Journal of Network and Information Security
Volume 5 Issue 2 2017
ISSN.: 2321-6859

# Real-Time Information Display System for Indian Railways Using RFID

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**Abstract: Passengers travelling in night trains usually wake up early to know which station the train currently passed by. During early morning hours or at night the visibility of outside railway station boards at stations are not clear from travelling trains. Passengers are often frustrated with wanting to know the details regarding the station. The proposed idea is to develop an information system using LED boards in coaches for providing real time information regarding the current station passed by. This cost effective approach enhances user experience by not disturbing the passenger's sleep in night trains as they need to wake up much early to avoid their destination been passed. Currently travelers rely on wakeup call service using 139 services or manually search the place using other map services using GPS. Map services by Google rely completely on availability of Internet services like 3G and above networks which is not a reliable network during train travels and consumes huge battery power and packet data.**

**The proposed system employs broadcasting of station information from a unit at station to the unit in train engine wirelessly upon the entry of that train to a station. The engine unit then updates this information in the LED units at each coach in real time.**

**Keywords: Display systems, Indian railways, RFID.**

## I. Working of the Proposed Innovation

The proposed system employs Radio frequency identification [1] wireless technology and tracking system for updating railway station information from railway platform to the train engine and in turn transfers this information to the coach LED display boards in a wired fashion. RFID tags can be used for identifying products and objects uniquely. It contains an integrated chip, an antenna and a memory unit which stores information related to product's electronic product code [EPC]. A Radio frequency identification system consists of 3 parts: - scanning antenna, RFID reader (transceiver) for decoding data and a RFID tag (transponder). The purpose of scanning antenna part of RFID reader is to radiate RF signals to do two things: One, a means of communicating with the RFID tag and two, it gives the RFID tag the necessary energy for communication.

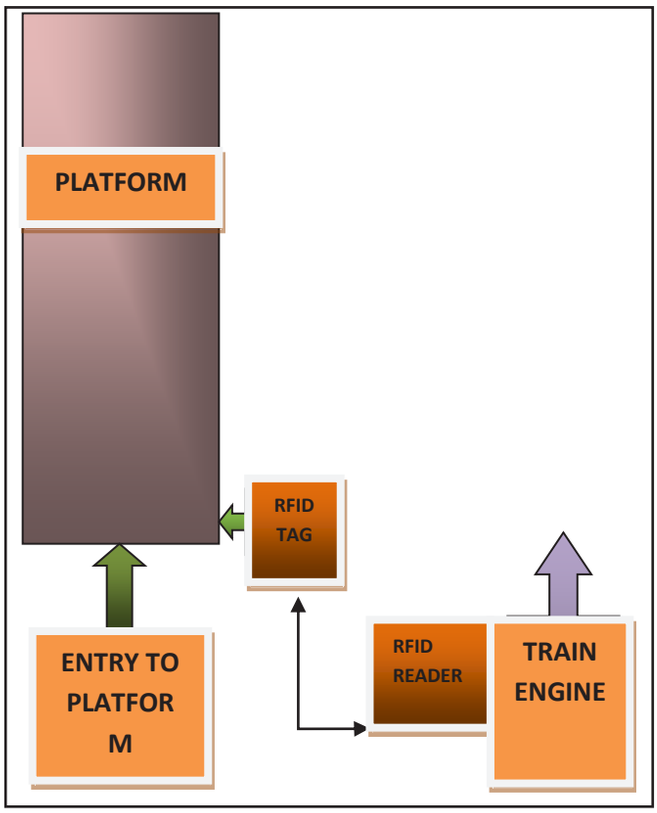


Fig. 1: Basic Layout

In the proposed system, the RFID tags stores information related to the corresponding railway station known as "station tags". Station tags are the short form notation which uniquely identifies each station name similar to station notations currently used in IRCTC. The train's engine uses an RFID reader [3] to read and track the RFID tags installed in the station. The reader then passes this station tag information to the corresponding coaches in real time. The tag installed at the stations contains details regarding the station name. The basic layout is shown in figure 1. The most optimal location to store RFID tag is at the entry of the platform as shown in figure 2.

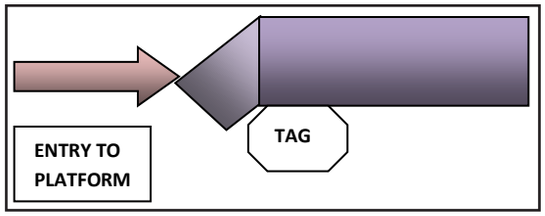


Fig. 2: Position of RFID Tags

The position of RFID tag below the entry position of platform is safe enough to protect it from rain water and it gives the optimal shortest distance to the train engine RFID reader. When the train engine approaches the platform, RFID tag passes through the field of the RFID reader's antenna and activates the RFID tag chip which in turn sends the data in its microchip to the RFID reader. The RFID tags receive their power from the magnetic field generated by the RFID reader in train engine through inductive coupling. Coupling elements of the RFID tag converts the received magnetic field and produces a current which powers the tag. The RFID reader will decode the received signal and send the decoded data to the LED boards in coaches in wired manner.

The main benefit of using RFID systems is its non-contact and non line of sight nature. RFID tags works in various challenging scenarios at remarkable speeds with response time taking less than 100 milliseconds in most cases. It also functions through a variety of substances like fog, snow, paint and could be effective in other visually and environmentally challenging conditions.

