Anti-collision System for Train Using Differential Positioning

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Abstract-Train accident occurs as a result of human errors or mechanical faults in trains, in tracks, or in the signalling system. Major and costly train accidents occur due to head on collision of train running on the same track towards each other. Several schemes have been proposed by the researchers in the past too detect the risk of possible collision and to take preventive measures, the aim of this paper is to design a novel micro-controller based system using RFID, GPS and RF transceiver module to detect possible collisions and inform the drivers when trains travel on the same track.

Keywords: RFID, Micro-controller, Communication, GPS Module.

I. INTRODUCTION

• Over the years the exponential increase in the trains and train frequencies has lead to increase in the accidents associated with them. Among the train accidents worse are those which include head on collision of trains travelling on the same track. Though there are systems existing they are either manually operated or outdated.

• This project aims at providing an alternative to the problem. Each track is fitted with a distinct, passive RFID Tag (it does not require maintenance, wiring and resistive to harsh weather conditions).

• Each train (i.e. train a, train B) consists of RFID Reader. After reading a corresponding tag train A, B will encode the tag using PN sequence and transmit the corresponding encoded.

A. Literature Survey:

1. The existing system depends on the communication through telephone. So basically it involves human interference. This may result in miss-communication, wrong allocation of track for trains leading to collision. And this kind of errors can be reduced by using RF technology.
2. If two trains are on same track then RFID readers will have the same track information. RF transceivers will keep on transmitting the Train number and number of the Track on which it is travelling. RFID system senses the trains at a particular distance from each other. And breaks could be automatically activated to stop the trains at a safe distance. Each Train and Track will have distinct number.

3. RFID tag is used to keep track on current position of the Train. FID reader will read this unique information and using transceiver it will transmit to take respective action by using micro-controller. Micro-controller compares RF receiver and its unique ID. If they match, micro-controller stops the Train using relay circuit and alarm rings.

B. Applications

Following applications are considered to demonstrate the functionality of the system. Although system is not limited to these specific applications.

- Toll Tax Payment Systems
- Video, Audio Encrypted Transmission( for exclusive military applications )

In all these applications, monitoring and control operations can be done remotely

II. Methodology

A. Block Diagram
B. General Discussion and approach

Collision Algorithm.

The collision detection algorithm is described below for the case when two trains happen to be on the same track:

Assume that two trains TR1 and TR2 have speeds S1 and S2 km/hr and are at a distance of d1 km from each other. The distance d1 between the two trains is calculated from knowledge of their GPS positions.

Assume that another measurement is made after T minutes (e.g. one minute). Let d2 be the new calculated distance between the two trains, and also assume that the speed of the trains do not change during time T.

The following process is repeated at regular intervals:

Case 1: If d2 > d1
Then there is no risk of collision.

Case 2: if $d_2 < d_1$

Case 2.1: Head-on collision will occur

If: $d_2 = d_1 - (S_1 + S_2) \frac{T}{60}$

And the estimated time to collision (ETC) is given by:

$$ETC = d_2 / (S_1 + S_2)$$

Case 2.2:

If otherwise $S_1 < S_2$ and $d_2 = d_1 + (S_2 - S_1) \frac{T}{60}$

Then the two trains are following each other with no risk of collision

Case 2.3: if otherwise $S_1 > S_2$ and $d_2 = d_1 - (S_1 - S_2) \frac{T}{60}$

Then the two trains are following each other and there is risk of Rear-to-end collision with the estimated time to collision (ETC) given by:

$$ETC = d_2 / (S_1 - S_2)$$
C. Result and Analysis

Currently GPS is interfaced with PIC18F which is used to acquire the current location of the train. The GPS module installed gains the current location (i.e. latitude and longitude) and passes the location to micro-controller via UART communication protocol. The software used for simulation is Proteus 8.0.
This is the simulation for the local oscillator which is used as a carrier signal used in digital modulation technique. The current oscillator circuit is implemented on the Multisim 8.0 software using LM7171 OP-AMP. The current local oscillator produces sinusoidal signal of frequency 469.483 KHz which will be used as a modulating signal in the wireless communication in order to exchange the information (i.e. location, speed).

III. FUTURE SCOPE

The developed system can be enhanced further by adding automatic emergency help line where the position of train can be sent to a help centre with pre-recorded messages, after an accident, using perhaps the GPRS or similar techniques.

REFERENCES:


