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Automated System Design for Metro Train Using Wireless Sensor Network

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ABSTRACT: The whole system is attached to the vehicle (BUS or Train). The encoded Sensor nodes are placed in the BUS stops or the railway stations. The microcontroller in the TRAIN is programmed in such a way that every station name saved in the voice chip which is having a unique code. So whenever the bus or train reaches the station, the reader in the bus or in the train receives the codes, which are transmitted from the tag and the microcontroller receives this code and checks in the look up table, saved in the chip. At the same time the train stops for about 10-15 seconds in the station and then before leaving the station, it will again start to announce "PLEASE GET INTO THE TRAIN, THE TRAIN WILL LEAVE IN 6 SEC" and the train starts to move to next station. The voice chip will play the voice and this will be heard in the speaker. This voice is repeated till the train leaves the station.

KEYWORDS: BUS, BASE STATION, TRAIN, MICROCONTROLLER, IC

I. INTRODUCTION

The automated system for a metro rail is an integrated application which makes announcements and displays the relevant station information when the train reaches a particular station. The implementation of the paper is based on Radio Frequency Tags and corresponding readers. Serial communication, non-volatile memory storage, voice chip implementation and others aid in bringing out the desired functionality. The main technique and the major aim of this system is to develop a new solution, based on a wireless network systems, for the problems faced in railway lines. The purpose in studying railway lines includes finding new methods to reduce the rate of accidents and improving the efficiency of railway-line maintenance. Railways comprise a large infrastructure and are an important mode of transportation in many countries. The railways have become a new means of transportation owing to their capacity, speed, and reliability, being closely associated with passenger and goods transportation. The poor maintenance of the railways can lead to accidents. New technologies for railways and better safety measures are introduced time to time but still accidents do occur. Thus, a proper strategy is required for maintenance and inspection of tracks. The irregularities in the Railway track gauge reduces the service life of rail and vehicle, and even result in vehicle falling off rail or wheel trapping, which causes driving accidents.

II. SYSTEM MODEL

The data were processed only with dc removal and without application of time gain. Reflections from the ballast surface and the ballast bottom side are clearly visible. Only a minor influence of the sleeper on the radargram. Only the ballast bottom side reflection is slightly affected by the sleepers. propagation velocity the normal move out time for each trace is calculated by the offset between transmitter and receiving antenna. In a second step the time position of each trace is corrected by the corresponding normal move out time. The reflection shown in Figure 6 appears tilted. If the appropriate velocity is chosen, the reflections will be displayed as horizontal lines in the radargram. The sum of all corrected traces will increase the summed amplitude of the reflections to a maximum at the zero offset position. To find the most appropriated propagation velocity, the normal move out has been corrected and all traces in a velocity range of 5x107 - 3.5x108 m/s have been summed up. Velocities greater than the speed of light are used only for visualizing the velocity spectrum. They have no practical meaning . Two regions of high amplitudes of the summed reflections are formed . The upper right region represents the ballast surface reflection and the centre region can be referred to the ballast bottom side reflection. This velocity analysis measurement shows that the multi-

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offset measurement of the propagation velocity inside the ballast can be used as an evaluation tool of the ballast degradation. Detection and maintenance of rail defects are major issues for the rail community all around the world. The defects mainly include weld problems, internal defects worn out rails, head checks, squats, spalling and shelling, corrugations and rolling contact fatigue (RCF) initiated problems such as surface cracks. If these defects are not handled and corrected they can lead to rail breaks and accidents .There are numerous challenges to rail community and the infrastructure maintenance people such as to perform effective inspection and cost effective maintenance decisions. If these issues are taken care of properly, inspection and maintenance decisions can reduce potential risk of rail breaks and derailment. In vibration based method our device will do calibration of the rail track by using vibration sensors. Vibration sensors will sense the vibration on the
track. If the track vibration are in the range of predefined standard values it means there is no faults otherwise track is defected. Damage component and faulty track information will broadcast to the server through wireless medium. By using both the method we can inspect the railway track in accurately. Our propose system focus on machine vision based and vibration based method to detect irregularities in track and defected component such as tie, tie plate, anchor, missing bolts.

III. WIRELESS COMMUNICATION

Delhi Metro Rail Corporation Ltd. (DMRC) for the city of Delhi with a population of round 12 (16.2) million should have had an MRTS network of at least 100 (300) KM by this time, whereas actually it is still (65.10 kms) at the take-off stage. Delhi has all the ideal dress-up for an excellent Mass Rapid Transit System to be brought in. It has wide roads (roads cover 23% of the city area) where road possession for construction is not difficult (except in the old city area). Implementation will also not involve demolition of large scale private properties.

