International Journal of Advanced Technology and Innovative Research

ISSN 2348–2370
Vol.07,Issue.18,
December-2015,
Pages:3632-3637

www.ijatir.org

Accident Detection System in Railway by Using Wireless Networks

CH. PRASANNA LAKSHMI[1], S. RAM KUMAR[2]

[1]PG Scholar, Dept of ECE, Lingayas Institute of Management and Technology, India.
[2]Assistant Professor, Dept of ECE, Lingayas Institute of Management and Technology, India.

Abstract: In the present current railway system, it is becoming ever more necessary to have safety elements in order to avoid accidents. one of the important causes that can provoke serious accidents is the existence of mobile this paper deals about one the efficient methods to avoid train collision and obstacle detection[1] and monitoring the surveillance of fire occurred and temperature in train and voltage faults and track faults can be monitoring in base station at railway department. The paper present a solution to provide an intelligent train tracking and management system to improve the existing railway transport service[3].the solution is based on powerful combination of mobile computing global system for mobile communication (GSM),global positioning system (GPS) technologies and soft ware .the in-built GPS module identifying the train location with a highest accuracy and transfers the central system the availability of the information t allows the train controller to take accurate decisions as for the train location . Positioning data along with train speed helps the central system to identify the possible safety issues and react to them efficiently using the communication methods provided by the system.

Keywords: ARM7(LPC2148), Track Sensor, Smoke Sensor, Obstacle Sensor, GSM, GPS.

I. INTRODUCTION

In all transport systems, particularly in the case of railways, safety and reliability are highly considered [4]. In recent years, with the development of high speed railway, speed and capability of the trains constantly improved, and traffic density gets more and more serious. As a result the requirements to the reliability and safety of the high speed train operation enhances increasingly. However, safety of high speed railway extremely relies on its surrounding environment. The number of collision connected railway accidents shows world-wide an increasing tendency year by year. The ever increasing operation velocities cause an increasing degree of the grave consequences both in loss of human life and severe damage to the train and other railway equipment. In the technical literature very few numbers of publications can be found that are dealing with investigations into the train collision processes to predict the level of forces and deformations realizing in the course of accidental collisions/crashes. The shortage of the literature sources can be explained by the extremely complicated character of the dynamics of train crashes. The paper takes an attempt to develop an iterative computation method for predicting the dynamics of train collisions/crashes. The train safety has been an issue with the increasing number of incidents being reported that has caused death and injury. Majority of deaths on the railway involve third parties with the incursion onto the level crossings.

Average train accident would cost millions of Indian rupees and these can be avoided if there is a mechanism to track the train location and speed and warn the locomotive drivers about possible safety issues. The solution is a comprehensive GPS/GSM based train tracking system, which provides accurate, dependable and timely information to the controller. The inbuilt GPS module identifies the train location with a highest accuracy and transfers the information to the central system via GSM. The availability of this information allows the Train Controller to take accurate decisions as for the train location. Location data can be further processed to provide visual positioning using maps granting a wholesome view on train location. Positioning data along with train speed helps the administration to identify the possible safety issues and react to them effectively using the communication methods provided by the system. Additionally, this paper proposes a system which monitors the track in front of a train for obstacle detection using multi sensor setup. If an obstacle is detected, the inbuilt GPS module identifies the train location with a highest accuracy and transfers the information to the central system via GSM. The availability of this information allows the Train Controller to take accurate decisions as for the train location.

II. LITERATURE SURVEY

Sandeep Patalay in [4] gave a basic approach of how the sensor network could be utilized in railways. Use of sensor nodes with a special node called driving node at the locomotive engine, Gateway node and a Base station could achieve an architecture needed for this scenario. he sensor nodes could detect the events occurring and could be triggered. The sensor node reports the events to the base station which could further take actions that depends on the applications. For e.g. In closing of railway gates

automatically once arrival of train is detected. In this scenario the event is the arrival of train and a vibration sensor which was laid in the track could detect this event and could report it to the nearby base station which then The sensor nodes are fitted to the carriages at a distance of four hundred meters apart which communicates to the driver node at the engine which then transmits the information to the Gateway node. A wired backend could serve as the communication medium for the communication between the gateway node and the Base station. The base station can then send back the commands to the driver node. Zeinab Sam Daliri, et.al., in [5] have given the method for providing security in railways through wireless sensor networks based on Fuzzy Logic which acquired the basic sensor network architecture and multi-layer routing from that of paper [7] and includes ultrasonic broken flaw detecting system. This system includes a transmitter which sends out high energy waves in two directions at estimated intervals. The break in rails will be indicated by the change in the amplitude of the waves. It has a system for tracking any materials in tracks which employs either image processing by analyzing the images captured by the cameras or leaky cable method for areas where there are possibility of landslides.

