Design and Development of Intelligent Automatic Train Collision Avoidance System

[1]Brinda R, [2]Ranjitha R, [3]Sindhu J, [4]Chaitra V, [5]Chaithanya.S,

[1,2,3,4,5] Dept. of ECE, RRCE, Bengaluru
Email: [1]brindalakshmi16@gmail.com, [2]ranjitha.r2011@gmail.com, [3]sindhuj1793@gmail.com,
[4]chaitravisman@gmail.com, [5]chaithanya06@gmail.com

Abstract- In rapidly flourishing country like ours, there are many train collision accidents that takes place in platform and also there is a loss of life in unmanned area of the track where people fail to recognise the train arrivance. Hence we are in a need to protect many lifes from these problems of railway system. Our project deals with two important goals and firstly is that, automating the signals in the platform whether the platform is free for upcoming train and secondly is that, alerting the people in unmanned area of the track about arrival of train. Here we use axle counters which detects the train wheel and starts its counting. As per the requirements signal is changed using ZigBee communication. Based upon this the upcoming train to the platform is either alerted by red signal if the other train is already present in platform or is alerted by green signal if platform is free. Similar way in the unmanned area when axle counter senses the train, LED lights are turned on for certain distance to alert people about the upcoming train.

KEYWORDS-Microcontroller, ZigBee, LED, Axle counters, Power supply, RED and GREEN signal.

I.INTRODUCTION

Railway is an Eco-Friendly and Popular mode of transport in major cities of the World. Train accidents occur normally due to safety violations resulting from „human errors or limitations" and „equipment failures" loosing precious lives. The Ministry of Railways (Railway Board), Govt. of India has referred many collisions in the past few years and therefore need for research is very important in this field.

The goal of this work is to design and implement a cost effective and intelligent Train Anti Collision System to prevent the train collisions. It aims to efficiently integrate into existing signalling system and avoid accidents in platforms and railway gate crossing. Presently, emergency may be passed through traditional telecommunication systems like Walkie-Talkies or other communication devices. In the traditional communication method, human error or carelessness may lead to severe disasters as noticed in the past. In places where there is no indication of the coming train, most of the people are losing lives.

The proposed of unmanned wireless intelligent train collision avoidance system consists of a self-acting microcontroller, Axle sensors, two way

ZigBee based data communication system which works round-the-clock to prevent train collisions and accidents at level crosses, to provide traffic assistance to the next coming train to the platform, also consists of IR sensors and LED lights to alert the people crossing the track.

Railway infrastructure has a limited physical capacity that is often insufficient to smoothly accommodate traffic when unexpected events perturb operations. This insufficiency appears in terms of train.

II. LITERATURE SURVEY:

Railway infrastructure has a limited physical capacity that is often insufficient to smoothly accommodate traffic when unexpected events perturb operations. This insufficiency appears in terms of train conflicts[1].

When an unexpected event occurs, trains suffer a non-negative delay at their entrance in the control area. This delay is typically named primary delay and it may cause the emergence of conflicts within the control area itself. The additional delay due to these conflicts is named secondary delay. According to the literature, the objective of the RTMP is the minimization of the maximum secondary delay assigned to trains. Multiple sets of constraints characterize this problem.

First of all, time concerning constraints: a train cannot be scheduled earlier than its entry time (if starting within the control area, the planned departure time is considered as entry time) and it must occupy each track-circuit along one route for a certain amount of time. In variable-speed models, this time depends on traffic conditions[1].

Due to all of these issues, the traffic management systems must be re-designed from systems that are oriented to the control through exceptions to systems that allows control through re-planning, building up integrated systems for strategical and tactical planning and real time re-planning, allowing the automatization of repetitive tasks like installations telecontrol[2].

Implementation of an efficient ZigBee based Train Anti-Collision and Level Crossing Protection System for Railways is being proposed in this paper. The system has four sub modules namely, Train Module, Control Centre Module, Signalling Post Module and Level Crossing Gate Module. A safe distance of 1 Km has been maintained between the trains after applying the emergency brake in case of collision detection. It is expected that if this system is implemented widely, train collisions and accidents at the Manned/Unmanned level crossing gate can also be avoided in the future[3].

This work is concentrated on predicting the major cause of railway accidents that is collision on the same track. The primary goal of this anti-collision system is to identify collision points and to report these error cases to main control room, nearby station as well as grid control stations[5].

