

Railway Register and Track Safety Monitoring System

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Abstract— The Goal of Automation of Railway Operations Is to Boost Capacity, Reliability, Energy Efficiency, Flexibility, Safety, And Value Effectiveness. Many Railways Experience an Increasing Transport Demand, Leading to Operation Near the Infrastructure Capacity Limits. In Every Sector of Industry, Automation Plays a Significant Role in Efficient and Accurate Working of That Exact System. As Far as Railways Is Taken into Account, Automation Is Efficacious So as To Enhance the Systems Accuracy and Its Efficiency. Reduce Worker Fatigue and Energy or Labor-Intensive Operation, Prevent Materials from Being Damaged, Increase Efficiency, Collect Better Data, Cost Effective and Works 24x7. By Keeping of These in Mind We Propose the IoT Based Railway Automation. The System Continuously Monitors the Track Safety and Cast Over the Online, And Therefore the System Also Predict the Weather for The Railway Operations. Looking On the Acquired Data Controller Plays the Automation of Rail Tracks. The Train Is Detected by The RFID Reader And Is Shipped to Processor for Comparing with Predefined Data and Perform Signaling Operations. This Will Be Utilized in Any Rugged Environment If Train Passes Through.

Index Terms: Track circuit, Railway register.

I. INTRODUCTION

In today's world technology is in everywhere. Automation is that the creation of technology and its application so on regulate and monitor the services. It performs tasks that were previously performed by humans. Automation plays a vital role within the advancement of science and technology. Nowadays, automation is everywhere except our Indian Railway, Indian railway plays a awfully important role in our country's economy. Today quite ever, speed reliability and convenience are the decisive factors for ensuring the desirability of up to this point mass transit railways and then for his or her commercial

success. The key to meeting these criteria is optimum line utilization through railway automation.

A. EXISTING VS. PROPOSED SYSTEMS

- In Indian railways most of the tracks depends on the manual track safety testing, tracks are inspected through the external vehicles which are failed in heavy rail traffic. So, we are proposing sensor-based track health monitoring system which monitors the track 24/7 which helps in the regular maintenance operations.
- DC track circuit is relay based which is high power consumption, and also needs heavy maintenance. Our system uses digital track circuit module which is based on digital signals.
- Rail registering is done by manual by station masters, which is automated in this project.
- Centralized control and monitoring can achieve through our project.
- Web dashboard helps to the CBTC (Communication based train control).

B. DISADVANTAGES OF EXISTING SYSTEM

- Manual control
- Very slow operating speed
- High maintenance cost
- High labor cost
- Can't use in rugged environment.

II. METHODOLOGY

The Track safety in the track is continuously monitored with the help of interfacing the sensors with raspberry pi. The data are fed to the raspberry pi which acts as a central processing unit, where the detected data is monitored using monitoring device. This system allows to find the faults in the track and

occupancy in the track thereby alerting through the cloud-based interface. The system is also integrated with real time weather prediction system which helps in the various railway operations. And we are introducing digital track circuit module which is reliable than the traditional DC track circuit. Digital track circuit is based on the “Transmit-Receive protocol”, Digital signal is compared at both sides. In our model we are using FSK modulation and Demodulation technique for modulation and demodulation. For railway register automation system specially makes use of RFID technology and specifically 2.45GHZ (Active RFID) microwave range which forms the heart of our system. It is capable of automatically detecting very high speed (up to 300kph) moving objects at long read range. It has read/write capability, no line-of-sight detection and less sensitive to electromagnetic interference. It is highly accurate (99%) and so it is reliable for real time processing. To Identify the railway, we are using RFID technology. From this technique locomotive can be identified by a unique id.

A. CODEDTRACKCIRCUITMODULE

- This method is applied to DC or AC track circuits. The track circuit signal activates and off (PWM) at a rate relative to the speed command. The switching speed ranges from about 50 to 500 revolutions per minute.
- When a given code (rate of transmission) is received, a selected relay within the decoding equipment is energized and remains energized as long as that code is being received.
- When a train approaches the track circuit, the code circuit is deenergized, and this fact is used to point the presence of a train.

