Identification of the Presence of Train and its Formation

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ABSTRACT*:* This paper presents an alternative for the Track Circuit and the Axle Counter which are used currently by the Indian Railways to find the presence and details of the train. Load Cell replaces the track circuit and the RFID technology is used to detect the train's number from which the details of train are retrieved. Using this, the number of wagons in a train can also be detected. The various studies and experiments showed that this method uses less power in comparison with the conventional style.

KEY TERMS- Track Circuit, Axle Counter, Load Cell, RFID

I.   INTRODUCTION

The vastness of railways – cars, cargo, track, countries and conditions presents a massive challenge for management of rolling stock and rail operations. IPICO's low cost, passive RF technology enables consistently accurate identification and control of assets in virtually any operating environment. As a freight giant, the railway industry is looking forward to improve the utilization of the wagons and has been on a look out for an online system for tracking wagons on its 62000 km worth of rail network. It is expected to identify the possible problem areas and come out with strategies to eliminate them. Under the Information Technology Vision 2012, announced in the Railway Budget for 2008-09 and 2009-10, the railway ministry plans to give the Railways a modern look and feel by implementing Modern Communication systems such as RFID, GPS and GIS. Modernisation of Indian Railways has always been a question in focus for the development of the basic infrastructure of India. Since the railways represent one of the best modes of transport available to the common people, it would be impossible to just keeping increasing the fares to meet the costs incurred due to maintenance, the large workforce and the expansion activities. The Railways should therefore, consider upgrading itself to cutting-edge technologies for better efficiency and cost reduction.

II.EXISTING SYSTEM

The contemporary way of detecting the train's presence and its number of wagons is done using the Track Circuit and the Axle Counter. A track circuit is a simple electrical device used to detect the absence of a train on rail tracks. The basic principle behind the track circuit lies in the connection of the two rails by the wheels and axle of locomotives and rolling stock to short out an electrical circuit. This circuit is monitored by electrical equipment to detect the absence of the trains. Since this is a safety appliance, fail-safe operation is crucial; therefore the circuit is designed to indicate the presence of a train when failures occur. Track circuits allow railway signalling systems to operate semi-automatically, by displaying signals for trains to slow down or stop in the presence of occupied track ahead of them. They help prevent dispatchers and operators from causing accidents, both by informing them of track occupancy and by preventing signals from displaying unsafe indications. A track circuit typically has power applied

to each rail and a relay coil wired across them. When no train is present, the relay is energised by the current flowing from the power source through the rails. When a train is present, its axles short (shunt) the rails together; the current to the track relay coil drops, and it is de-energized. Circuits through the relay contacts therefore report whether or not the track is occupied.

Each circuit detects a defined section of track, such as a block. These sections are separated by insulated joints, usually in both rails. To prevent one circuit from falsely powering another in the event of insulation failure, the electrical polarity is usually reversed from section to section. Circuits are commonly battery-powered at low voltages (1.5 to 12 V DC) to protect against line power failures. The relays and the power supply are attached to opposite ends of the section to prevent broken rails from electrically isolating part of the track from the circuit. A series resistor limits the current when the track circuit is short-circuited, saving battery power.

Track circuits, though seem to be an eminent one, may suffer from the following limitations.

➢ A broken rail or wire will break the circuit between the power supply and the relay, de-energizing the relay.
➢ A failure in the power supply will de-energize the relay.
➢ A short across the rails or between adjacent track sections will de-energize the relay.
➢ Longer trains with more wheels have better conductivity. Short trains or single engines can be a problem. Trains with a single Budd rail motor, which are also lightweight, and with disc brakes, had some problems when they stopped, and had to make a double stop to ensure good contact with the rails.
➢ Mechanical failure of the relay, causing the relay to be stuck in the "track clear" position even when the track is occupied.
➢ Conditions which partially or completely insulates the wheels from the rail, such as rust, sand, or dry leaves on the rails. This is also known as "poor shunting".
➢ Conditions in the track bed (roadbed) which create stray electrical signals, such as muddy ballast (which can generate a "battery effect") or parasitic electrical currents from nearby power transmission lines.
➢ Parasitic oscillations in the equipment that controls the track circuits.
➢ A more persistent problem is rust. Usually the railhead is kept clean of rust by the regular passage of trains' wheels. Lines which are not used regularly can become so rusty as to prevent vehicles being detected.
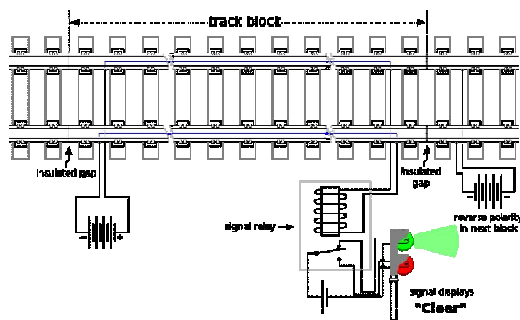

