Railway System Monitoring Using IoT With IR Based Unmanned Gate Crossing Control System

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Abstract- *Need of internet of things (IoT) has advance in the fields like sensors, radio access, and platforms for enormous market applications. In this, we introduce a cost-effective IoT solution consisting of device platform, gateway, IoT network, and platform server. The IoT solution applied for the smart railway application helps to grasp the condition information over a wide railway area. The railways provide the cheapest and most convenient mode of transport for long distance. Also, most of transport in India usesthe railway network. About 60% accidents are occurring at railway track crossing and due to crack in railway tracks resulting in loss of precious life and loss of economy. So there is need to think about new technology that is robust, efficient and stable for automatic gate closure system so we propose an unmanned gate crossing technology. This is a IR sensors based system. Therefore, unmanned gate crossing controller system prevents accident which are caused due to railway track crossing and railway crack detection system used for detecting crack in railway track using internet of things technology.*

Keywords- Smart railway, Condition based maintenance, Internet of Things, Unmanned gate control,IR transmitter and Receiver

I. INTRODUCTION

The railway method is used to transport a massive population along the determinant paths. This method helps to travelling a far distance. It possesses many features like high capacity, and energy efficiency.

The various entities of a railway system are train vehicles, tunnels, bridges and facilities [1]. The one of the main responsibility of the railway operator is to guarantee that every entity in the railway system operates in a good condition. Because the unexpected fault may cause the threat the safety of massive passengers. So, the government forces the railway operators to fully engage in conducting the maintenance. Due to this the operators necessarily arrange a certain amount of budget for the maintenance of the railway system.

Most railway entities exist in the outdoor environment. Therefore, it is unfavorable for keeping the condition in a good state. This situation leads the operator to take more effort for the maintenance. Due to this, it impose a heavier financial burden to the operators.

Therefore, this railway system faces a lot of challenges due to human errors such as level cross accidents, collisions due to broken track etc. A level cross is an intersection of a road and a railway line, it requires human coordination, the lack of which leads to accidents.

In earlier, railway crossings are managed by the gatekeeper and the gatekeeper is instructed by the means of telephone from the control room. Manual error that these level crosses are high because they are unsafe to perform with no knowledge about the train timing. Delay in the gate's opening and closing lead to railway accidents.

In this paper, to avoid the human errors that could occur during the operation of gates this paper presented here introduces the concept of railway gate automation by using IR sensors and IOT (Internet of Things) technology which performs automatic gate. Using IoT concept, the staffs can be easily aware of the condition of targets to be maintained and make a decision for respective actions can be done without the difficult procedure of the direct inspection.

The IOT is the network of physical devices, such as vehicles and other items connected with software, electronics, actuators, sensors etc. used to collect and exchange data. The IOT represents the coordination of multiple machines by multiple vendors, devices and appliances connected to the Internet via various networks

II. RELATED WORKS

The aim of railway maintenance is to keep the railway system on performing its functions in good state during the life time. Under the Condition Based Maintenance(CBM) concept, a staff inspects the condition of entity in the railway system and repairs or replaces where

necessary[1].At a specific inspection period the maintenance staff directly visit the site and measures the entities. Staffs then decide which status each target is in and whether the target needs maintenance. The budget for the maintenance actions is negotiated leading to a large maintenance cost.

The Siemens Track sure track monitoring system was which makes use of the existing on-board GSM-R cab radio present in every train through the fitment of a sensor card, which detects track condition over three axes of train vibrations[2]. Data is transferred to the Ground System. This ensures maintenance staff are accurately directed to the location of voids, minimizing time spent inspecting and maintaining track and improving safety.

Stochastic Scheduling Approach for Predictive Risk-Based Railway Maintenance belongs to the framework of predictive maintenance[3]. When asset has reach a certain degradation state, being the future track conditions forecasted by appropriate models. It considers the stochastic nature of risk and of the real-world maintenance operations, introducing stochastic deadlines.

Many various systems have been proposed for railway gate controlling. Some system have poor stability and performance while others utilize active sensors which defects like instability and short reliable life cycle. FM communication system has been used to automatically close gates. Sensors are used for the closing and opening of the gate are performed [4] . A GPS receiver was designed and operated to monitor the L-band amplitude scintillations. [5]. Zig- Bee based train anti-collision and level crossing protection system consists of 4 modules: train module, control center module, signaling part module, and level crossing gate module [6]. A data-driven method employed to replace interlocking device [7]. GPS and GSM was used for crossing warning system increasing efficiency in railway crossing [8].

