway station and within the train

1.Types of rail accidents

While trains are the most convenient and cheapest most of travelling and transportation, they have become a greater danger over the years as their speed has increased and also the rise in population. Following are the list of railway accidents which are most commonly observed in Indian railways :

1. Head-on Collison
   Head-on Collison is a situation of traffic collision where the front ends of two trains hit each other in opposite directions
2. Sideswipe collisions
   It is a situation where the sides of two trains travelling in opposite directions touch.
3. Rear-end collision
   It is a traffic accident wherein a train crashes into a train in front of it.
4. Collisions with buffer stops
   A recent accident with buffer stop was observed at churchgate station.A local train crashed into the dead end at Platform Number 3 of Mumbai's Churchgate Station.If the train does not stop
5. Obstructions on the line
   (road, vehicles, landslides, avalanches)
6. Derailments(Plain tracks,curves,junctions)
7. Passing signals at danger
8. Excessive speed

1. When accidents occur, the information is sent to the control room.
2. The information gathered is used to find out the root cause of the accident.
3. The station master or the announcement department then announces about the accidents

3.Limitations of existing system

3.1.Speed of Information Delivery

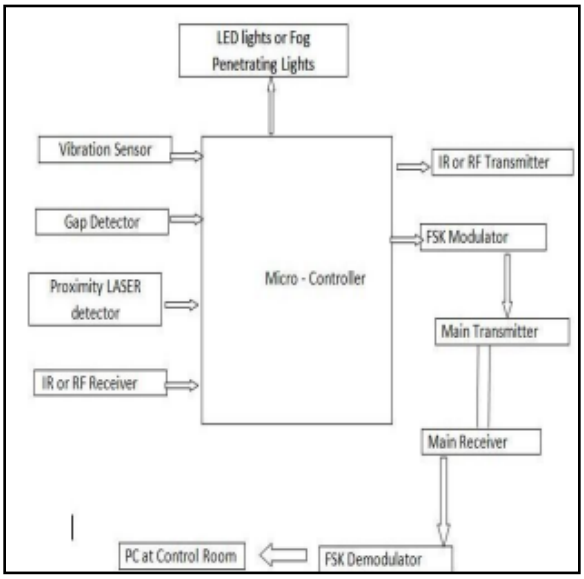
The time span taken to deliver information about the accident to the control room is comparatively slow .If the accident is major, it is necessary to deliver information at fast rate to avoid further major effects of that accident.
Example,if a major problem like train went out of track has been detected, it is necessary to quickly inform another train which is travelling exactly behind the same train on the same track to avoid train accidents. The speed of running train is very fast and cannot be controlled immediately, and hence it is necessary to inform about the problem prior.

3.2. Lack of source of information

Passengers present on the railway station can get live information about train accidents and they can switch their plan of travelling through train and can opt for travelling through some other vehicle. The problem will arise when a person is planning to go somewhere out through train but is unaware about the accident and the announcements which are made at railway station .The same scenario is observed for the passengers who are already traveling by train.

4. Proposed System

BLOCK DIAGRAM OF SENSOR SYSTEMS TO DETECT RAILWAY ACCIDENTS



4.1 **Gap Detector:** At bends or near curves, there should be gap between the rails of successive different paths. Even if there is a small gap between the tracks, the train would get mislead and travel in a different path which leads to collision. There are different sensors to indicate the short circuiting of the gaps but practically even a small dust can short circuit the gap which makes the current system incapable of providing desired results. Hence we use adjustable mechanical or elastic claw to find the gaps and provide indicationabout the gap immediately to the Control Room. The above figure shows a rail road indicating a condition of gap and fog times .Any given snowy, foggy or rainy night can turn into a disaster or major accident because of low visibility in these conditions which can increase the potential of danger. Rough weather conditions call for precision driving. The PLC system is not considered here instead, a zig-bee technology is used to communicate with the neighbor nodes.The proposed system focuses on safety of passengers, whether they are at station, they are at home or already travelling by train. Numerous sensor detecting systems can be used for detecting railway accidents. The sensors will send the information about the accident to the control room. The control room forwards this information to all the stations. This information is quickly uploaded on the 'm-indicator '. The processor is also capable of finding the relative velocity between the train and the target by taking measurement of the Doppler shifted signal.

