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Intelligent Collision avoidance and monitoring system for railway using wireless network

V.S.Doijad[1], R.T.Patil[2]
[1,2]*Department of Electronics Engineering, T.K.I.E.T. Warananagar*

Abstract— In the current railway systems, 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 obstacles on the tracks, either fixed or mobile. This project deals about one of the efficient methods to avoid train collision and obstacle detection. A GPS system is being used to pinpoint the location of faults on tracks. The project presents a solution, to provide an intelligent train tracking and management system to improve the existing railway transport service. The solution is based on powerful combination of mobile computing, Global System for Mobile Communication (GSM), Global Positioning System (GPS) technologies and software. The inbuilt GPS module identifies the train location with a highest accuracy and transfers the information to the central system. The availability of the information 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 effectively using the communication methods provided by the system.

Keywords- ARM Controller, RF Module, GPS, GSM, Ultrasonic Sensor.

I. INTRODUCTION

In all transport systems, particularly in the case of railways, safety and reliability are highly considered. 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 rapidly 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.

In the current railway systems, 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 obstacles on the tracks, either fixed or mobile. This project deals about one of the efficient methods to avoid train collision and obstacle detection to provide an intelligent train tracking and management system to improve the existing railway transport service. The solution is based on powerful combination of mobile computing, Global System for Mobile Communication (GSM), Global Positioning System (GPS) technologies and software. The inbuilt GPS module identifies the train location with a highest accuracy and transfers the information to the central system via GSM network. The availability of the information allows the train Controller to take accurate decisions as for the train location. Positioning data along with train speed helps the central

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system to identify the possible safety issues and react to them effectively using the communication methods provided by the system.

The project takes an attempt to develop an iterative computation method for predicting the dynamics of train collisions/crashes. This project deals about one of the efficient methods to avoid train collision and obstacle detection. The fundamental process in our system is to avoid collision of trains and using ultrasonic sensor and 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. 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.

II. LITRATURE REVIEW

An intelligent system, which allows detecting obstacles in railways, based on optical emitters. The sensorial system is based on a barrier of emitters and another of receivers, placed each one of them at one side of the railway. Apart from the disposition of the sensorial system, a codification method of the emission is also presented in order to detect the reception or the non-reception of transmissions between an emitter and a receiver. Obstacle detection is carried out by the lack of the reception in the detectors. A solution is proposed to reduce the number of false alarms related to these systems. [1] A simple approach for obstacle detection and collision avoidance of an autonomous flying quadrocopter using low-cost ultrasonic sensors and simple data fusion is presented here. The approach has been implemented and tested in a self-developed quadrocopter and its evaluation shows the general reliability as well as the drawbacks of this approach. The presented approach is intended to be used as part of the AQopterI8 project at the department of Aerospace Information Technology, which aims to develop an autonomous flying quadrocopter for indoor application. [2]

To design a tracking unit that uses the global positioning system to determine the precise location of a object, person or other asset to which it is attached and using GSM modem this information can be transmit to remote user. It can provide tele-monitoring system for inter-cities transportation vehicles such as taxis and buses. This system contains single-board embedded system that is equipped with GPS and GSM modems along with ARM processor that is installed in the vehicle. During object motion, its location can be reported by SMS message. A software package is developed to read, process, analyze and store the incoming SMS messages. The use of GSM and GPS technologies allows the system to track object and provides the most up-to-date information about ongoing trips. If a password like SMS is sent by the owner, it automatically stops the vehicle or we can use it for different other work, it can provide real time control. This system finds its application in real time traffic surveillance. It could be used as a valuable tool for real time traveler. The current system can be able to provide monitoring process from anywhere. [3] A GPS system is being used to pinpoint the location of faults on tracks. The paper presents a solution, to provide an intelligent train tracking and management system to improve the existing railway transport service. The solution is based on powerful combination of mobile computing, Global System for Mobile Communication (GSM), Global Positioning System (GPS) technologies and software. The inbuilt GPS module identifies the train location with a highest accuracy and transfers the information to the

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central system. The availability of the information allows the train Controller to take accurate decisions as for the train caption. Positioning data along with train speed helps the central system to identify the possible safety issues and react to them effectively using the communication methods provided by the system. [4]