III. EXISTING SYSTEM

In the existing system complex mechanisms are used about one the efficient methods to avoid train collision and obstacle detection and monitoring the surveillance for trains transport.

IV. PROPOSED SYSTEM

In the proposed system monitoring the all parameters those are fire and temperature &voltage fault and track damages. complex mechanisms are used about one the efficient methods to avoid train collision and obstacle detection and monitoring the surveillance for trains transport and track the train location by using GPRS technology.

A. Hardware Description

These system consists of two main section .they are

- Train monitoring section.
- Mobile section.

B. Train Monitoring Section

This section consists of different sensors like track fault sensor, voltage fault sensor, obstacle sensor. it also consists of display devices , communication devices like GPS,GSM modules shown in FIG.1..Main section every second monitor all sensors, if any sensor triggered then microcontroller sends message to mobile unit section.

C. Mobile Section

In this section mobile unit receives message from main section and control commends sends to main section.

Smoke Sensor: Sensitive material of MQ-2 gas sensor is SnO2, which with lower conductivity in clean air. When the target combustible gas exist, The sensor's conductivity is more higher along with the gas concentration rising. Please use simple electro circuit, Convert change of conductivity to correspond output signal of gas concentration. MQ-2 gas sensor has high sensitivity to LPG, propane and Hydrogen, also could be used to Methane and other combustible steam, it is with low cost and suitable for different application.

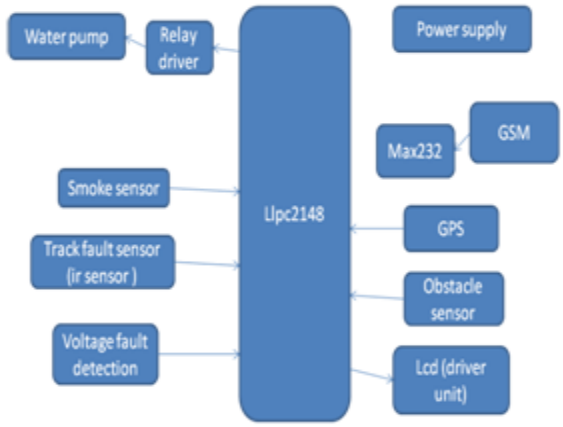

Fig.1. Block Diagram of Train monitoring section.

Track Sensor (IR Sensor): The IR TX and RX are placed adjacent to each other. The TX transmits the IR radiation continuously and these will pass away when there is no object interrupting the signal. The IR receiver does not receive the IR radiation in this case. When there is an obstacle or when someone interrupts the IR signal, the rays transmitted by the IR transmitter will get reflected back and these reflected rays will be received by the IR receiver. Thus, the IR receiver receives the signal now in this case. The microcontroller detects this change and does the necessary action.

D. Obstacle Detection

In the obstacle detection module [1], redundant ultrasonic sensors are used to increase detection resolution and sensor data reliability. Since ultrasonic sensors have a width dihedral detection angle, the resolution of detected obstacles is very low. The implemented approach uses always two ultrasonic sensors for one half of the same angle. Hence, though the double amount of sensors is needed, the redundancy and resolution is also doubled.

E. Microcontroller

The NXP (founded by Philips) LPC2148 is an ARM7TDMI-S based high-performance 32-bit RISC Microcontroller with Thumb extensions 512KB on-chip Flash ROM with In-System Programming (ISP) and In-Application Programming (IAP), 32KB RAM, Vectored Interrupt Controller, Two 10bit ADCs with 14 channels, USB 2.0 Full Speed Device Controller, Two UARTs, Two I2C serial interfaces, Two SPI serial interfaces Two 32-bit timers, Watchdog Timer, PWM unit, Real Time Clock with optional battery backup, Brown out detect circuit General purpose I/O pins.