Fig.1.Delhi Metro Rail Corporation building unit at Badarpur

The project update is as follows:

PROJECT UPDATE

Phase I Network | Project Cost | Expected Ridership | Present Status | Training School | Delhi Metro is a world class Metro | Consultancy Project

Phase I Network

Phase I of Delhi Metro Rail project consists of the following three lines:

Line	Length (Kms)	No. of Stations
Line No.1- Shahdara-Tri Nagar-Rithala	22.06	18
Line No.2- Vishwa Vidyalaya-Central Secretariat	10.84	10
Line No.3- Indraprastha-Barakhamba Road-Dwarka Sub City	32.10	31

Phase II Network*

Phase II of the Delhi Metro Project consist of the following lines:-

Line	Length (Kms)	No. of Stations
Shahdara – Dilshad Garden	3.09	3
Indraprastha – Noida Sector 32 City Centre	15.07	11
Yamuna Bank – Anand Vihar ISBT	6.17	5
Vishwavidyalaya – Jahangir Puri	6.36	5
Inderlok – Kirti Nagar -Mundka	18.46	15
Central Secretariat – Sushant Lok	27.45	19
Dwarka Sector 9 to Dwarka Sector 21	2.76	2
New Delhi – Airport	19.20	4
Anand Vihar – KB Vaishali	2.57	2
Central Secretariat – Badarpur	20.04	15
Total	121.17	81

Table 2.DMRC Project update

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Salient features:
1. Route length - 11.07 km
2. Elevated alignment- 100 %
3. Maximum gradient- 4.0%
4. Minimum curvature - 100 m
5. Minimum Ground Clearance - 5.5 m
6. No. of stations - 12
7. Platform Length - 135 m
8. Car Depot - D.N Nagar
9. Length of coach - 22 m.
10. Width of coach - 3.2 m.

Wireless sensor networks are wireless communication networks in which constructed when small sensor devices without any predetermined routers are jointlyarrayed to sense happenings and events (Srovnal andPenhaker, 2007). A wireless sensor network consists ofthree units: sensor nodes, collection hardware and dataprocessing (the sink node), and a remote-monitoringdevice (the control center). Sensor nodes are in charge ofcollecting data and sending it to the sink node (Pandianand Safeer, 2008).

IV NODE SECURITY USING WIRELEES SENSOR NETWORK IN RAILWAY:

Wireless sensor network in a railwayline. This network includes one or several control centers(sink nodes) which are connected to each other by wires.A large number of wireless sensor nodesare distributedthroughout railway lines. Each of these distributed sensornodes is able to collect the required data and to send it to the sink node (the control center) (Ganesan, 2002, Ding and Sivalingam, 2003; Sadeghi, 2008).

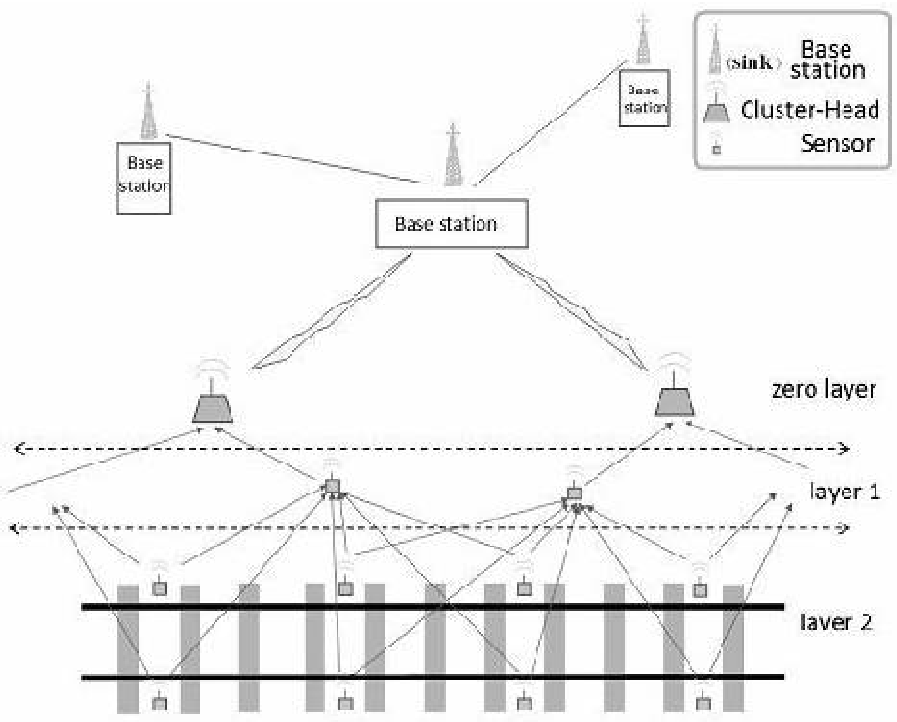

Figure 2. Source railway system with wireless sensor nodes and multi-layer routing.

