



RAILWAY TRACK POINT MACHINE HEALTH MONITORING SYSTEM

C. Pon Nirmal¹,
Assistant Professor,
Electrical and Electronics
Engineering,
SCAD College of Engineering
and Technology
Cheranmahadevi,
cpnajak@gmail.com

P. Sathya Devi²,
Final Year,
Electrical and Electronics
Engineering,
SCAD College of Engineering
and Technology,
Cheranmahadevi
sathya2121devi@gmail.com

M. Priya Subha³,
Final Year,
Electrical and Electronics
Engineering
SCAD College of Engineering
and Technology,
Cheranmahadevi
priyasubha2001@gmail.com

D. Seliliya⁴,
Final Year,
Electrical and Electronics
Engineering
SCAD College of Engineering
and Technology,
Cheranmahadevi
seliliyadurai2000@gmail.com

Abstract:

This paper presented the work carried out by us on the health monitoring of railway point machines. The developed health monitoring system includes a variety of sensors for acquiring trackside data related to different parameters. Key events to be logged include time stamping of points operation such as the current to the motor voltage to the motor, track flexibility of curve of the track and to measure the distance between the rails. The system also has built-in Web functions. This allows a remote operator using Google chrome to observe the condition of the point machine at any time, while the acquired data were updated automatically for every 3-5 seconds, providing more detailed information on the health condition of the monitored point machine. It assures reliability and increases the lifetime of the point machine. A short daily condition report can also be made with these databases.

Key words: Point Machine, Arduino UNO, Atmega2560, Sensors, cloud.

Introduction

Point Machines are used for operating railway turnouts and are used as critical track elements in railway assets. A poorly maintained point machines could also be a safety concern. Railway plays a major role in day-to-day life of public, all over the world. When we think about public transport Railway is the first medium which is preferred by most of the industrial and daily wages people, because of its affordable ticket price. But now, Railway industry grows very faster, and it grabs all kind of opportunities which will help the railway maintenance team, to make their tasks easier with the

help of IOT. To manage the railway traffic, they provide multiple tracks with point machine at certain distance. With

this Point machine, they are changing the tracks. A switch motor (also known as a switch machine, point motor, point machine, or automate) is an electric mechanism that aligns

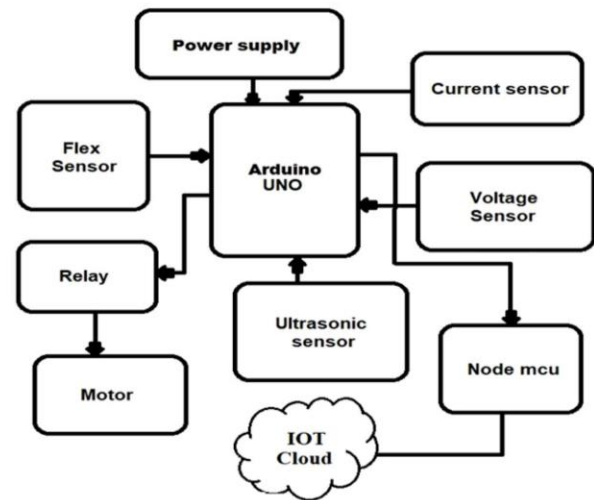
the points with one of the possible routes. To operate this system smoothly and flawlessly continuous monitoring and maintenance is required. But it is done on manual basis once in a week. Unfortunately, if there is sudden failure in the system it takes a lot of time to recognize the problem and to solve it. This proposed system is designed to resolve this problem by continuous monitoring of switch motor using sensors. With the help of this sensor, health of the point machine is taken care by monitoring its vibrations and current supply provided to the system. These things are covered by the manual maintenance team every week. Faults in the switch motor are identified, by exploring IOT database and through some computational analysis.

