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Detection of Cracks and Railway Collision Avoidance System

S. Ramesh

Asst. Prof., S.R.M. University
2010-2011, Uttar Pradesh (Ghaziabad), India
E-mail: ramembengineer@gmail.com

Abstract

One of the major problems that railroads have faced since the earliest days is the prevention of service failures in track. As is the case with all modes of high-speed travel, Rail is manufactured in different weights; there are different rail conditions (wear, corrosion etc.) present; there are a significant number of potential defects possible; and the task has to be performed with some speed to reliably inspect the thousands of miles of track stretching across the land failures of an essential component can have serious consequences. The main problem about a railway analysis is detection of cracks in the structure. If these deficiencies are not controlled at early stages they might cause huge economical problems affecting the rail network (unexpected requisition of spare parts, handling of incident and/or accidents). The main part of the work was to carry out a feasibility study on two methods for detection of cracks and avoidance of the collision between the rails. The detection of cracks can be done by ultrasonic waves or sensor. Collision avoidance system can be done by the following nodes: Server side node, train side node, track side node and station side node.

Keywords: Avoidance, cracks, detection, vibration sensor.

Introduction

Today, rail networks across the world are getting busier with trains travelling at higher speeds and carrying more passengers and heavier axle loads than ever before. The combination of these factors has put considerable pressure on the existing infrastructure, leading to increased demands in inspection and maintenance of rail assets. The expenditure for inspection and maintenance has thus, grown steadily over the last few years without however being followed by a significant improvement of the industry's safety records. As a direct consequence the immediate key challenges faced by the rail industry are: The improvement in the safety of the railway system, The development of new railways to accommodate the continued growth in demand, and Contributing to a more sustainable railway, in both environmental and financial terms, by delivering further efficiencies and exploiting technological innovation. High safety standards required in the management of railroad lines demand the inspection of railway wheels directly after production in order to detect the presence of surface cracks that could seriously affect the integrity of the railway, and therefore passengers' safety. During the last one year, we have been developing the proposed system for the detection of cracks and railway collision avoidance systems(RCAS). The detection of Cracks can be identified by using vibration sensor. This system also detects while breaking the tracks by the miscreants. The vibration sensor detects the abnormal vibration. Whenever vibration comes it tries to communicate with the train and identifies that it is the vibration by train and if it can't communicate with the train then the node identify it as a abnormal vibration. Then the track-side node passes this information to the nearby station using ad-hoc network method. Then the station-side admin person can pass this node information with latitude longitude position to the main control room or server. (Later the server side admin department can communicate with other servers for tracking purpose such as GPS satellites and monitoring etc.)Avoidance of collision can be carried by the the track side system. The track side system is mounted to the post which is located every km and it consists of vibration sensor, memory, microcontroller and ZigBee. This node stores its corresponding location information (longitude and latitude). The vibration sensor is connected with the track. It detects for the abnormal vibration in the track. Collision avoidance can be done by the vibration detection as well as track side node communication. If two trains come in same track in opposite direction, the track-side nodes detect it and send the information to the train as well as control room.

Detection of Cracks

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Avoidance of Collision

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Nature of Work

The basic objective of this project is to develop an embedded system which is used to track the locations of the trains, avoids the collisions, detects while breaking the tracks by the miscreants and reporting other management information.

This project is divided in to four sections, as server side, train side, track side and station side. The track side system is mounted to the post which is located every km and it consists of vibration sensor, memory, microcontroller and ZigBee. This node stores its corresponding location information (longitude and latitude). The vibration sensor is connected with the track. It detects for the abnormal vibration in the track. Collision avoidance can be done by the vibration detection as well as track side node communication. If two trains come in same track in opposite direction, the track-side nodes detect it and send the information to the train as well as control room.

Next one is the train-side node which is used for train identification and track information purpose. It consists of memory, microcontroller and ZigBee. This node stores the train information with a unique TIN (train identification number). Before the train starts from a place, this node communicates with the control room which feeds the track information, train name, start and end point etc to the train side node.