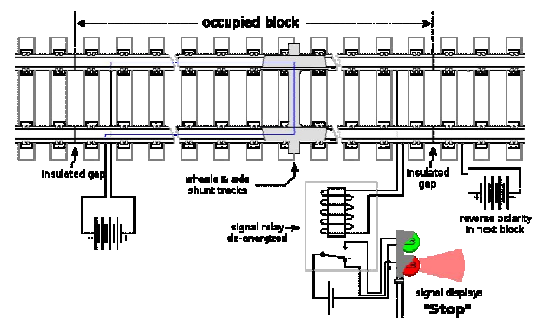Fig. 1 Schematic drawing of track circuit for unoccupied block   Fig. 2 Schematic drawing of track circuit for occupied block

Taking into considerations the above failures, Load Cell seem to be more efficient. "Axle counters" refers to subsystems which are utilized for track vacancy detection on fixed-guide way transport systems such as railways. Axle counters function b y detecting the presence and travelling direction of wheels at various points along the right of way. The right of way is broken into "blocks" with wheels (axles) being counted into and out of the block. If the same amount of axles is detected departing the block as were previously detected entering it, the block is considered vacant.

Axle counters primarily consist of two types of components: axle counting head and axle counting computer (sometimes referred to as an evaluation computer). The axle counting heads are mounted alongside the rail profile and actually detect the presence of wheels. They typically use LC oscillators to detect when the flange of a railroad wheel has modified the magnetic field created around the axle counter. The evaluation computer typically resides in a signal control enclosure alongside the wayside. The evaluation computer generates data based on the axle counting heads and generates either a vacant or occupied declaration of one or more blocks (track sections).
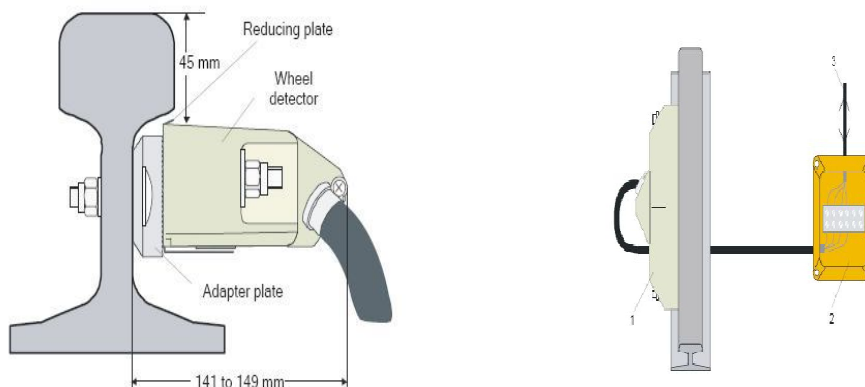

Fig. 3 Axle Counter field equipment Layout.

There are few disadvantages pertaining to the Axle Counter. Axle counters may 'forget' how many axles are in a section for various reasons such as a power failure. A manual override is therefore necessary to reset the system. This manual override introduces the human element which may be unreliable. An accident occurred in the Severn Tunnel and is thought to be due to improper restoration of an axle counter. This, however, was not proven during the subsequent inquiry. In older installations the evaluators may use eight-bit logic, causing numerical overflow when a train with 256 axles passes the axle counter. As a result, this train will not be detected. This imposes a length limit of 255 axles on each train. Due to these limitations Axle Counter though more advantageous seem to lack certain features.

II.PROPOSED SYSTEM

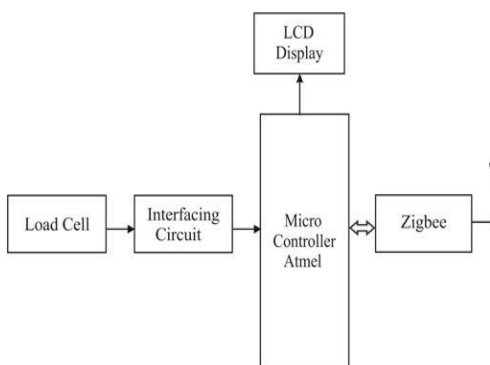A.   Implementation Using Load Cell

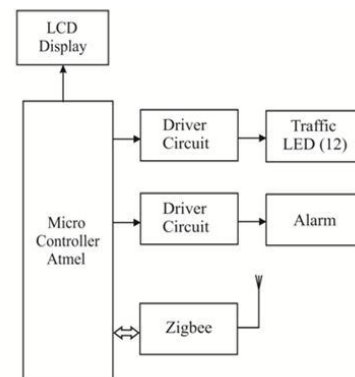
Fig. 4 Block diagram of Transmitter   Fig. 5 Block diagram of Receiver

