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Train Track Monitoring cum Bridge Overload Detection System

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ABSTRACT

Communication-based train control (CBTC) systems use wireless local area networks (WLANs) to transmit train status and control commands. Since WLANs are not originally designed for applications with high mobility, random transmission delays and packet drops are inevitable, which could result in unnecessary traction, brakes or even emergency brakes of trains, loss of line capacity, and passenger satisfaction. In this paper, we study the packet drops introduced by random transmission errors and handovers in CBTC systems, analyze the impact of random packet drops on the stability and performances of CBTC systems, and propose two novel schemes to improve the performances of CBTC systems. Unlike the existing works that only consider a single train and study the communication issues and train control issues separately, we model the system to control a group of trains as a networked control system (NCS) with packet drops in transmissions. Extensive field test and simulation results are presented. We show that our proposed schemes can provide less energy consumption, better riding comfort ability, and higher line capacity compared with the existing scheme.

Keywords: Communication-Based Train Control, Networked Control System, CBTC Systems.

I. INTRODUCTION

Consumer electronics are electronic equipment intended for everyday often in entertainment, communications and office productivity. Radio broadcasting in the early 20th century brought the first major consumer product, the broadcast receiver. Later products include computers, telephones, MP3players, audio equipment, televisions, calculators, GPS automotive electronics, digital cameras and players and recorders using video media such as DVDs, VCRs or camcorders. Increasingly these products have become based on digital technologies, and have largely merged with the computer industry in what is increasingly referred to as the consumerization of information technology.

Rail-Guided transport systems have attracted much attention since they can provide greater transport capacity, superior energy efficiency, lower carbon emission, and outstanding features of punctuality and safety when compared with other mass transit methods. In traditional rail systems, a track circuit is commonly used to coarsely determine the location of a train and to transmit unidirectional ground-train control information. The coarse train positioning and low unidirectional communication throughput lead to low line capacity of the track-based train control (TBTC) system. The typical minimum headway, which is the time interval between two neighboring trains, of TBTC is several minutes. As a modern successor to TBTC, communication-based train control (CBTC) systems use continuous high-capacity bidirectional train–ground communications to transmit status and control commands of trains and to realize automatic train control functions. The line capacity can be increased. The typical minimum Headway of CBTC is 90 s or even less. For urban transit systems, wireless local area networks (WLANs) are commonly used due to the open standards and the available commercial-off-the-shelf equipment.

The project relates to the location of singular points in the automatic control of railway tracks. According to a possible embodiment, the railway carriage carrying the control equipment's is provided with sensor orientated to detect the crack and fire sensor used to detect the fire. This project pertains to a process for monitoring the condition of rail on train tracks and more specifically has the object of the identification of defects detected by monitoring equipment on the tracks to be checked to allow maintenance crews to subsequently find these defects. When we give the supply to the device, the DC motor gets start through relay driver circuit.

The equipment Track Detection Electronics System (TDES) are placed in the track with the interval of two distances. The TDES has one voltage generator, one comparator and one RF Module. The Voltage generator generates the dc voltage and supply through the track to the next TDES. The comparator compares the input voltage from previous TDES with the reference voltage. If the voltage does not match, i.e., the track was broken the TDES send the signal to Control System through the RF Module.

The load cell measures the load of the train, compares the values with the reference from control system, and informs to control system, if the train is overloaded. The train receives the signal from control system to stop the train, if any crack was found on the track or the bridge overloaded.

II. PROPOSED SYSTEM

Owing to the crucial repercussions of this problem, this paper presents an implementation of an efficient and cost effective solution suitable for large scale application. With the advent of powerful digital signal processors, Image Processing techniques have been explored to formulate solutions to the problem of railway crack detection. Though it provides good accuracy, this method uses techniques like image segmentation. The usage of microwave antennas in Crack detection investigated in research. Another important technique for crack detection is infrared sensing which seemed to more suitable but later it became inaccurate.

Hence this paper proposes a cheap, novel yet simple scheme with sufficient ruggedness suitable to the Indian scenario that uses an Weighting Machine to calculated the efficiency of Bro IR-Photo diode arrangement to detect the crack in railway lines, which proves to be cost effective as compared to the existing methods.