But Nowadays Railway industry is at that position where it grabs the opportunities which helps them to make their tasks easier with the help of IOT. There is main five ways in which IOT can and has started redefining the railways bringing in increased efficiency and enhanced passenger experience: Greater Reliability and Safety, Fewer Maintenance Delays, Advanced Analytics for Streamlined Operations, Restructured and Optimized Passenger Experience, Better Product Development in the Industry. So, in this work, we are introducing the system which will reduce the time taken for weekly maintenance of Point machines at railway tracks and help to reduce accidents happened due to failure of working of actuators. This web-based system compatible with mobile phones also to know status of parameters from remote locations as the monitoring of main parameters will be done online 24/7 in a control room.

The proposed methodology focusing on improving the Railway management system which will be useful for railway stuff as well as passengers by solving the main issues for railway tracks happened during the switching of tracks as well it will be a benchmark for mission Internet of Trains. The Existing method provides a point machine

which is used to operate railway turnouts especially at a distance. Earlier they were operated manually by leavers but nowadays they are operated electrically from the control room. The Point machine consists of Motor gear, Clutch system and it is attached to the linear actuator. The Railway authorities pays a strict attention in maintenance of rail Tracks every week to avoid further problems. In this maintenance work health checkups of point motor, voltage, and current supply to the motor as well as the oiling of the parts also are done on manual basis. Another common problem faced by the Indian Railways is the problem of citizens trespassing across the tracks creating safety issues, hygiene issues, and unfortunate accidents. Indian Railways operates 8,702 passenger trains and transports around five billion annually across twenty-seven states and three union territories (Delhi, Pondicherry and Chandigarh). Sikkim is the only state not connected. The passenger division is the most preferred form of long distance transport in most of the country. In South India and North-East India however, buses are the preferred mode of transport for medium to long distance transport. A standard passenger train consists of eighteen coaches, but some popular trains can have up to 24 coaches. Coaches are designed to accommodate anywhere from 18 to 72 passengers but may actually accommodate many more during the holiday seasons and on busy routes. The coaches in use are vestibules, but some of these may be dummied on some trains for operational reasons. Freight trains use a large variety of wagons. Each coach has different accommodation class; the most popular being the sleeper class. Up to nine of these type coaches are usually coupled. Air-conditioned coaches are also attached, and a standard train may have between three and five air-conditioned coaches. Overcrowding is the most widely faced problem with Indian Railways. In the holiday seasons or on long weekends, trains are usually packed more than their prescribed limit. Ticket-less travel, which results in large losses for the IR, is also an additional problem faced. The Indian Railways manufactures a lot of its rolling stock and heavy engineering components. This is largely due to historical reasons. As with most developing economies, the main reason is import substitution of expensive technology related products. This was relevant when the general state of the national engineering industry was immature. Production Units, the manufacturing plants of the Indian Railways, are managed directly by the ministry. The General Managers of the PUs report to the Railway Board. Air-conditioned coaches are also attached, and a standard train may have between three and five air-conditioned coaches. The passenger division is the most preferred form of long distance transport in most of the country.

Block Diagram



Overview

An electric point machine is a device, which can perform the function of unlocking and operating the point switches in the desired position and lock them and detect their correct setting with the aid of an electric motor, like that performed by an operator through a lever in a mechanical lever frame. During the failure of motor, point etc. due to power supply or for maintenance work, facility must be provided for locally operating the points manually. This project aims to reduce the manpower and continuously monitor the power supply and voltage maintenance for early stage of failure of point machine. It uses an array of sensors to monitor all relevant parameters, to provide advanced warning of degradation prior to point machine failure. This will provide continuous monitoring, as a supplement to scheduled examinations by maintenance personnel.

Challenges of Railway Industry

The Delay

Indian trains are metaphorically synonymous to delays, ask any train commuter, the answer will be yes. There could be many reasons like a train break down, maintenance of rail tracks, time taken in the maintenance, unfortunate events across the route etc. Any of these problems can cause chaos in the rail network, and once it does, it results in delays across all the rail network, causing many passengers to stress and frustrated waiting at the stations.