A **Load cell** is a transducer that is used to convert a force into an electrical signal. Load cells are rated in units of weight i.e. grams, kilograms and tonnes (or pounds in the case of American-made load cells).A load cell will measure from zero to the stated capacity. The accuracy of the load cell is generally stated as a percentage of the overall capacity. The load cell adopted for the detection of track occupancy is **CZL601** which is a single Point Load cells that probably account for the largest percentage of all Load cells in existence worldwide. It is made up of Aluminium alloy and surface. The Load Cell is mounted on the sides of the track. When the train passes over the portion of track containing track circuit, then there exerts force on the load cell thereb y the load cell converts that force (physical quantity) into electrical quantity. This is used for further signaling purpose. The output from Load Cell is amplified and converted to digital form using ADS1230. Then it is sent to Microcontroller AT89C51 for processing.This can be applied to ULC (Unmanned Level Crossing) to avoid accidents. In the ULCs the accidents are more common and account to about 38% of the total accidents involving railways. The Load Cell can be placed at a distance from the ULC and when train passes over the Load cell, the information can be passed to the ULC via Zigbee Protocol or GSM. When the information is received at the ULC, an alarm can be made to blow and we can even have the LEDs to glow red indicating that a train is going to pass through that particular ULC and the trespassers will be warned avoiding accidents.
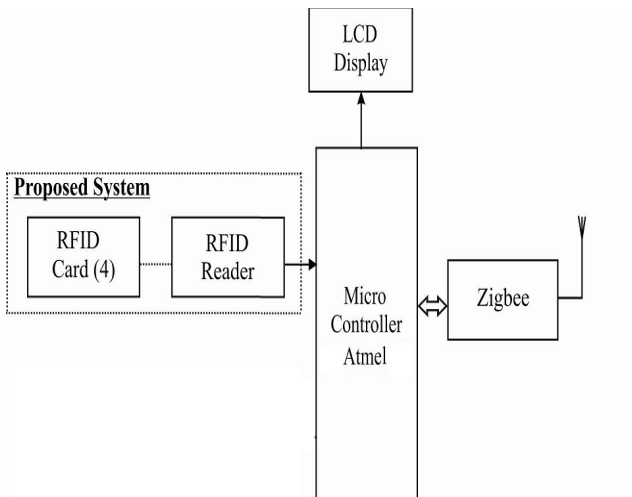
B. Implementation Using RFID

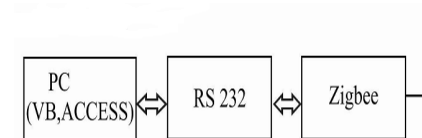Fig. 6 Block diagram of Transmitter section   Fig. 7 Block diagram of Receiver section

Radio-frequency identification (RFID) is the wireless non-contact use of radio frequency electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. It is a means of identifying an item based on radio frequency transmission. This technology can be used to identify, track and detect a wide variety of objects with the help of two components: Tag and Reader. Communication takes place between a reader and a transponder (derived from TRANSmitter / resPONDER- Silicon Chip connected to an antenna), usually called "tag".With Load Cell the presence of train is known and by using RFID, the details of a particular train such as the train number and the number of wagons can be continuously monitored. The RFID reader is placed on the Track and the RFID tags are placed on each wagon in a train. When the train passes on the track, the reader receives signal from the tag i.e. the tag responds to the queries of reader. When the reader receives the signal it sends to PC via Zigbee or GSM. For the prototype, 4 RFID cards are used. Applying RFID to identification of details of train, Collision between trains can be avoided. The PC receives signal from RFID. For management of database about the details of the train, Visual Basic can be used. Using VB we can display the details of the train and this can be used in stations for the reference of passengers also.