In our project we have three modules. They are TDES module, Load cell Module, Train Module and a common monitoring system i.e., control system.

A. Block Diagrams

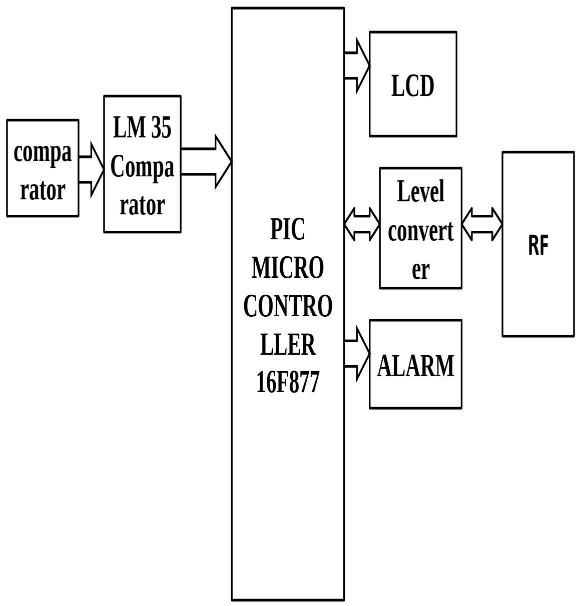


Figure 1. TDES Block Diagram

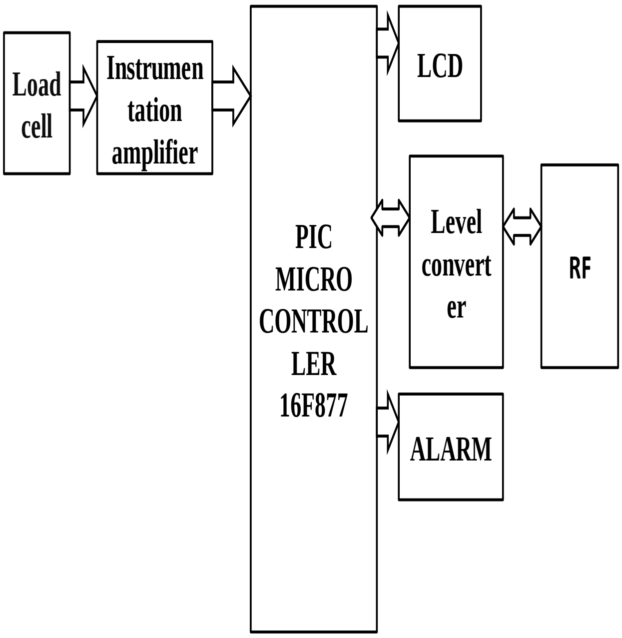


Figure 2. Bridge Section

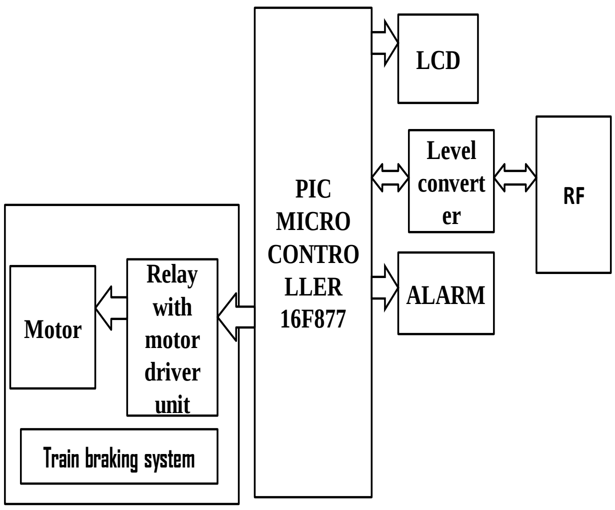


Figure 3. Train Module

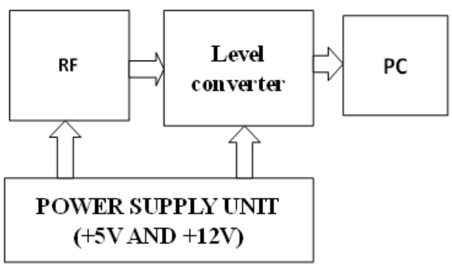


Figure 4. Monitoring Unit

Track detection electronic system has the major components like voltage generator, voltage comparator and RF module. The voltage generator generates 5V DC supply and sends it through the track to another TDES, which is placed with the distance of few kilometres. The second TDES receive the voltage from first one, and compare it with the reference value. LM35 comparator and PIC 16F877 microcontroller is used to compare the values.