The increased growth in the railway sector has resulted in an increase in the train traffic density across the world. This has resulted in the increase in the number of accidents involving trains. In this paper, the proposed system aims at averting collisions between trains and further it is used to provide the driver with information on obstacles present in the track. The proposed system is an upgrade to the existing TPWS and ACD systems. The system makes use of RFID, FLIR cameras and other embedded systems[6].

III. MOTIVATION:

The Ministry of Railways (Railway Board), Govt. of India has referred many Train Collisions in the past for development of an efficient Train Anti-Collision system and the need for research in this field. Railway infrastructure has a limited physical capacity that is often insufficient to smoothly accommodate traffic when unexpected events perturb operations. This insufficiency appears in terms of train conflicts: multiple trains concurrently claim a portion of track. In case of conflicts, trains must be delayed for sequencing their use of the critical portion of track. The main reason for taking up this project is to make the transportation by railways much safer.

IV. PROPOSED SYSTEM:

In these days, as train accidents are most common and the damage due to the seaccidents are more severe which also leads to loss of lives of passengers, it is mandatory to reduce the accident rate. The goal of this work is to design and implement an intelligent fully automatic Train Anti Collision System to prevent the train accidents. It aims to efficiently integrate into the existing signalling system and avoid accidents in manned as well as unmanned area of the track. The new technology of using the Axle counters and LED lights alerts the people while crossing the track to save their lives. Also informs the next approaching train about the traffic in the platform using automatic signal indication that is RED for indicating that the other train is present in the platform, GREEN for indicating that track is traffic free. Hence this technology can save many lives and improve railway system.

V. BLOCK DIAGRAM DESCRIPTION:

The block diagram consists of,

Power supply:

Power supply is used to energies the equipment such as microcontroller, sensors, ZigBee module. It consists of amplifier, regulator, and rectifier. In our project 5V adapter is used as power supply. ZigBee:

ZigBee is an established set of specifications for Wireless Personal Area Networking (WPAN), ZigBee is an IEEE 802.15.4 standard for data communications with business and consumer devices. ZigBee is a low-cost, low-power, wireless mesh networking standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications, the low power-usage allows longer life with smaller batteries, and the mesh networking provides high reliability. MicrocontrollerAT89S52:

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel‟s high-density non-volatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out.

Axle counter: An axle counter is an electronic instrument which is used to sense and count the number of wheels of the train.

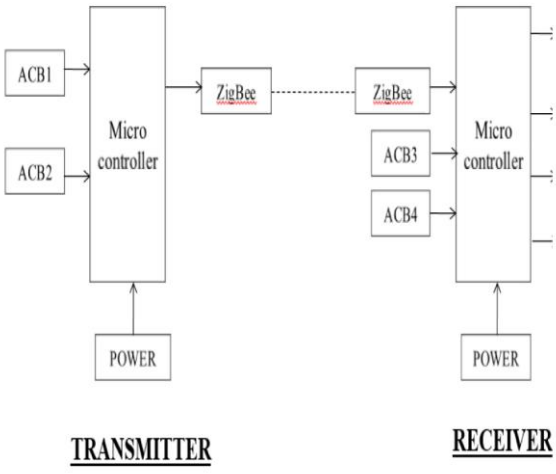


Fig 1.Block diagram of Intelligent Automatic Train Collision Avoidance System

VI. WORKING METHODOLOGY

i. TRAFFIC ASSISTANCE:

ACB1 and ACB2 are placed before and after the platform respectively. They get activated as soon as they sense the first wheel of the train coming to platform. It starts counting the number of wheels of the train. ACB1

sends the signal to the micro controller indicating that the train has arrived. The signal is passed to the receiver through ZigBee. When the signal is received the micro controller turns ON the RED signal indicating that the train is present in the platform. ACB2 also starts counting the wheels. The count of both the sensors are held by the micro controller. When the count of ACB1 is equal to that of ACB2, the micro controller sends a signal through ZigBee to receiver end. The micro controller in receiver end turns ON the GREEN light and turns of the GREEN light indicating that the platform is traffic free. ZigBee is the wireless network system used to transmit data efficiently up to 40km. It works on UART protocol with serial communication of data. Here Microcontroller acts as the base station which holds the count of the sensors and does the operation of transmitting and receiving the signal effectively.