III. PROPOSED WORK

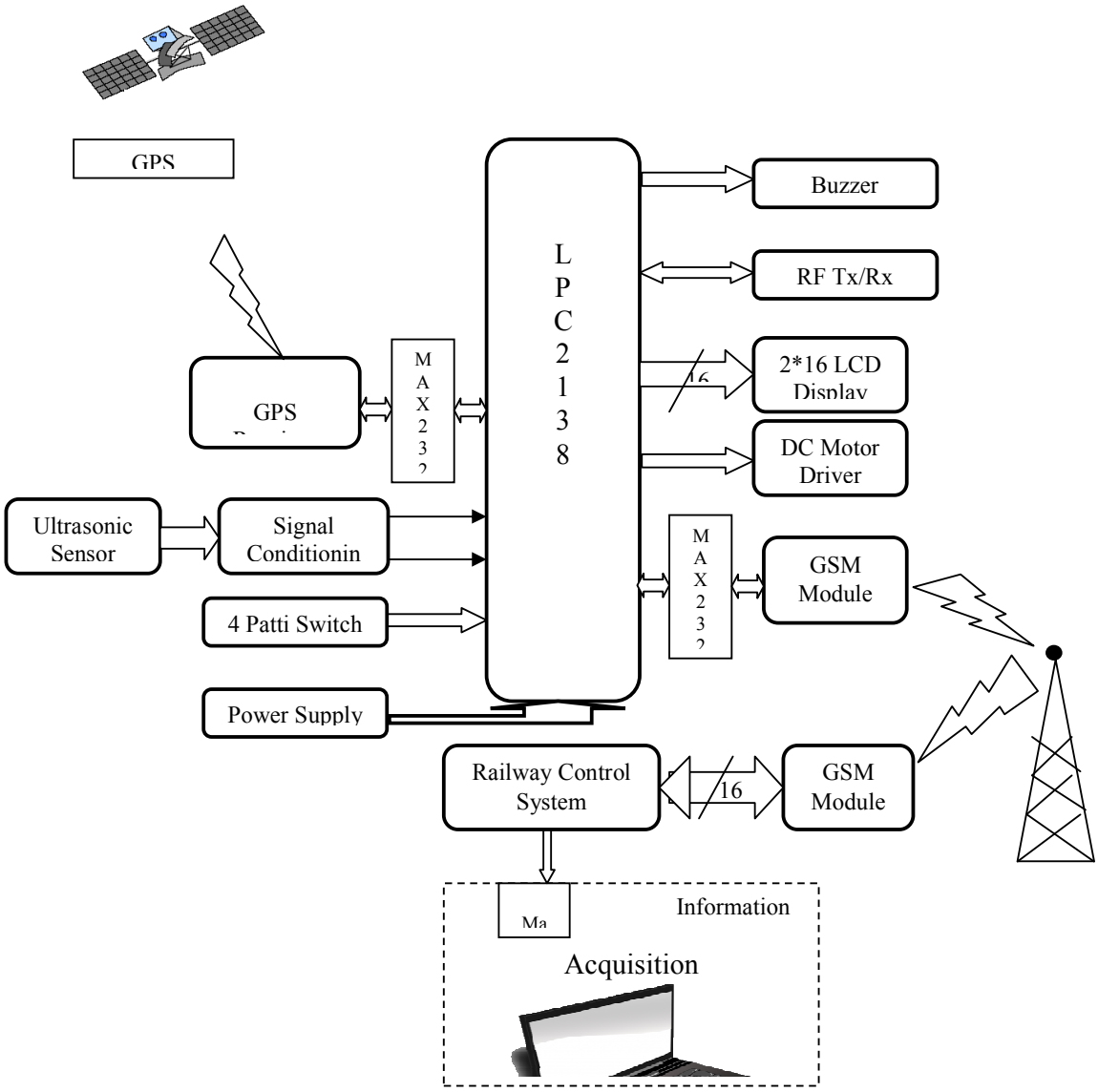

Figure 1. Block diagram

IV. EXPERIMENTAL RESULTS

Result 1: Interfacing Sensors

Figure 2. GPS Coordinate and distance displayed on LCD

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Result 2: Interfacing Ultrasonic (If obstacle is closer than 30 Cm) (SCALE 30Cm = 1Km)