V. TERMINOLOGIES

A. GPS/GSM Based Train Tracking System

We strongly believe that the correct combination of latest information and communication technologies can provide an effective and feasible solution for the requirement of a reliable and accurate train tracking system to improve the efficiency and productivity of Indian Railways. The solution we propose encompasses a powerful combination of mobile computing, Global System for Mobile Communication (GSM), Global Positioning System (GPS), Geographical Information System (GIS) technologies and software to provide an intelligent train tracking and management system to improve the existing railway transport service. All these technologies are seamlessly integrated to build a robust, scalable architecture as illustrated in Fig.2.

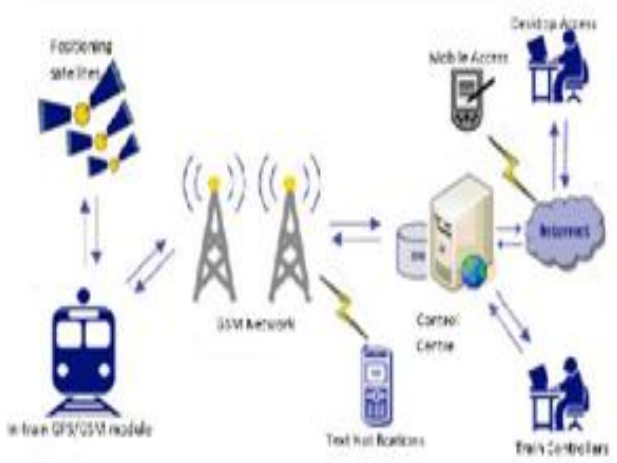

Fig.2. GPS/GSM Based Train Tracking System.

The fundamental process in our system is obtaining train location using GPS technology and transmitting the data via GSM network to the central control unit for data processing and information analysis and to take appropriate decision. The position data is periodically sent to the central server through the GSM transmitter of the module. The server automatically updates the database with latest position, speed and direction information of each train The GPS receiver of the unit is capable of identifying the latitudinal and longitudinal position and ground speed of the specific train by receiving information from the GPS satellites. The device is capable of storing data in a buffer at a time of GSM connectivity failure, and can synchronize with the remote server when GSM is back online. The device can also respond to commands and data calls from the central remote server as per administrative requirements of the train controllers. The use of GSM over GPRS significantly improves the feasibility and availability of our system [4]. We have chosen GSM as the communication medium between the train locator and the central server to improve availability of our system by utilizing the existing GSM network which covers the whole country. The central control system includes a remote server for handling and processing all the position information received from train locators via the GSM network.. Our main objective is to avoid collision of trains and detecting objects on track fulfilling the fundamental requirement of reliable and real time information of train positioning for monitoring and administration purposes by the Railway Department.

B. Global System for Mobile Communication

GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot.GSM is a digital mobile telephony system that is widely used in Europe and other parts of the world. GSM uses narrowband TDMA, which allows eight simultaneous calls on the same radio frequency. It operates at either the 900 MHz or 1800 MHz frequency band and is the most widely used of the three digital wireless telephony technologies (TDMA, GSM, and CDMA).

C. Global Positioning System

GPS is a space-based satellite navigation system that provides location and time information in all weather, anywhere on or near the Earth, where there is an unobstructed line of sight to four or more GPS satellites. The GPS program provides critical capabilities to military, civil and commercial users around the world. In addition, GPS is the backbone for modernizing the global air traffic system as shown in Fig 2. It is maintained by the United States government and is freely accessible to anyone with a GPS receiver. The use of GSM and GPS technologies allows the system to track train and provides the most up-to-date information about ongoing trips. This system finds its application in real time traffic surveillance. It could be used as a valuable tool for real time traveller information, congestion monitoring, and system evaluation. An intelligent, automated train tracking system can resolve following problems such as, late arrivals to scheduled, accident, collision of trains. Tracking the each train to identify the parametric values in each train .by using GPS.

D. Proposed Algorithm

Algorithm for the proposed system is divided in two parts as follows: Train monitoring section and Mobile section.