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The system for tracking objects and snags in rails:

In this system, two methods are used:

1. In the image processing method, the systems for tracking objects on the rail are able to track stones, wood, metallic objects, animals, human beings, and vehicles (at railway crossings): the pictures continuously taken of the rail by one or two video cameras are analyzed by a system for processing pictures. There are many algorithms for tracking objects, but the basic performance of these algorithms is based on first tracking the rails and then on finding breaks on either of the two rails. The presence of a break signifies the presence of a foreign object on the rails.

2. In the leaky cable method, the system for recognizing objects and snags on rails is designed to be installed at places where there is a possibility of landslide covering rails with stones. The principle underlying the performance of the system is that whenever an object is located near a source radiating electromagnetic waves (like an antenna), it causes a change in the impedance of the source, and hence the intensity of the radiated waves will change. In this system, a leaky coaxial cable, which is laid on the rail bed on the ground, acts as a radiating source and the sensor system which injects waves into this cable continuously evaluates the volume of the return wave. Under normal conditions, the volume of the return wave is constant, which is considered the reference volume when the system is installed and starts operating.

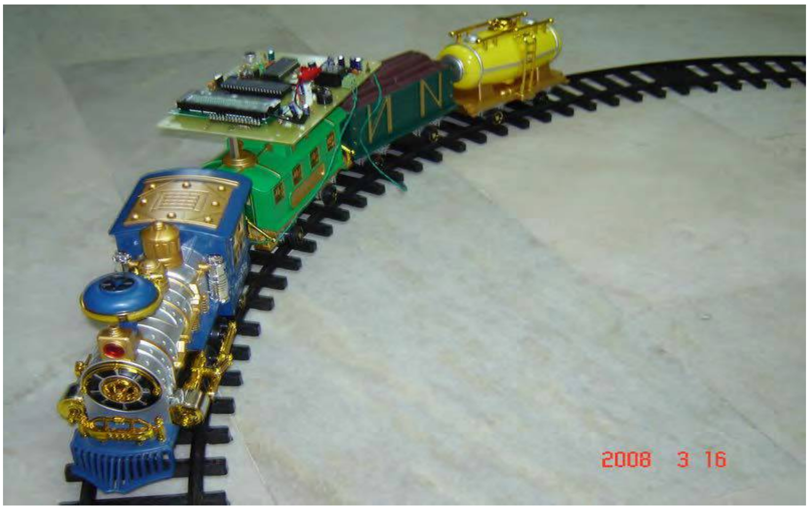

Fig.3.train stopped at one of the Base stations

V. RESULT & DISCUSSION

The input linguistic variable of temperature is divided into the three subintervals of high freeze, low freeze, and no freeze, which are explained below.

High freeze this set is on the basis of parabolic membership functions of the type zmf. In this set, the membership degree of one is assigned for temperatures below -30°C, the membership degree of 0 is given to

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temperatures higher than -20°C, and temperatures between -20 and -30°C receive membership degrees between zero and one. Low this set is based on parabolic membership functions of the type zmf. Values less than 15% are given the membership degree of one, values more than 25% receive the membership degree of 0, and values between 15 and 25% are assigned membership degrees from 0 to1.

Big this set is based on parabolic membership functions of the type smf. Values less than 45% are given the membership degree of zero, values greater than 55% receive the membership degree of 1, and values between 45 and 55% are assigned membership degrees from 0 to 1. Low freeze this set is on the basis of parabolic membership functions of the type pimf. In this set, temperatures below -30°C and above 0 receive the membership degree of one, and temperatures between -10 and -20°C are given the membership degree of one, and temperatures between -20 and -30°C and between -10 and 0°C are assigned membership degrees from 0 to 1.

No freeze: this set is on the basis of parabolic membership function of the type smf. In this set, the membership degree of zero is assigned to temperature below -10°C, the membership degree of one is given to temperatures above 10°C, and membership degrees between o and 1 are considered for temperatures between -10 and 0°C. High: this set is based on parabolic membership functions of the type pimf. Values less than 30% and more than 60% receive the membership degree of 0,values between 40 and 50% are given the membership degree of 1, and values between 30 and 40% and between 50 and 60% are assigned membership degree from 0 to 1.