Sr. No.	Distance	Speed of train	Time elapsed to stop
1	30 Cm	6 Cm/Sec	6 Sec
2	24 Cm	5 Cm/Sec	5 Sec
3	19 Cm	4Cm/Sec	4 Sec
4	15 Cm	3Cm/Sec	3 Sec
5	12 Cm	2 Cm/Sec	2 Sec
6	10 Cm	1 Cm/Sec	1 Sec
7	9 Cm	0 Cm/Sec	0 Sec

Table 1. Speed of train after obstacle detected

Result 3: Interfacing Ultrasonic, GPS and GSM

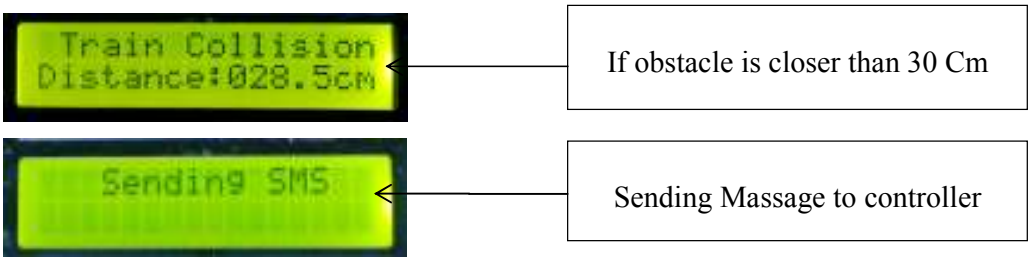

Figure 3. If obstacle detected, Sending Coordinate to controller

Result 4: Interfacing RF Module

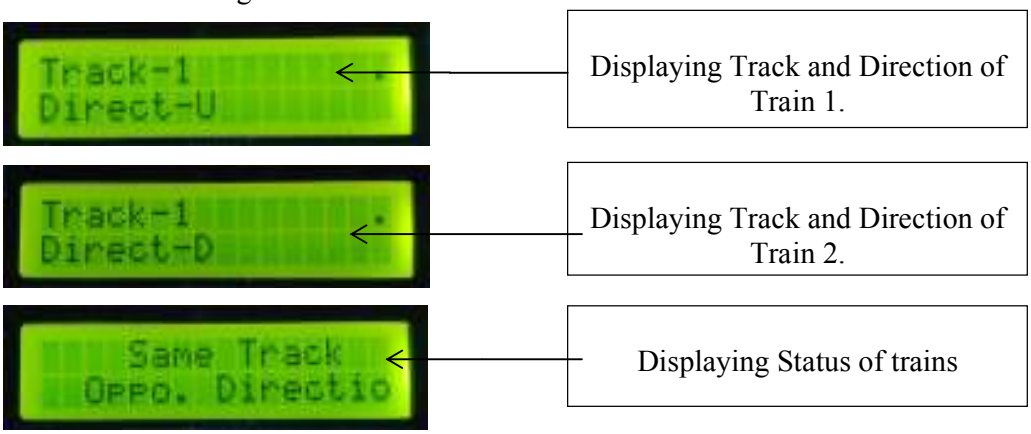

Figure 4. Displaying Track and Direction of Trains

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Result 5: Different SMS on Owner's mobile phone.