Track faults

Track fault includes problems related to fractures, wear and tear, friction issues, loose keys and missing keys that the tracks go through. Detecting these ends up becoming a huge problem, and identifying these can then cause significant mishaps. The additional problem with track maintenance is that they should be classified as soon as possible. The problem with tracks,

especially the fractures is that they have to be identified and fixed as quickly as possible, which takes time because of human intervention ultimately resulting in delays and danger to the human examiner.

Single Track Route Governing

Most of the rail tracks in India are single routed, with trains travelling in both directions on the same path (definitely not at the same time) using track junctions. Therefore, when one train gets delayed, the other one gets delayed as a result. Another common problem faced by the Indian Railways is the problem of citizens trespassing across the tracks creating safety issues, hygiene issues, and unfortunate accidents.

Railway Signaling, Routing and User Experience

When it comes to railways, there is a need for up-gradation of signaling regarding safety. Communication holds a pivotal role in this area, and the connection has to be fast and precise. The railway department also has to keep a track of the train safety which comes under maintenance involving parameters like conditions of brakes, wheel sets, engines, etc. User experience involves everything from searching for trains until the passenger's experience inside the trains, which definitely needs improvement.

Trespassing

Another common problem faced by the Indian Railways is the problem of citizens trespassing across the tracks creating safety issues, hygiene issues, and unfortunate accidents.

Proposed Work

To manage the railway traffic, they provide multiple tracks with point machine at certain distance. With this Point machine, they are changing the tracks. A switch motor (also known as a switch machine, point motor, point machine, or automate) is an electric mechanism that aligns the points with one of the possible routes. To operate this system smoothly and flawlessly continuous monitoring and maintenance is required. But it is done on manual basis once in a week. Unfortunately, if there is sudden failure in the system it takes a lot of time to recognize the problem and to solve it. To avoid this, we propose a prototype system, designed for continuous monitoring of this switch motor using a sensor. So, in this project, we are designing the prototype of point machine, then we are monitoring health of point machine by its vibrations and current supply provided to the system. These things are covered by the manual maintenance team every week. Faults in the switch motor are identified, by exploring IOT database and through some computational analysis.

Switch Mechanics

This picture depicts the switch mechanism driven by the electrical motor as shown in the below fig 1

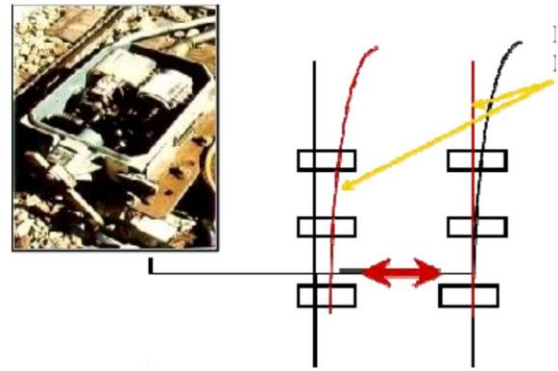


Fig no 1 Switch mechanism driven by an electrical motor.

A physical model of the system simply uses the signals of the electrical power consumed during the switch actuation period (see figure 2 and figure 3). It consists of two steps:

1. The feature extraction from signal,
2. The learning of the different class parameters (class without defect, class with minor defect and class with critical defect) using a labialized collection of signals.