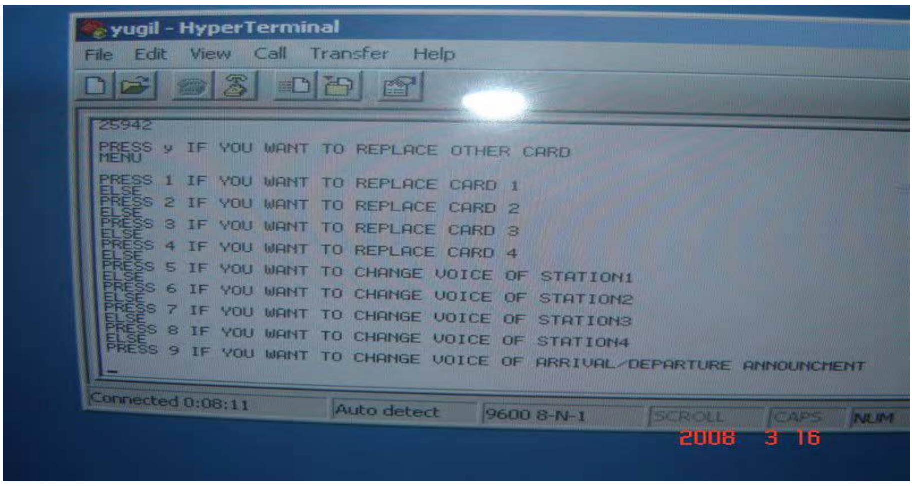

Fig.4. Hyper-terminal showing the menu options in serial communication module

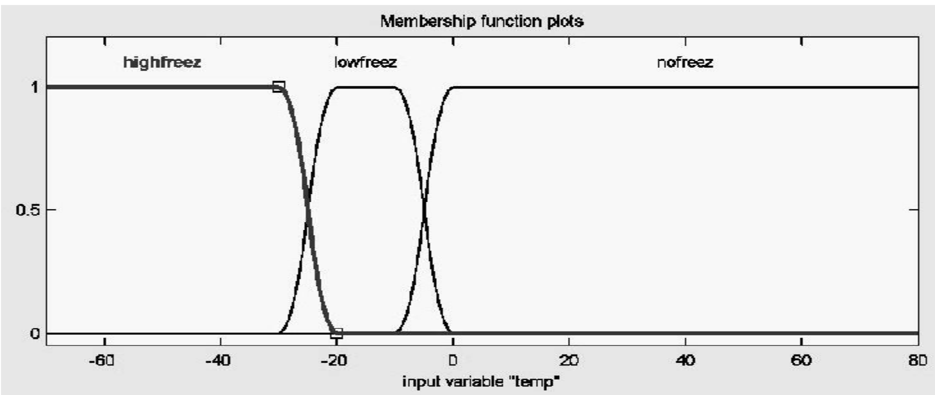

Figure 5. The Membership function of the input linguistic variable of temperature.

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VI. CONCLUSION

This paper aims at an automated system to make announcements and display at stations codes. Finally as a part of a project we can implement an automatic door opening system in feature by interfacing a dc motor to the micro controller. The main aim of this project is to make an automated place announcement system for Train using voice IC and the radio frequency wireless card for tracking the station data. It can be extended to any number of stations. Train accidents all over the world, and human and material losses suffered in these accidents, have prompted scholars to tackle these accidents by using upto- date technology and to ensure security in train transportation. In this article also, an attempt has been made to track problems such as snags on rails in suspicious areas, breaks in rail, etc. through the use of wireless sensor networks in which electromagnetic and ultrasonic sensors are used. Information thus gathered can be sent to control centers in time so that proper decisions are made and security is established by taking suitable actions. Accidents occurring in railway transportation systems cost a large number of lives. Many people die and several others get physical and mentally injured. Accidents are the major causes for traumatic injuries. There is certain need of advanced and robust techniques that can not only prevent these accidents but also eradicate all possibilities of their occurrence. Wireless sensor network which continuously monitors the railway track through the sensors and detect any abnormality in the track. The sensor nodes are equipped with sensors that can sense the vibration in the railway track due a coming train. The geographical positioning sensors are placed on the trains. These sensors send the train's geographic location. The complete process is needed to be real time in nature and should meet the deadlines.

Optimization of the communication protocol and real time working network with minimum delay in multi-hop routing from the nodes to the train using a static base station is needed, so that the decision making can be done and the decision is forwarded to the train without any delay. Conventional propagation velocity analysis can be applied for the investigation of ballast track beds. For a fast acquisition on a railway inspection train, a multi-offset array can be used, which is acquiring the necessary traces for velocity analysis in one step and with minor impact to the quality of the velocity spectrum. In a ongoing investigation it will be investigated, if a decrease of propagation velocity caused by fouling of the ballast will lead to a significant shift of the high amplitudes in the velocity spectrum towards lower velocities on the left side of the spectrum.

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