Automated vehicle for railway track fault detection

IOP Conf. Series: Materials Science and Engineering **263** (2017) 052045 doi:10.1088/1757-899X/263/5/052045

Automated vehicle for railway track fault detection

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Abstract. For the safety reasons, railroad tracks need to be inspected on a regular basis for detecting physical defects or design non compliances. Such track defects and non compliances, if not detected in a certain interval of time, may eventually lead to severe consequences such as train derailments. Inspection must happen twice weekly by a human inspector to maintain safety standards as there are hundreds and thousands of miles of railroad track. But in such type of manual inspection, there are many drawbacks that may result in the poor inspection of the track, due to which accidents may cause in future. So to avoid such errors and severe accidents, this automated system is designed.Such a concept would surely introduce automation in the field of inspection process of railway track and can help to avoid mishaps and severe accidents due to faults in the track.

1. Introduction

Automation has touched every aspect of our daily life. More and more advancement is being introduced in almost each and every field to reduce human efforts and to save time. Thinking about the same we are trying to introduce automation in the field of railway track inspection system. Railway track form a very critical part of any company's asset base, as it provides them with the required business operability. The mishaps taking place due to problems in the railway track need to overcome[1,2]

The recent trend used by the Indian railway is manual inspection of this railway track which requires much of man power and consumes time. Our project finds its main application here. This vehicle would run over the railway tracks inspecting the tack and finding the fault if any. With the introduction of such and automated vehicle we are trying to reduce the human efforts, save time and provide a much accurate and precise output [3]

In our paper the fault detection on railway track is done by different sensor modules mounted on the moving robot. The different faults which our robot would encounter are: [4]

Obstacles on track
Discontinuity
Absence of nuts and bolts
Misalignment

The different techniques used for the detection of same are infrared sensors (IR module), limit switch and ultrasonic sensors. All these sensors are interfaced with LPC 1768 ARM micro controller. When any of the fault is detected on the track, output of the sensors is made high and given to the

micro controller. With this, the vehicle is made to stop there and the sensed fault is send to control room or the railway station by GSM module. Thus the sensed fault and actual distance where the fault is being detected is being received at the control room making an alert signal ON.

2. Methodology

The vehicle is placed on the railway track, which is to be inspected. The vehicle id and the track id can be feeded for identification. Then the vehicle is sent for its further operation.The vehicle then runs on the track for inspection from source railway station to the destination railway station. It runs on power supply provided by the battery. It also contains various sensors to identify various faults.It can detect four types of track faults, i.e. misalignment, break in track, absence of nut & bolts and obstacles on the track. When any of the above faults is detected, the vehicle stops there itself. The micro controller fitted on the vehicle calculates the distance from the source where it was sent. It then sends a signal to the control room with the help of GSM module. The message sent to the control room consists of the fault which is detected and its distance from source station. The control room then takes the further action to repair the faults present. This also helps to inform the incoming train drivers to be aware and to take necessary actions saving life of the people.In our project the inspection of the railway track and fault detection on railway track is done by different sensor modules mounted on the moving vehicle. The different faults which our vehicle would encounter during inspection are:

2.1Obstacles on track:

Obstacles present on the track are also detected by using the IR transmitter and receiver module. IR transmitter and receiver module is placed on front of the robot. The transmitter continuously transmit the IR signals. If any obstacle is present on the track then the transmitted signal is reflected back to the receiver. If receiver receives the reflected signal then we come to know that there is an obstacle on the track.More than one IR transmitter and receiver modules are placed such that if the obstacle surface is not plane and the reflected signal is not linear then one of the receiver should receive the signal and obstacles on the track is detected.

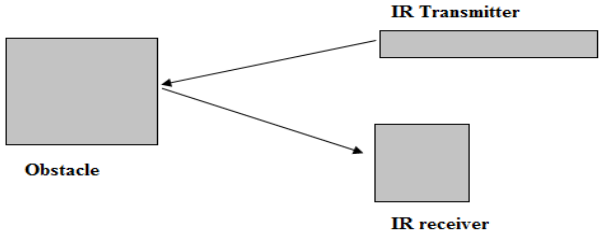


Figure 2.1 Set up to detect the obstacle on the track.

2.2. Discontinuity

Our robot detects the track is continuous or not. IR transmitter and receiver are used to detect the continuity of the track.IR transmitter abs receiver are mechanically adjusted such that they detects the continuity and absence of nut and bolt also. IR sensors are placed parallel to the track. If the track is broken or not continuous then the IR receiver will receive the signal transmitted by transmitter and we will come to know that nut and bolt are absent.