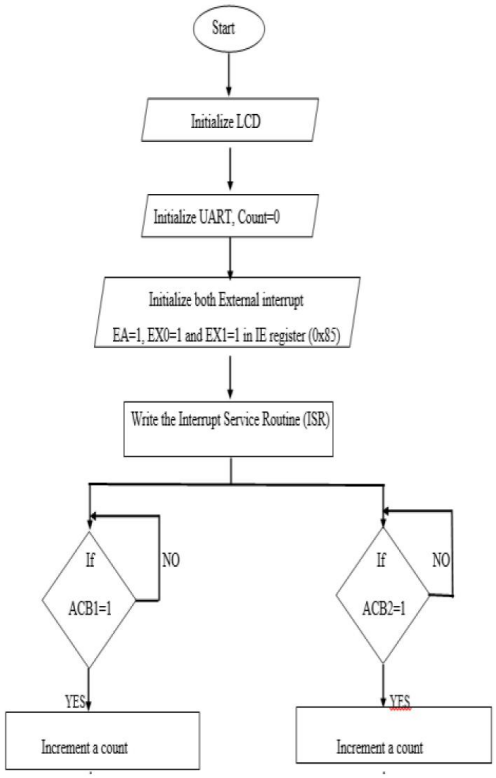
ii. METHOD TO ALERT PEOPLE ABOUT THE APPROACHING TRAIN:

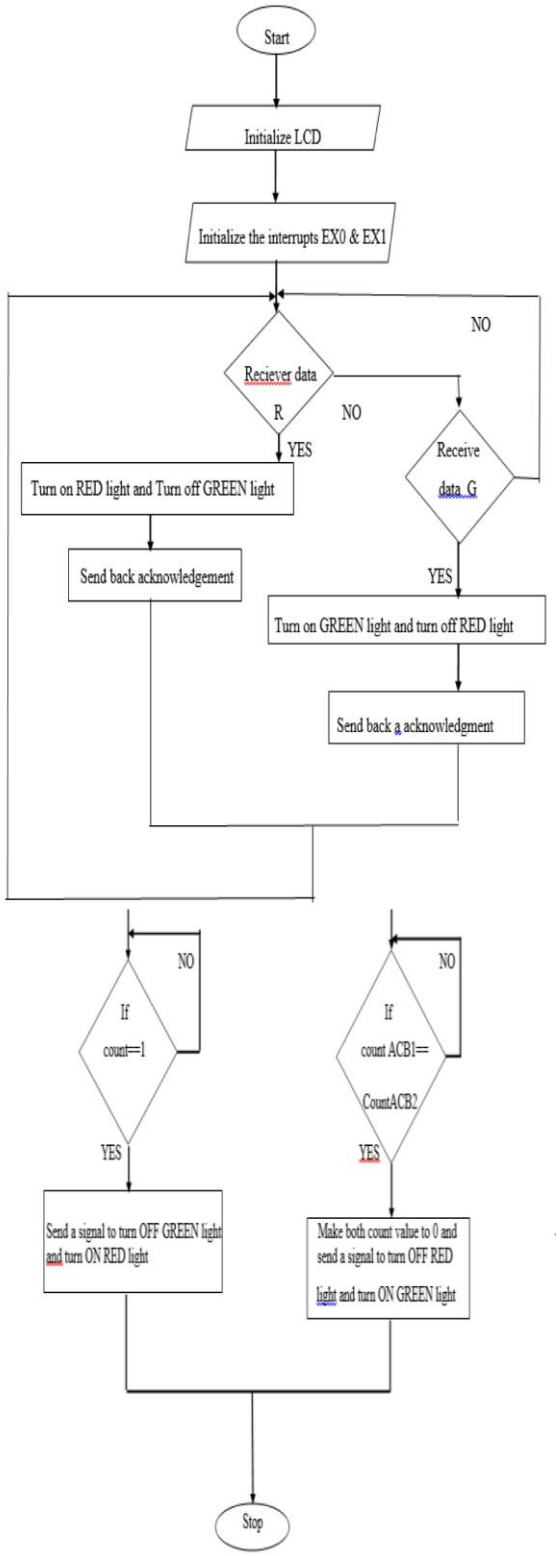
ACB3 is placed at certain distances near the track that gets activated as soon as it senses the wheel of the train and turns ON the LED lights that are placed further for certain distances in order to alert the people of the approaching train and save the precious lives in unmanned area.

iii. AUTOMATIC GATE CONTROL:

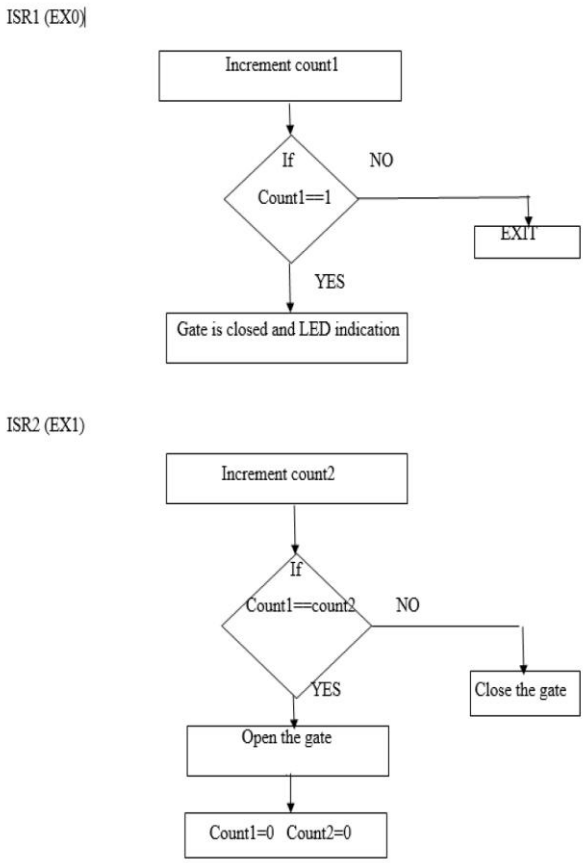
As the ACB3 senses the first wheel it activates the motor and the motor turns to close the gate in unmanned regions where there are level crossings. These reduces work of an operator.

Transmitter flow:





Reciever flow:



VII. ADVANTAGES:

1. Train collisions will be avoided with better traffic assistance.

2. Innocent lives will be saved in unmanned regions with better signalling system.

3. High speed signal transmission.

4. Gate control is made automatic.

VIII. LIMITATIONS:

1. Axle counters are expensive.

IX. VII. CONCLUSION:

Hence by implementing this project we can avoid train accidents in platform and can alert people about the upcoming train which saves many precious lives. This technology improves the transportation through the railway system and makes it much safer.

X. ACKNOWLEDGEMENT

Our special thanks to Dr. M S Bhagyashekar, Principal, RRCE, Bengaluru, for providing us a platform to present our paper. We acknowledge the unbridled enthusiasm of Mrs. Chaithanya.S, Assistant Professor, Dept of E&C, R.R.C.E, Bengaluru, for her encouragement and valuable guidance for the presentation of this paper.

REFERENCES

[1] Real time railway tra_c management modelingtrack-circuits :Paola PELLEGRINI, Gr_egory MARLIERE, Joaquin Rodriguez

[2] Automatic railways traffic management in high speed lines:Francisco José de la Vega1.Presenting Autor, A. Berrios1 , Luis Díez1 and Jose Miguel Rubio21ADIF, Railways Infrastructure Manager, Madrid, Spain.; 2Indra, Railways Area Manager, Madrid

[3] Arun. P, Saritha. S,K.M. Martin,Madhu kumar.S "an efficient train anti-collision system using LEO two way sattelite communication.," in national conference on Computer networks, human computer interaction and image processing,pp.32,March 2012.

[4] Arun. P, Saritha .S, K. M. Martin, Madhukumar. S "Simulation of zigbee based TACS for collisiondetection and avoidance for railway traffic.," in International conference on advanced computing & communication technologies for high performance application, paper ID 51,June 2012

[5] Bhatt, Ajaykumar A, „An Anti-Collision Device (ACD) Network – A train Collision Prevention System (TCPS)". A concept for reducing railway accidents. H Ben Brown, Jr. Gregg Podnar, Mel Siegel, February, 2005.

[6] Jennic, JN-AN-1059 Deployment guidelines for IEEE 802.15.4/ZigBee wireless networks,37-38, 2010.

[7] A concept for reducing railway accidents. H Ben Brown, Jr. Gregg Podnar, Mel Siegel, February, 2005.

[8] Corman, F., D'Ariano, A., Pacciarelli, D., Pranzo, M.: Dispatching and coordination in multi-area railway track management. Tech. Rep. RT-DIA-190-11, pp. 1{30, Dipartimentodi Informatica e Automazione, Roma Tre (2011).

[9] Corman, F., D'Ariano, A., Pacciarelli, D., Pranzo, M.: Bi-objective conict detectionand resolution in railway trac management. Transportation Research Part C: Emerging Technologies 20(1),79{94 (2012).

[10] Goverde, R.M.P.: A delay propagation algorithm for large-scale railway trac networks. transportation Research Part C: Emerging Technologies 18(3), 269{287 (2010).

[11] http://www.digi.com/products/wireless-wired-embedde solutions/zigbee-rf-modules/zigbee-mesh-module/.