The PIC microcontroller validates the output of comparator. If the crack is available in the track, the output of the comparator is "0", else the output is "1". Then the microcontroller sends the stop signal to monitoring system to stop the train, if the comparator output is "0".

We are using RF module to send the signal to monitoring system. The level converter is used to establish the serial communication between microcontroller and RF module.

In Bridge section, we are placed one load cell on the track few kilometers before bridge. This load cell calculates the total load of the train and compares this value with the reference from monitor unit. If the load of the train is more than the reference value, this module sends the stop signal to monitor unit.

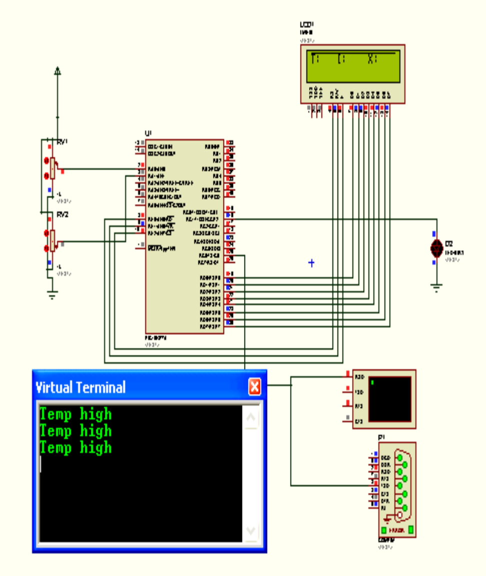
In Train section, we are placed one load cell on the track few kilometres before bridge. This load cell calculates the total load of the train and compares this value with the reference from monitor unit. If the load of the train is more than the reference value, this module sends the stop signal to monitor unit.

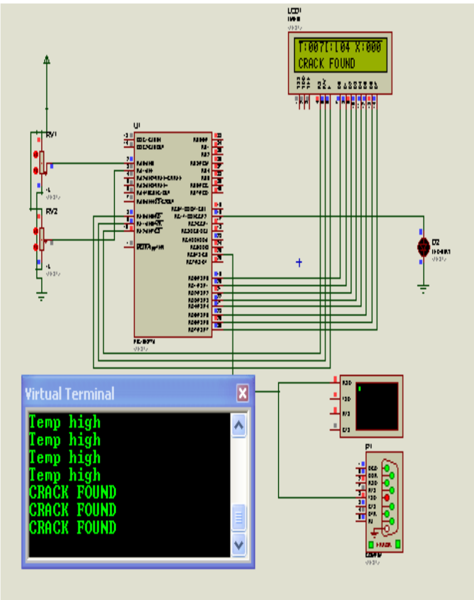
In monitoring unit, the monitoring unit organizes the entire system and control the train. In this module one PC connected with RF module receives the data from TDES and load cell. The corresponding command (STOP Command) to send the train if any crack was found in the track or bridge overloading is occurs.

III. RESULT AND DISCUSSION

The PC based monitoring system continously monitor the bridge section,TDES and train also, If the temprature in train may rise the control PC generally notified COOL TERM software used to monitor the entire the system with virtual terminal.

If the continuity of the track was broken the PC given analog and notification message as shown in the figure. If the load cell output is more than the reference value the system, generate the error message to stop the train.





IV. CONCLUSION

The railway environment monitoring system is erupted for finding the problem on the track as well as the inside train information's by using of the sensor networks in addition using to monitoring bridge weight by using of load cell. It's used to monitoring the bridge health status such as sensor is transmitted to a master station (or) monitoring. Control from the train this is developed mainly on to prevent the precaution effect at the railway networks.

In future the reference value for Bridge Load Cell is monitors automatically by an efficient electronics system incorporated with civil measurements. The entire project will be speed up with OFC connection by the help of RailTel Corporation to improve our work.

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