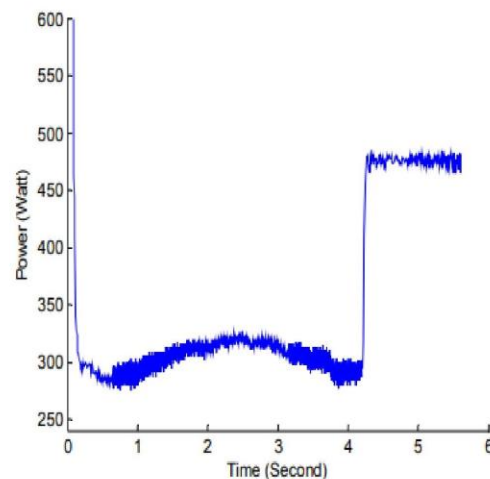


Fig 2 Signal corresponding to a normal switch operation

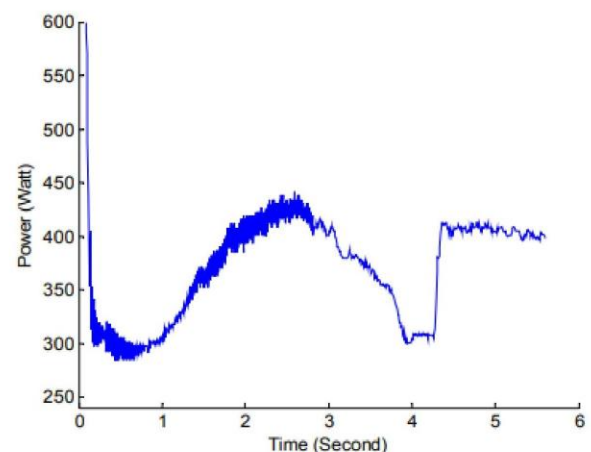
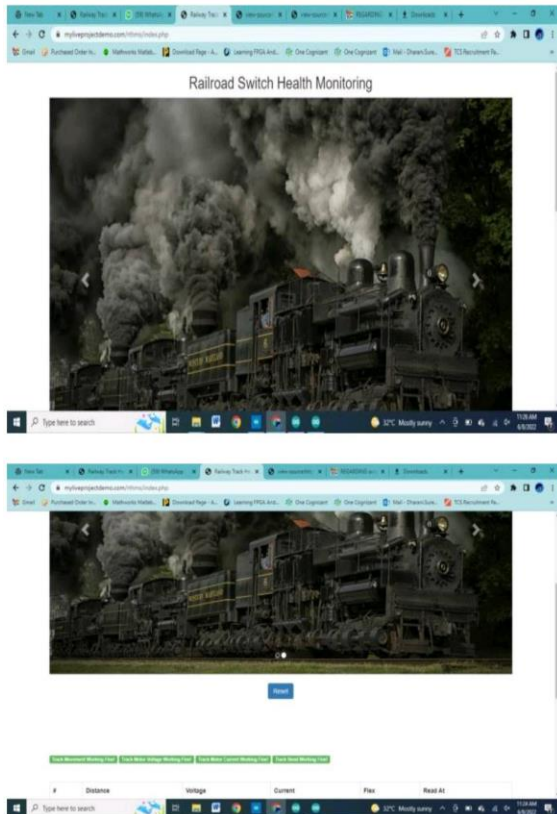


Figure 3 Signal corresponding to a switch operation with lake of lubrication

Result:**Display the value stored in the database**

ID	Type	Location	Status	Speed	Distance	Time	Read
14	79	12.11	13.00	450.00	00.00	00.00	00.00
15	3	12.16	13.00	450.00	00.00	00.00	00.00
16	3	12.16	13.00	450.00	00.00	00.00	00.00
17	3	12.16	13.00	450.00	00.00	00.00	00.00
18	3	12.16	13.00	450.00	00.00	00.00	00.00
19	3	12.16	13.00	450.00	00.00	00.00	00.00
20	3	12.16	13.00	450.00	00.00	00.00	00.00
21	3	12.16	13.00	450.00	00.00	00.00	00.00
22	3	12.16	13.00	450.00	00.00	00.00	00.00
23	3	12.16	13.00	450.00	00.00	00.00	00.00
24	3	12.16	13.00	450.00	00.00	00.00	00.00
25	3	12.16	13.00	450.00	00.00	00.00	00.00
26	3	12.16	13.00	450.00	00.00	00.00	00.00
27	3	12.16	13.00	450.00	00.00	00.00	00.00
28	3	12.16	13.00	450.00	00.00	00.00	00.00
29	4	12.16	13.00	450.00	00.00	00.00	00.00
30	2	12.16	13.00	450.00	00.00	00.00	00.00

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