Next one is station side node which consists of microcontroller, zigbee, memory and display. When a train is about to reach a station, the train-side node and the station-side node communicates. The train passes the management information to this station. Simultaneously the display displays the intimation of the in-coming train to the passengers.

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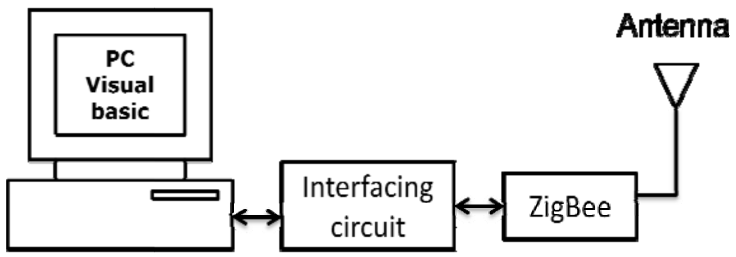
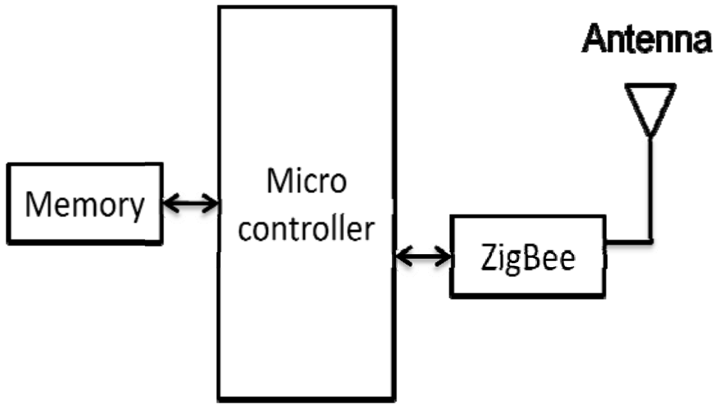
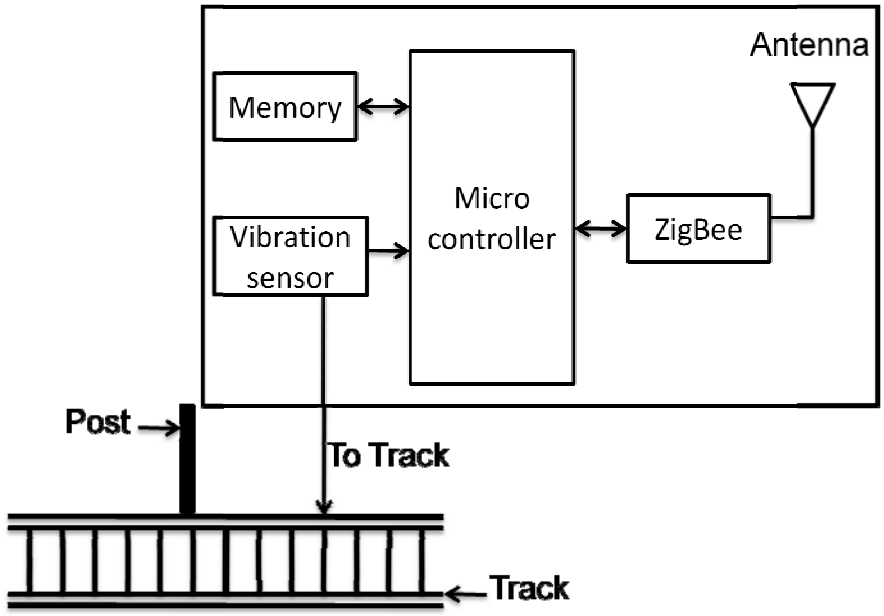
Server side node