Train & Mobile Monitoring Section: Algorithm for transmitter side which consists sensors, ARM7 microcontroller GSM and GPS communication is as follows:

- Initialize SPI (Serial Peripheral Interface).
- Initialize LCD.
- Initialize GSM and store number.
- Display current status of sensors.
- If any sensor activated then go to step 7 else next step.
- All sensors monitoring go to step 4.
- Initialize GPS load GPS current GPS value. go to next step 8
- And GSM sends message to store number, current GPS value and sensor status stop the train.

VI. EXPERIMENTAL RESULTS

Hardware components of device shown fig 3. it contain sensor section ,microcontroller section ,GSM , GPS section ,display section . Microcontroller every time monitoring sensor condition and display current status and current location values.

Fig.3. Hard ware section.

Fig.4. Temperature sensor activation and GPS values.

Fig.4 shows temperature value when temperature exceed reference value then automatically turn on the motor section and calculate current location value and send message to store number in micro controller.

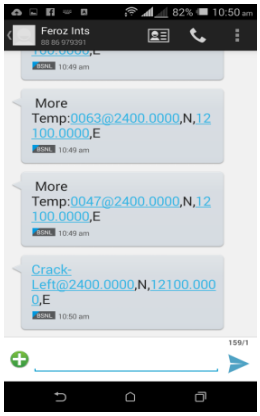

Fig. 5. Mobile Unit.

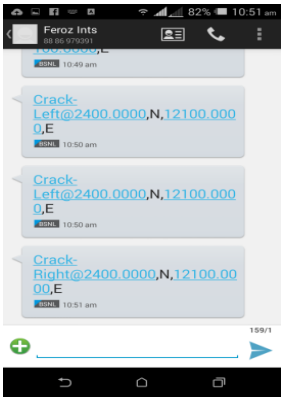

Fig.6. Track left.

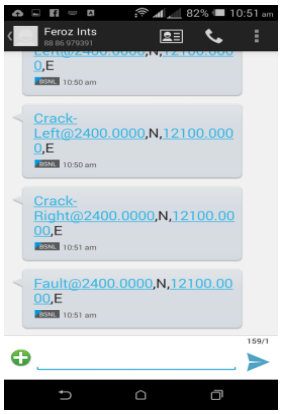

Fig.7. Track right.

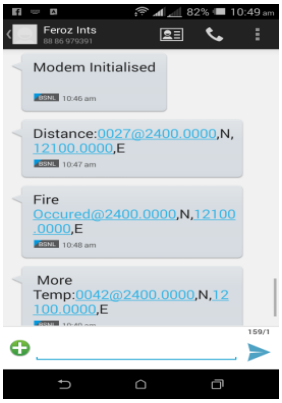

Fig.8. Distance.

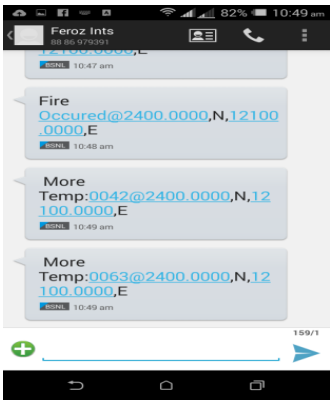

Fig. 9. Fire Occurred

Mobile unit shows data received from train monitoring section. it display parameter like sensor status and current GPS location values, examples shown in figs.5 to 9.

Disadvantages of Existing System:

- Existing systems are not able to predict the cracks on the railway track.
- Existing systems are not able to manage when the two trains travel opposite to each other.

Advantages of Proposed System:

- Establish management structure based on performance evaluation and monitoring process.
- Enhance the percentage of efficiency.
- Facility to send alerts/warnings to particular train drivers on possible collisions, derailment through the system.
- Functionality to generate time-distance graph for trains which can be used to control and plan the train movements.

VII. CONCLUSION

This paper discusses the critical safety techniques for high-speed train operation environment based on the train control system. In order to ensure safe operation of trains, we propose a wireless network access framework according to the monitoring network of surrounding environment and the deployment of transition network to avoid collision of trains and obstacle detection. System has ability to pin point the location and other attributes of an operational train in an economical accurate manner. The goal of this work is to design and implement a cost effective and intelligent full-fledged and wireless based Train Anti Collision and detection System to avoid accident.

VIII. REFERENCES

[1]J.García,J.Ureña, Á. Hernández, "Efficient Multisensory Barrier for Obstacle Detection on Railways" IEEE Transactions on Intelligent Transportations Systems, Vol. 11, no. 3, September2010.