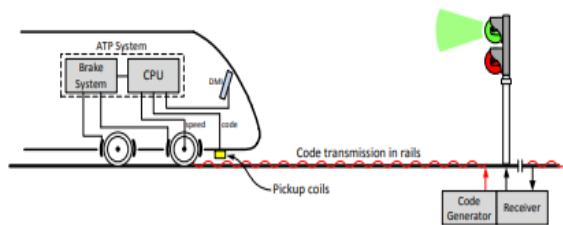


Fig 1 CODEDTRACKCIRCUITMODULE

BINARYCODEDTRACKCIRCUIT

This method is sometimes used with audio frequency AC track circuits. Instead of turning the rail circuit

signal on and off, the frequency of the rail signal is changed to one of two separate frequencies, producing a binary modulated FSK signal. Especially suitable for digital systems where one frequency corresponds to "1" transmission and the other frequency corresponds to "0" transmission. The track circuit receiver responds to both signal frequencies used. As the train approaches the track circuit, the signal amplitude from the track circuit receiver drops below a certain threshold and this information is used as an indicator of the train's presence.

B. BLOCK DIAGRAM

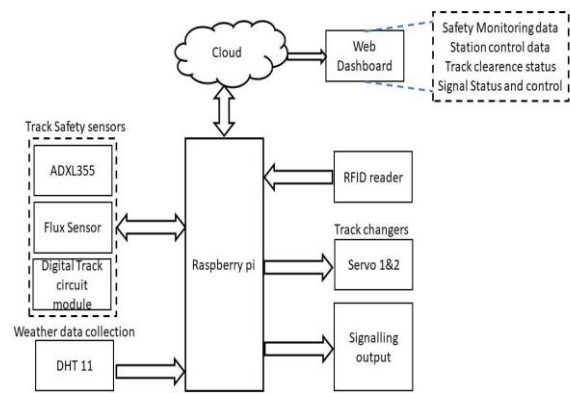


Fig 2. Block diagram

C. SENSORS USED

ADXL345

- ADXL345 is a 3-axis accelerometer that senses both static acceleration (due to gravity) as well as dynamic acceleration (due to motion or shock). So, it can be used as a tilt sensor or to detect free fall.
- It is a MEMS accelerometer consisting of a polysilicon surface-micro-machined structure built on the top of a Polysilicon wafer. It is a capacitive accelerometer sensor.

LOAD CELL WITH AMPLIFIER

- A load cell is a transducer used to generate an electrical signal whose magnitude is directly proportional to the force being measured.
- Basically, a device that measures voltage and then converts the force into electrical energy, acting as a measurement for scientists and operators.

- Strain measurement with strain gages helps maintain the integrity of pressurized devices and protects nearby people and equipment.

DHT11

- The DHT11 is an inexpensive digital temperature and humidity sensor. This sensor can be easily connected to any microcontroller such as Arduino, Raspberry Pi, etc for instant measurement of humidity and temperature.
- The DHT11 Humidity and Temperature Sensor is available as a sensor and module. The difference between this sensor and module is the load resistance and the enable LED.
- The DHT11 is a relative humidity sensor. This sensor uses a thermistor and a capacitive humidity sensor to measure the ambient air.

RFID READER (MFRC522)

Read and write various types of Radio Frequency Identification (RFID) cards on raspberry pi using an RC522-based reader connected through a Serial Peripheral Interface (SPI) interface with the read range of 5cm.

III.RESULTS AND DISSCUSSIONS

1. CIRCUIT DIAGRAM

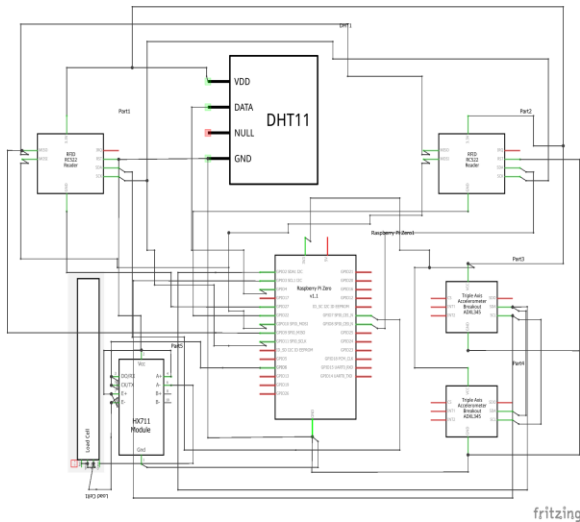


Fig 3. Circuits diagram

2. WORKING

To study the structural state of railway track , The system consists of a miniature rail track that simulates the scenario of a true train on the track. the system is divided into three parts.