IV.RESULTS

A.Implementation   Using   Load
Cell

When there is no train on track (i.e) track is free near the ULC then at the receiver side (at ULC) the LCD displays
"NO TRAIN ON TRACK" and the LEDs glow red. When there is train on track (i.e) track is occupied, force

is exerted on load cell then at the receiver side the LCD displays "TRAIN ON TRACK" and the LEDs glow green and additionally a buzzer can be blown to warn the trespassers that a train is approaching the ULC.
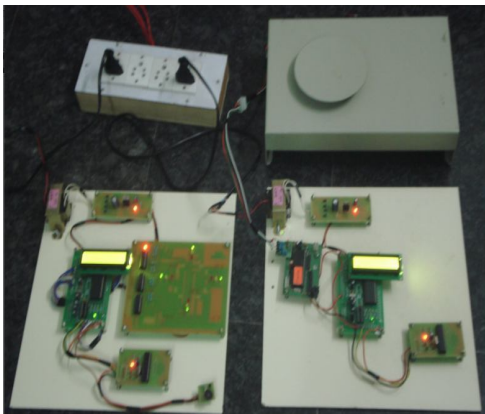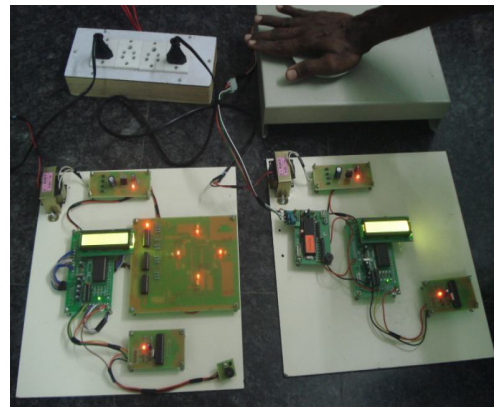

Fig. 8 Model of no train on track

Fig. 9 Model of train on track

B.Implementation Using RFID

When no train passes over the track on which the tag is placed, the VB in PC displays "NO TRAIN ON TRACK". And when the train passes, it displays train number depending on which train passes.
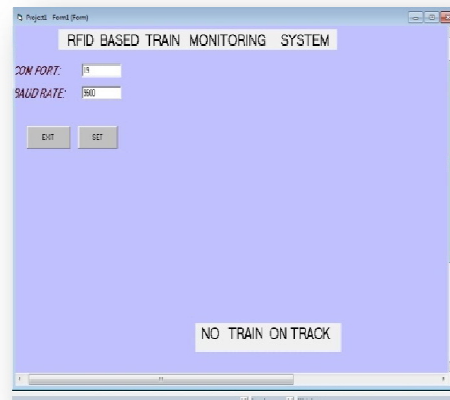

Fig. 10 Output when train 2 passes over the track

Fig. 11 Output when no train is present

V.CONCLUSION

Practical RFID systems are involved in real time tracking and monitoring of events. The system performs appropriate actions in response to events based on certain conditions. It is natural to consider the use of the Event, Condition and Action (ECA) framework to address event management issues. The paper gives an overview of the current state and trends of RFID technology and how RFID can be deployed in the railways to identify the train number, its current location and time and the number of wagons attached to the train. Even though numerous limitations and unresolved issues still hinder the widespread application of RFID, it can be already seen that especially enterprises in complex supply chains will benefit from RFID, once the application difficulties are overcome.

REFERENCES

[1] Adriana M.Adami; Misha Pavel;Tamara L.Hayes "Detection of movement in bed using unobtrusive load cell Sensors",IEEE transaction on Information Technology in Biomedicine,Vol.14,No.2,March 2010.
[2] R.Ramachandran; J.Thomas Joseph Prakash "FPGA based SOC for Railway Level Crossing Management System", International journal of Soft Computing and Engineering,Volume 2,Issue-3,July 2012.
[3] Amitabh , P. C. Sharma (2004) "Safety as Key Business Theme! -Indian Railways Perspective", International Railway Safety Conference.
[4] Sandhya gautam, Sandip nemade, Teena sakla (2010) "Simulation of an anti-collision system on same track for Railways", International Journal of Engineering and Technology Vol. 2(9), 2010, 4832-4837
[5] Debashreet Das "RFID Deployment in Indian Railways: A case study of E-Transport Initiative in India", International Journal of Instrumentation, Control & Automation (IJICA), Volume 1, Issue 1, Pg:55-60,2011.
[6] Alírio J. Soares Boaventura; Nuno Borges Carvalho "A Battery less RFID Remote Control System", IEEE Transactions on microwave theory and techniques, vol. 61, no. 7, July 2013.
[7] Jiwhan Lim; Sangjin Kim; Heekuck Oh; Donghyun Kim "A Designated Query Protocol for Server less Mobile RFID Systems with Reader and Tag Privacy", Tsinghua Science And Technology, Volume 17, Number 5, Pg:521-536, Volume 17, Number 5, October