[2]Burak Akpinar and Engin Gülal, "Multisensor Railway Track Geometry Surveying System" IEEE Transactions On Instrumentation And Measurement, Vol. 61, No. 1, January 2012.

[3]Xinhong Hei, Lining Chang, Weigang Ma, "A Safety Framework and Alarming Model for Train Operation Environment Based on CPS" IEEE 2011 Seventh International Conference on Computational Intelligence and Security.

[4]Zujun Yu, Shixin Li, Hongmei Shi, and Liqiang Zhu, "Jointless Track Monitoring System Based on Fiber.

[5]Bragg Grating Sensors" 20121ntemational Conference on Measurement, Information and Control (MIC).

[6]K. Noori,K. Jenab, "Intelligent Traction Control Model for Speed Sensor Vehicles in Computer-Based Transit System" IEEE Transactions on Intelligent Transportations Systems, Vol. 13, NO. 2, JUNE 2012.

[7]S. Lohmeier, R. Rajaraman, V. Ramasami, "PI-27: An Ultra-Wideband Radar for Vehicle Detection in Railroad Crossings" IEEE 2002.

[8]Salim, Mohammad, Marini Othman, and Maha M. Ablahd. "A Development of an ISG Framework for Mosul's Health Sector.", ijcsn, vol 1, issue 3,2012.

[9]C.C hellaswamy , S.Arul , L.Balaji ," Design and Analysis of an Intelligent Collision Avoidance System for Locomotives" Chennai and Dr.MGR University Second International Conference on Sustainable Energy and Intelligent. July. 20-22, 2011.

[10]Mohamed Ghazel, " Using Stochastic Petri Nets for Level-Crossing Collision Risk Assessment" IEEE Transactions On Intelligent Transportation Systems, Vol. 10, No. 4, December 2009.

[11]D. Jayakody, M. Gunawardana, N. Wicrama, D. G. Jayasekara, C. Upendra Rangana De Silva, "GPS/GSM based train tracking system – utilizing mobile networks to support public transportation"

[12]F. Maire, A. Bigdeli, "Obstacle-Free Range Determination for Rail Track Maintenance Vehicles" IEEE 2010 11th Int. Conf. Control, Automation, Robotics and Vision.

[13]H. R. Dong, B. Ning, B. G. Cai. Zh. Sh. Hou. Automatic Train Control System Development and Simulation for High-Speed Railways. IEEE Circuits and Systems. 2010.10(2): 6-18.

[14]Wu xu, Hu siji etc, "High-speed railway information systems security research," China Safety Science Journal, vol. 25, pp. 4, Apr. 2005.

[15]He Jifeng, "Cyber Physical Systems," China Computer Federation Communications, vol. 6, no. 1, pp. 25-29, 2010.

[16]Milan Ruder Nikolaus Mohler Faruque Ahmed, "An Obstacle Detection System for Automated Trains" IEEE 2003.

[17]M. Arai, "Railway safety for the 21st century," Jpn. Railway Transp. Rev., vol. 36, pp. 42–47, Sep. 2003.

Author's Profile:

Ch.Prasanna Lakshmi received the B.Tech degree in Electronics and Communication Engineering from the Nova college of Engineering and Technology for Women, Affiliated by JNTUK, Ibrahimpatnam, Krishna District, Andhra Pradesh , India. in 2013. She is currently studying towards the and intends to pursue the M.Tech degree Year of 2013-2015 , at Lingayas Institute of Management and Technology, Affiliated by JNTUK, Nunna, Madalavarigedem, Krishna District Andhra Pradesh, India. She is research interests include in GSM and GPS.

S.Ram Kumar, received the M.Tech degree in Communication and Signal Processing from the VR. Siddhartha Engineering College, Vijayawada, Affiliated by Acharya Nagarjuna University. He is currently working As a Asst.Professor in the Dept of Electronics and Communication Engineering at Lingayas Institute of Management and Technology, Nunna, Madalavarigudem Krishna District, Andhra Pradesh, India. And intends to

pursue the Ph.D. degree in Acharya Nagarjuna University Guntur Andhra Pradesh, India. His research interests include Embedded Systems, Antennas and Microwave, Digital Image Processing.