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Review on Design and Development of Robot Base Crack Detection System for Railway Track

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Abstract -

Indian Railways has one of the largest railway networks in the world, spanning over 1,15,000 km across India. But in terms of reliability and passenger safety, Indian Railways is not up to global standards. A recent study revealed that more than 25% of the track length needs to be replaced due to cracks. Manual identification of traces is cumbersome and not fully effective because it takes a lot of time and requires skilled technicians. This project work aims to solve the problem by developing an automatic track slotting system. As the sensor and LCD screen become more common. A huge amount of data can be collected to locate and trace rail faults.

Keywords: Railway Track , Crack detection , Automatic Robot , Sensor and Controller etc.

1. Introduction

Railway is an essential and cheapest mode of transport in India and is considered superior to all other modes of transport. Reading daily newspapers, we come across many railway accidents. Railway accidents are more dangerous than other traffic accidents both in terms of severity and mortality, etc. Therefore, more efforts are needed to improve security.

Railway safety is an important part of railway traffic all over the world. Failures that lead to accidents tend to receive widespread media attention even when the railroad is not at fault, and create an ineffective image of the railroad among the public that often encourages immediate reforms. Indian Railways

has one of the largest railway networks in the world, spanning over 1,15,000 km across India. But in terms of reliability and passenger safety, Indian Railways is not up to global standards. Among other things, the cracks on the rails caused by the lack of timely detection and related maintenance raise serious questions about the safety of rail traffic. A recent study revealed that more than 25% of the track length needs to be replaced due to cracks. Manual identification of traces is cumbersome and not fully effective because it takes a lot of time and requires skilled technicians. This project work aims to solve the problem by developing an automatic track slotting system. With the proliferation of LCD screens. A huge amount of data can be collected to locate and trace rail faults.

The aim of the project is to help the relevant railway administrations to strengthen their safety culture and develop monitoring tools necessary for modern safety management. Railway crossings are very unique, special, potentially dangerous and at the same time unavoidable in the world. Here, two different entities with completely different responsibilities, fields of activity and activity meet and come together with the aim of providing a service to the road user. In this project we use an IR sensor to detect cracks in railways. When a crack is detected, its status is sent to the control room via the LCD screen. An infrared sensor is then used in the measurement process. This system is designed to operate a railway safety monitoring system with an Arduino Uno (ATmega328), IR sensors and an LCD display.

2. Problem Identification

The main problem was the lack of cheap and effective technology to detect problems in the tracks and of course the lack of proper maintenance of the tracks, which caused the formation of cracks in the tracks, etc. . similar problems caused by antisocial factors that threaten the safety of rail traffic. In the past, this problem has caused several derailments resulting in many casualties and property. In the past, track cracks were identified as the main cause of derailment, but no inexpensive automated solutions were available for testing.

Derailment is one of the leading causes of the most expensive and dangerous derailments worldwide. Considering derailments in general, the United States alone averages more than one major derailment every three-day period, consistently for more than a decade.

Fig. 1. Crack on track

3. Objective

This system involves the construction of a crack detection robot to look for cracks on railway tracks. This system uses a controller to interact with the robotic vehicle and detect cracks.

The aim of this project is to develop an embedded system that automatically detects train faults with an infrared sensor and an LCD screen.

- Detects obstacles entering the track.
- The system detects track failure to ensure safety when trains travel.
- Create a system that detects a trace with an infrared sensor.
- We use for ease of use, for example to mark the direction of cracks.
- Update information about LCD screen.

4. Literature Survey

· **Sudarsan .P, 2ram Kumar. S, 3surendar. R, uday Sankar. T, 5karthik. S (June-2014)** The main objective of this project is to automate the crossing of pedestrians on the track without using stairs and inform platform users about the arrival status. This system is also used to avoid train collision problems. Because train accidents happen frequently in India these days. One of the main causes of train accidents is two trains traveling in opposite directions on the same track. To avoid accidents due to the mentioned reasons, we have designed this project. This project detects the status of each train using infrared radio receivers and reports it to the microcontroller. If the sensor block detects both trains on the same track, the microcontroller automatically initiates the train, which is more than enough to avoid such an accident. This project is used to prevent train collusion, saving valuable lives and losses. So this project is useful for railway departments.