WIFI hotspots within the train can provide connectivity with RFID reader so that commuters can obtain the real-time location details. The android application can be equipped with in-built algorithm for calculating the next station details, a machine learning algorithm for finding the expected destination time and other interesting features. Another add-on to the proposed system is using a handheld attachment connected to an android-based mobile device which gives more interesting real time information.

## II. Elaboration on Utility to Passengers and How the Innovative Concept/ Design Enhance the Passenger Experience

Passengers often wake up early in the morning in night trains due to uncertainty in knowing which railway station the train might have reached. Due to the sudden changes in the railway station it seems harder for a passenger to read a railway station board in a moving station. And passengers can't fully rely on wakeup call service 139 either due to uncertainty of waking up a person in deep sleep and other external noises.

The passenger's experience will get enhanced in trains if they can see which railway station has arrived or which one just passed by. In AC coaches [2 Tier, 3 Tier or Chair car], the visibility of railway station boards is poor in day time and much more difficult during night or early morning hours. The proposed system establishes a simple user friendly display system which gives commuters the necessary railway station details.

One of the enhancement for the proposed system is by creating an android application that can give commuters more information regarding next train information, expected destination time, next stop where food is available in addition to alarm settings. For this enhancement, WIFI technology can be utilized.

## III. Feasibility of Implementation of the Proposed Innovation and Integration with the Existing Infrastructure and New Setup Including Retro-Fitments and Modifications

Radio frequency identification belongs to a family of Automatic identification and Data capture. RFID tags [2] are simple to use and works very well even during bad weather conditions. It would be impossible to know the station details from AC coaches when it's raining. The RFID tags proposed is used in passive mode which does not require any power source like a battery and hence will remain usable for longer period of time. The power comes from induction method from the RFID reader in the train engine, i.e; the induction from RFID reader is filtered and rectified into DC for powering the tags. Once the RFID tag comes closer to RFID reader, the data in RFID tag's memory will be read by RFID reader. These RFID cards or tags costs about Rupees 50 and the size are analogous to size of a coin.

The RFID reader emits RF waves in ranges varying from few inches to 100 feet or more, depending upon the power output and RF used. The reader's RF waves creates electromagnetic field and if the RFID tag comes within the sphere of this field it gets activated and send the memory data to the RFID reader which in turn decode it and produces useful information.

## IV. Explain How the Existing Infrastructure is Integrated with the Proposed Innovation

Currently the railway employs LED display boards in coaches to display whether anyone currently occupied the toilet or not. This same system can be extended to display the current railway station just passed by. The non functional features are fully compatible with the existing system as the same type of contract can be extended to achieve this. The wiring operation can be made simpler by integrating the wiring with the connectivity mechanism already implemented from train engine to each coach for emergency braking system. The power requirement for the LED display is already implemented for toilet occupancy display board. For the start-up cost involves cost for readers, tags, software unit, wiring and display boards.

To integrate with the existing system, the RFID system should be properly tested and implemented. Hence time must be spent as a best practice approach before finalizing the kind of RFID

tag to be employed [5]. The hardware should be tested for potential pros and cons. Testing phase should utilize different types of tags after proper type of RFID reader and antenna is selected depending upon the range requirement.

Currently there is no such information system in any public transportation systems which employ RFID tagging methodology for passing station information to the commuter information boards. Presently in public busses the LED boards shows the next stop information.

## V. Cost Effectiveness of Proposed Design for Setup and Operation (To Include Initial Cost, Operating Cost and Life-Cycle Costing)

The cost of RDIF reader ranges from 300 to 1000. The setup cost involves cost for packaging the reader unit in engine, wiring to the respective coaches, LED display units per train and the control unit (software unit) which analyses and decodes the railway station information. Also it is expected that with more and more applications switching towards RFID technology both in commercial and industrial in near future the cost will reduce. The cost per unit of RFID tags will be reduced further if orders are in bulk.

## VI. Maintainability of the Proposed Design Explaining its Ruggedness, Ease of Maintenance and Swift Replacement of Spares

The RFID technology offers so many advantages compared to other information transfer systems. RFID technology provides longer operational life as it doesn't require external power source and the power is obtained in wireless mode. The usage of passive tags makes it easy to replace or maintain the tags. The cost of maintenance per passive tag is much lesser compared to active tags. The periodic maintenance can be conducted on the reader device in the train engine by checking the value read from a test RFID passive tag and troubleshooting if any reading error occurs. The tags at the station can also be tested periodically by the same approach.

The main benefit of using RFID systems [4] is its non-contact and non line of sight nature. RFID tags works in various challenging scenarios at remarkable speeds with response time taking less than 100 milliseconds in most cases. It also functions through a variety of substances like fog, snow, paint and could be effective in other visually and environmentally challenging conditions. Again the data obtained from each RFID tags can be centrally stored and with the help of Big Data analysis, the proposed system can be extendible to an accurate predictive model.

## VII. Possible Constraints Anticipated in Deployment

Reader collision occurs when the signals from two or more readers overlap. The tag is unable to respond to simultaneous queries. Systems must be carefully set up to avoid this problem. Few constrains anticipated during set-up phase is that the range should be properly calibrated for the proposed system by the hit and trail method. One of the constrains of using RF waves is the interference effect due to metal bodies. Tag misalignment, the presence of water in the vicinity of RFID reader system and the location selected for installing RFID tags poses some difficulties during reading phase.

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