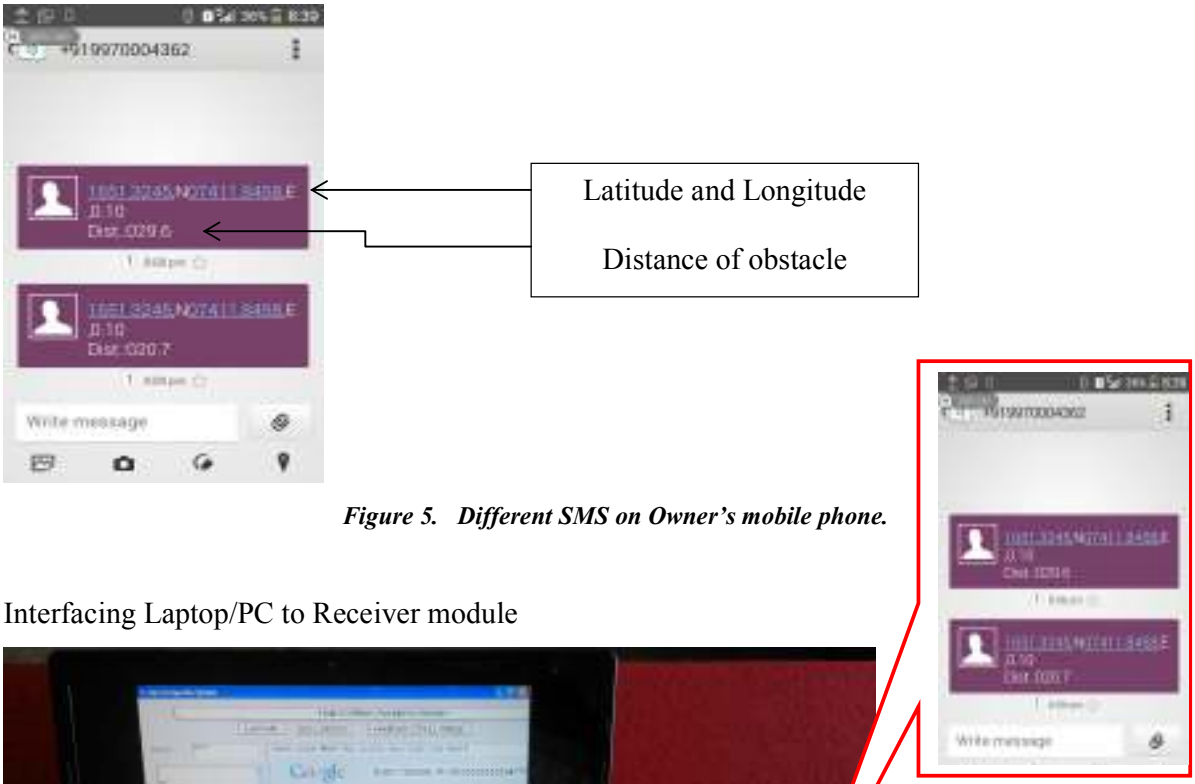

Figure 5. Different SMS on Owner's mobile phone.

Interfacing Laptop/PC to Receiver module

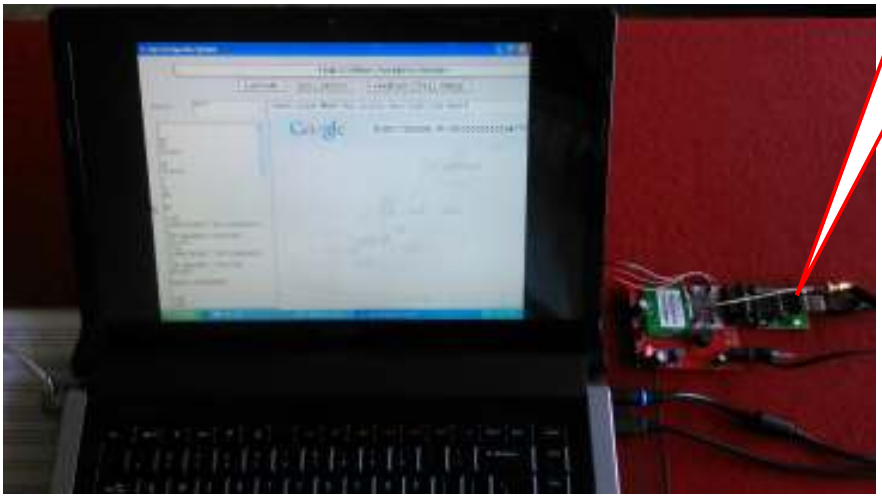

Figure 6. System at train controller

V. CONCLUSION

- Installing this system on Train will give the real time information of distance and location.
- All movement can be traced and tracked as it occurs in real-time.
- 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.

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