- Sensor Network: the primary part is placed on the rail track and contains several sensors and a microcontroller.
- Communication Setup: Second part is that the communication system, this part transfers the collected data by the sensors to an overseas site.
- Central Server: The third part comprises of the receiver and software programs which decode the info and display it during a graphical manner.

3. WEB DASHBOARD

URL for Web Dashboard:

<http://railproject.pythonanywhere.com/>

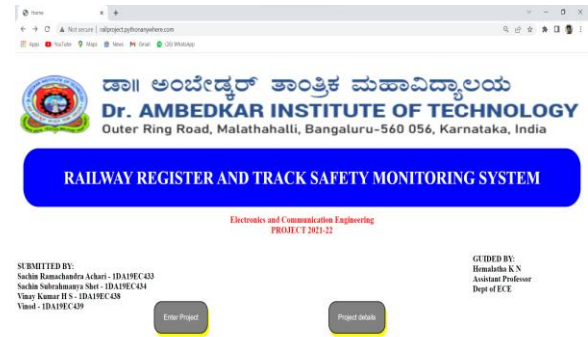


Fig 4. Home Page

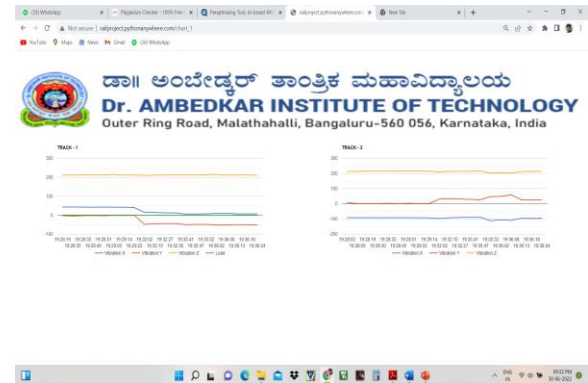


Fig 5. Track Safety Data

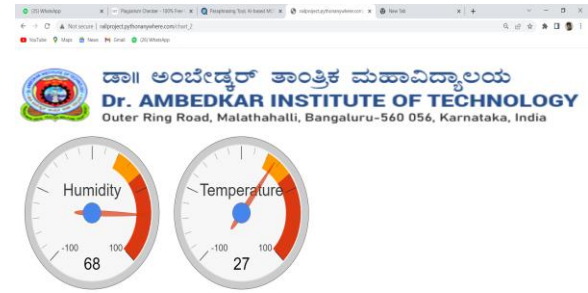


Fig 6. Weather Data

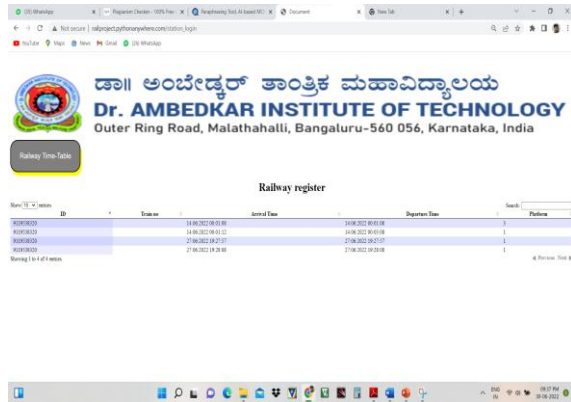


Fig 7. Railway Register

IV.CONCLUSION

For many of the railway accidents rail track defect is the major reason. To avoid such accidents, it is necessary to frequently monitor the safety of the track, which helps in the regular and emergency maintenance of the railway tracks. Currently used techniques have many disadvantages as discussed in the presentation. So we proposed IoT based railway automation which does the operations like track safety monitoring, weather forecasting, Register automation for railways, and depending on the conditions signal automation and track switching operation to be performed.

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