Figure 2.2 Broken Track

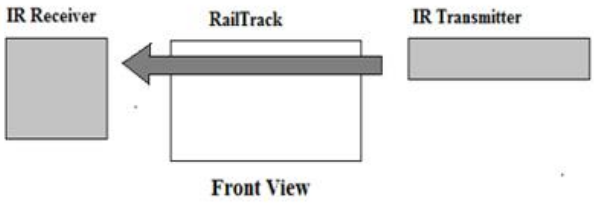


Figure. a

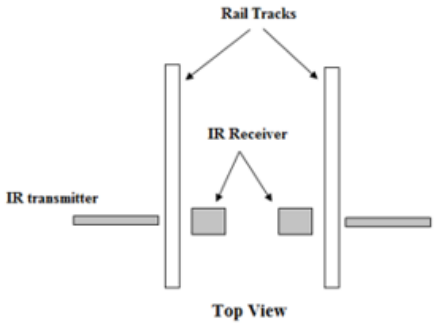


Figure. b

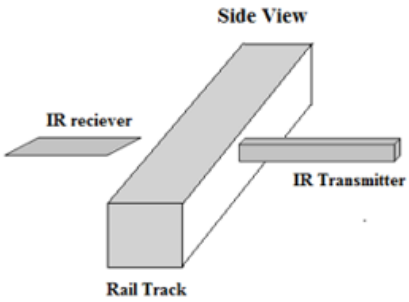


Figure. c

2.3. Absence of nuts and bolts:

Absence of nut and bolt is another fault which is responsible for the train accidents. If nut and bolts are not present then the track will break away when the train will arrive and lead to an accidents. The absence of nut and bolt will be detected by using Limit switch, is a mechanical switch with to electrically separate contacts one is normally open and other is normally closed. If the switch is normally closed, output of the switch will be high otherwise the output will be low.

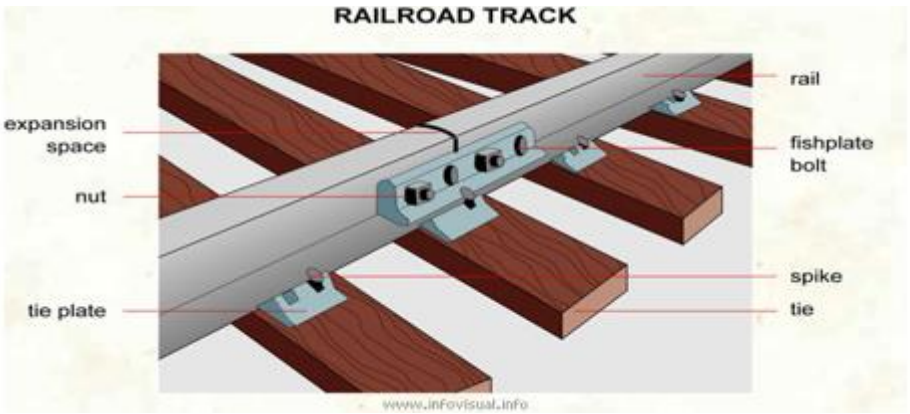


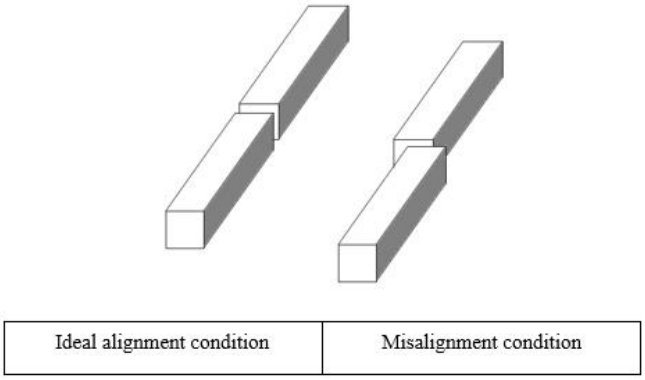
Figure 2.3 Part of railway track where two tracks are connected accordingly

Limit switch is placed as shown in the figure. Limit switch work on snapping action. The flap of the

limit switch is placed such that if the nut and bolt are present then it will get closed and the output of Limit switch become high and if the nut and bolt are present it will not get closed and the output will remain closed. Hence we will come to know that the nut and bolt are present or absent.

2.4. Misalignment:

Misalignment of the track is detected by using Ultrasonic sensor. Ultrasonic sensors are placed on the robot parallel to each other on corner of both the track .Ultrasonic sensors are mechanically adjusted such that if the track is misaligned the receiver receives the Ultrasonic signal that is not received at the time that isfixed and is fed in the controller.



(a) (b)

Figure 2.4 (a) Area of track where the misalignment can occur (b) Part of track where the Limit Switch is used for detection

Ultrasonic sensors are also used instead of limit switch. The Ultrasonic transmitter continuously transmits the signal and receiver receives the signal in the fixed time that is calculated and the value is put in the controller. The controller continuously compares the value with the current value. If the value is same then the track is aligned. But if the value is not same then the track is not aligned. Hence if the value is not matched then the track is not aligned and fault can be detected in this way as well.

3. Conclusion

From the paper we have studied about the working of different modules like GSM, Ultra sonic sensor, IR transreceiver, Limit Switch. We have done the field survey to gather more information so as to do modifications in project. Thus this project will successfully add to automation in the current manual system. We have shown that it is feasible to perform inspection of the rail-track containing crack and misalignment using various sensors and GSM module. Observations and detection of a region containing a crack and misalignment can be done with the help of automated vehicle which involves various sensors and GSM. This may be Possible that rail-track may contain less serious shallow cracks that can also be detected. These cracks can develop into more serious defects or may cause accidents also, so it is important that to identify an approach that can avoid such serious accidents happening due to crack. Finally the approach taken here is fundamentally very different to that already employed conventional i.e. manual vehicle of inspection ,where manual detection of the tracks are taken place. Due to the transition or use of the ultrasonic's, makes the measurement at speed more viable.

References

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