4.2 LED or Fog penetrating Lights:

These lights are very useful during mist or foggy weather, as, near the signals, still now many employees use explosives or other form of lights for indicating signals which involves the manual monitoring next to the signal 24*7. So, detection of arrival of signal with the help of Vibration Sensor, the LED lights can automated and made to switch off automatically in the signals reducing the manual labour and monitoring and the driver in the train could be signalled easily.

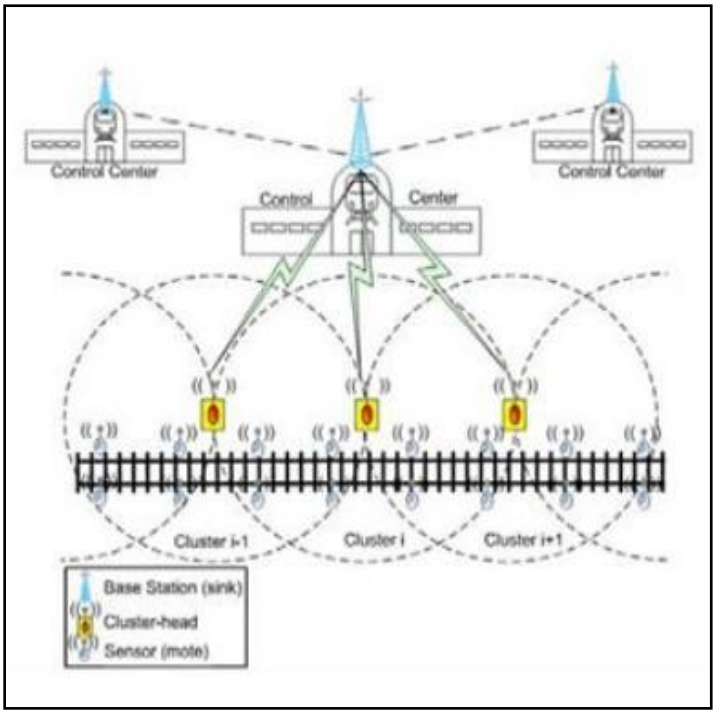
4.3 Vibration Sensor:

It makes use of piezoelectriceffect: ability of certain materials to generate an electric charge in response to applied mechanical stress, for detecting the vibrations in the rails due to the arrival or departure of trains and the direction of vibration indicate the arrival or departure. This could sense the train's position at roughly at 800 to 900 m away. This input is fed to the

the arrival of one train detected using vibration sensor can be immediately prompted to the Control room and the power supply can be switched off within 3 minutes so the trains could be stopped without colliding each other. Vibration sensors or shock sensors are commonly used in alarm systems to activate an alarm whenever the devices to which they are attached are touched.

4.4**Proximity LASER Detector:**

Most of the time collisions occur due to running train colliding with the Standing Train.A LASER detector can be used to detect the presence of any train coming behind the running train. A laser proximity sensor for a train consistsof a laser diode having front and rear facets. The diode generates a main laser signal and directs the first portion out of the front facet as a source beam. Then it focuses the source beam on a target, and focuses the return beam reflected from the target into the laser diode through the front facet. The laser diode receives the return light beam, provides it with a positive gain, mixes it with the main laser signal, and guides it out the rear facet as a mixed beam. A detection focusing device focuses the mixed beam onto a PIN detector. The PIN detector coherently detects the mixed beam and provides an output signal having a perturbation where the target enters the local field of the focusing optics. A processor detects the output signal from the PIN detector and may activate a breaking mechanism in the train



microcontroller. This could help in avoiding accidents between the trains at slopes because

4.5IR obstacle sensors

The IR obstacle sensor is fitted at the front of the train's engine to detect presence of any obstacle on the railway track within the line of sight. If any obstacle is detected, it will then send appropriate signal to the train's control system, which will then immediately stop the train to avoid accident.