III. PROPOSED SYSTEM

For improving the efficiency of the inspection process is to utilize the concept of IOT. It is a good solution to provide real-time monitoring services, because at remote sites, it is helpful for estimating the properties of maintenance targets and gate level controlling.

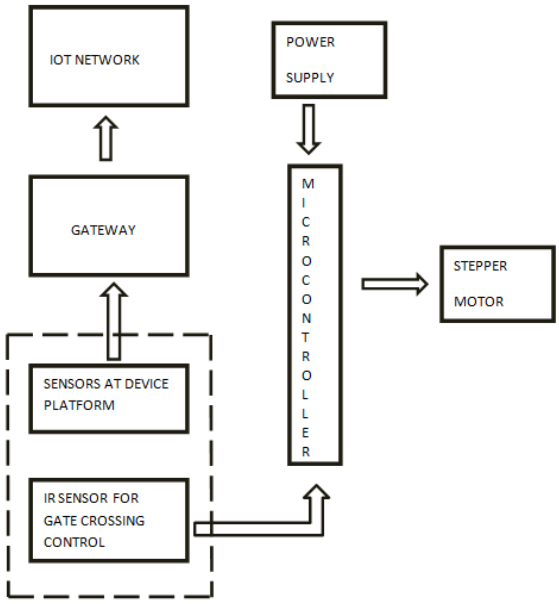

Figure 1: Block diagram of Railway Monitoring System with Unmanned Gate Crossing Control

The features of IOT such as high efficiency, accuracy, and economic benefit reduce the human intervention. Using the IOT concept, the operators can be easily known the present condition of the maintenance targets and take a decision without the direct inspection procedure.

So various sensors need to be easily equipped with terminals of the IOT. In this sense, the terminals are used to control and monitor the sensors operation instead of staffs. Also, it is important to reduce the cost of the terminals. In the railway system the sensors should be distributed over a wide area, and a large number of the terminals needed to cover the whole area. The IOT terminals installed in a railway field are also required to operate normally for a sufficient period.

As condition information data is generated from a sensor, device platform gathers and transmits the data to the IoT network. A gateway relays the data from the device platform which is not able to make a direct connection to the IoT network. The IoT network routes the data to the platform server which has roles of storing, processing and analyzing the condition information. Device platform is to provide common functionality of various sensors. At the terminal side, it needs to have a flexible structure to interwork with various combinations of sensors. Device platform reduces financial burden of deploying and operating a large number of sensors. The device platform itself contributes to minimize CAPEX. Device platform can make it easier to replace the sensors which become out of order to reduce the Operational Expenditure (OPEX).

A platform server gathers the condition information in a centralized form and processes that incoming condition information for various data consumers. It also remotely configures and manages the working of the device platforms for collecting the condition information which the platform server requires. The main operation that the platform server needs to be considered for the railway system is to take care of important information. Since the vital information in railway is importantly related to the safety of passengers, platform server should have QoS management schemes which could guarantee QoS of the important services.

In the case of unmanned gate crossing controller system we used LPC2148 Microcontroller. It has 64 pin and high Performance ARM microcontroller. It is also small size and low power consumption microcontroller. It has serial communication interfaces ranging from a USB 2.0 Full Speed device, multiple UARTS, SPI; SSP to I2Cs.It has on-chip SRAM of 8 kb up to 40kb. So, makes devices very well suited for communication gateway.

It uses FM communication system. It has one arrival point that is 3 km distance on one side and one departure point at3km distance for train from the level crossing. The system have microcontroller for receiving the signal from sensors that placed at the level crossing and as per receiving signal opening and closing of gate are performed. When train comes at arrival point, the arrival IR sensor, sense the arrival of the train and send signal at the level crossing therefore at the same time closing of the gate are performed.

Similarly when train goes at departure point the Departure IR sensor, sense the departure of the train and send signal at the level crossing and opening of the gate performed. The stepper motor is used to get pulley up down at the level crossing in the unmanned gate crossing controller system.

IV. CONCLUSION

This system is very reliable one. We can prevent loss of life using internet of things technology and IR sensor based system. In the proposed system the unmanned railway gate crossing system helps to automatic opening and closing of gate function without the help of human participation and also railway track system automatically detects faulty railway track without human intervention. The advantages of proposed system compared with previous system includes less cost ,low power ,high accuracy, low power consumption ,less analysis time and most important advantage in crack detection is to we can find the exact location of the faulty track using hosted website(IOT)so that many lives can be saved.

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