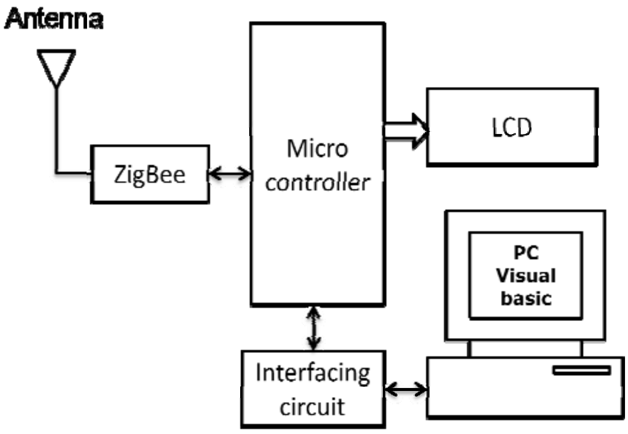
Train side node



Track side node



Station side node



Results and Discussions

The main result for this paper is to avoid the detection of cracks and avoidance of collision between the rails. A collision avoidance technique based on short-distance train-to-train transmission is under test at the Wegberg-Wildenrath test centre near Düsseldorf in Gernamy.The trials are being led by aerospace research agency Deutches Zentrum für Luft- und Raumfahrt (DLR), which is providing researchers from its institutes for transportation systems and robotics & mechatronics. DLR partnered with train operator Bayerischen Oberlandbahn (BOB) for the trials – BOB offered use of an Integral dmu and crew. The other vehicle used was DLR's own "Rail Drive" road-rail unit.

Figure 5: Detection of cracks.

"RCAS is a system for preventing train collisions that operates independently of other safety technology deployed alongside the railway track", Professor Dr Thomas

String, project director at DLR explains. The DLR researchers delivered lectures and showed models to participants during a day of demonstration on 11 May. Observers were able to travel on the Integral, which was equipped with RCAS to communicate with the road-rail vehicle.

The two trains simulated three scenarios:

- One where the two were running alongside each other, simultaneously approaching a section of single-track line.
- In the second, one train headed for a set of points beyond which one route was occupied and the other clear, but the setting of the points was unclear.
- In a third test run, a train was left stationary near a set of points but did not constitute a hazard, and the system successfully recognised this.In all cases, RCAS assesses the situation automatically.

If it detects a conflicting move, the RCAS onboard interface prompts the driver to apply the brakes. “RCAS is initially intended for routes and situations where, at present, no other protection systems are employed – for example, routes with very low volumes of traffic, industrial railways, construction sites or shunting areas”, according to Dr Michael Meyer zu Hörste, a DLR rail transport researcher. RCAS is in no way intended to replace ERTMS, he added. “It is an add-on system – RCAS can act as a safety overlay in places where conventional technology is not being employed.”According to DLR, the existing prototype is based on “standard commercial hardware and software”, which in its existing form does not hold official approval for safety-critical fields of operation, and this will not be sought. In order to avoid these types of cracks we are used the proposed model of vibration sensor and uv rays. Anyway, the presented results, which also can be considered as preliminary results, are very encouraging and they suggest the possibility of increasing and generalizing the Vibration sensor set up.

Conclusions

Our proposed model is facing a new challenge to further improve the reliability of rail testing techniques, while seeking for new and emerging technologies in Vibration sensor that aid the detection of rail defects. With the vibration sensor test equipment, focus has been on better understanding adhoc networking i.e.,communication node systems. Further results, such as the crack location, depth, type etc. can be deduced through the analysis of the GSM Ongoing work is under way to develop improved automated rail testing techniques, mostly in the field of employing the proposed model for detection of cracks. Development of new processing algorithms (e.g. pattern/signaturerecognition) to detect defects has become the major focus of most research activities to detect defects quickly and reliably, aiming to reduce the incidents of false alarms.In most cases, data recording capability of the rail testing equipment allows the inspector to download the data for off-line signal analysis.But our concept is mainly to detects the cracks and avoid the collision in the tracks Both will be carried out successfully and in the Proposed Model.

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