4.6IR curve detection sensors

The IR curve detection sensor is fitted on the left side of the train's engine. When train is near curve, an obstacle is detected by this sensor and the curve detection signal is sent to the train's control system which will further control the train speed at the curve.

4.4 Fire sensor

A fire sensor is usually placed inside every coach of the train for detection purpose. whenever fire is detected and if the temperature within the coach exceeds beyond a particular limit/value, then a signal is sent to the train's control system which further detaches the couch which has caught fire and immediately stops the train.

Technologies used to transfer alerts

1) Wireless Sensor Networks Based on Fuzzy Logic

The concept of fuzzy logic is used by various sensors which are in existence today. A model and concept for placing these sensors on the railway track are described in the system. There are many base stations and control centers which collect data from the varioussensor nodes placed on the railway tracks. The concept of multilayerrouting is used to transmit the sensed data to the control station. The sensor nodes then transmit the data to their nearby cluster heads. Multilayer routing is used for the purpose when the nodes in lower layer transmit their data to the nodes on higher layer instead of transmitting it directly to base station. For detecting cracks on rail tracks ultrasonic method is used. The Ultrasonic waves are injected into the rails by special transducers wherein high energy signals are sent in two directions at predetermined or specific intervals. The transmitted signals are propagated in the rail and are received by the receivers. The nearby transmitters send ultrasonic waves with the same frequency but with different period's .In this way, the receivers will be able to recognize the direction (left or right) from which they receive the signal. If there is a break or chafe or any damage in the rail, the amplitude of the waves received by receivers will be reduced and an alarm signal will be sounded.

2) ZigBee RF Module

ZigBee module is used for the transmission of data collected from train's data, station data, and train accident information between base station and trains. The microcontroller AT89S52 of Atmel is used as hardware platform to monitor and control the railway track and the train operations like checking track continuity, detecting obstacles and curves using previously stated IR sensors connected to microcontroller. It helps in sending appropriate control signals. This model is designed to receive or to send the data which is collected to the zig-bee device for the communication which is carried out between the train and the base station. It is also used for sending messages to LCD which acts as warning information device in both train and base station**.**

TECHNOLOGIES FOR MESSAGE TRANSMISSION AND DATA COLLECTION

1) GPRS

The General Packet Radio Service offenly termed as GPRS is a packet-switching technology that helps inthe data transfer through cellular networks. It is used for mobile internet, MMS and other data communication systems. The speed limit observed of GPRS is about 115 kbps, but in most networks it is around 35 kbps.It also provides high data transfer rates which is useful for internet connectivity through various protocols like TCP/IP, X.25 and CLNP (connectionless network protocol). The data rates may vary widely due to the dependence upon factors such as network congestion, terminal (cell phone), distance to the base station or user velocity (if the user is moving). GPRS can be used as a bearer of SMS. If SMS over GPRS concept is used ,an SMS transmission speed of about 30 SMS messages per minute may be achieved.

2) GPS

The Global Positioning System also called as GPS is a space-based navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth. GPS is group of satellites which receives signals from the GPS transmitter and transmits them or sends data to the receiver. This enables to know the exact location, speed, events where it has GPS tracking unit .This system will help in playing vital role to provide exact location of accident to the control room.

3) GSM Module

The SIM 9000 GSM module is used to achieve the SMS functionality. GSM communicates with Arduino Uno serial communication. Serial communication uses two pins of microcontroller that is the transmitter and receiver. GSM used here provides SMS functionality which will transmit SMS to all the subscribed passengers from the control room.

How can we overcome this problem?

1) M-Indicator(For all subscribed passengers)
2) telent Technology - Communications and Network Services
   a) Automatic flight announcements
   b)Foreign language announcements
   c)Safety, security and housekeeping announcements
   d)User recordings and storage of announcements
   e)Live announcement function
   f)User selection of public address zones for announcements
   g)Unattended 24/7 announcement broadcasts
   telent Lighting Control Systems

Conclusion

This new approach of Railway accident Tracking alert system
Mainly focuses on safety of passengers and if applied in real time will majorly help all the passengers and also the railway system to reduce the number of accidents.

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