• **Mrs. Swati Rane1, Mayuri Pendhari2, Pooja Patil3, Prakash Sakari, Yashmith Shetty5 (2017)** The project uses two pairs of infrared sensors, one pair of infrared sensors is used to control the railway gate and the other infrared sensor is used to automatically change the train . a track These IR sensors are used to detect train arrival and departure. A rod switch is used to control the movement of the train. The reed consists of a switch that contacts a magnet. Since the entire system is automated, errors due to manual control are avoided, as the accuracy of automatic operation is more than manned. Our project is developed on an embedded platform using a microcontroller as the control device.

• **Prashantha.B.Y1, Harisha.S2V. (2016)** The aim of this work is the automatic opening of a railway gate at a railway crossing without human intervention. This work proposes to replace the station with a fully automatic railway gate opening function and an automated platform bridge to help people move from level to level. Nowadays, accidents are common all over the world due to lack of technology and carelessness of people in time. And these random obstacles can not be completely avoided, but some fruitful steps will certainly reduce to some extent, that is why self-initiated steps are needed to prevent the death of many people in any place and at any time with the introduction of new technologies. , here is the effort to open the automatic railway gate without gate protection near the level crossing and with the introduction of an automated platform bridge. The above mentioned system works with microcontroller based technology and rack and pinion mechanism which is used to control the bridge platform.

• **Anand Bansal, Ankit Aneja, Janender Bansal, Sachin Sharma, Raghav Ankur (2018)** This project aims to provide advanced technology for overall railway station development. Assigning a platform to the number of trains in a shorter time is quite difficult with a token system because it is done only by guesswork, which is not so efficient, and also a small error in judgment can lead to an accident that can be dangerous. many lives. So there is a great need for a change in this technology. With this project, we solved this problem and got a very effective solution. We used the RFID tag and ZIGBEE connected to MSP30 to send the unique ID of the train to the server room, and the server room shares the platform, which can finally be displayed on the LCD screen.

5. Block Diagram

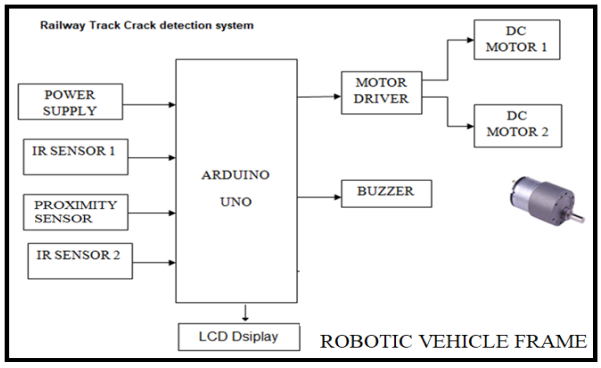

Fig. 2. Block Diagram

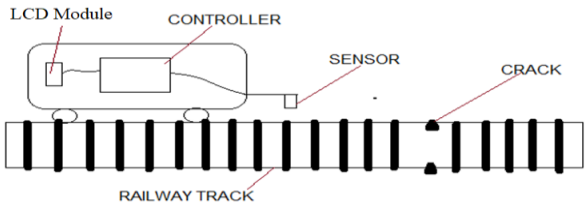

Fig. 3. Experimental Diagram

6. Working Principle

The model has an arduino board that acts as an interface between the infrared sensors, the passive infrared sensors and the LCD screen. The whole system is integrated in a four-wheeled LCD robot/vehicle that travels between the railway

tracks. The robot is programmed to move forward with an infrared sensor attached to the left, right and front lanes to detect obstacles. which detects a road break. Arduino is programmed with Arduino IDE and connected with various devices such as motor driver needed to move our robot forward and backward, LCD display module to send messages to higher authorities, infrared sensor to detect cracks, inches our project has two sets of railway model. installed on both sides of the IR sensor units.

This device is used to activate/deactivate the LCD display module when there are cracks in the track. An IR transmitter and IR receiver circuit are used to detect cracks. It is attached to the front of the vehicle in a suitable arrangement. When the vehicle is turned on, it moves along the model track. IR sensors monitor the condition of the tracks. The engine is in normal mode, the sequential gearbox is in the starting stage. When the microcontroller is powered by battery power, its forward motor and serial transmission are used to send messages to the microcontroller. When the IR sensor detects a crack, the vehicle will stop immediately and the LCD display module will pull the data through the controller and send the data to the control room.

7. Advantage

- Highly efficient and user friendly design.
- Easy to operate.
- Low power consumption.
- To detect the crack using IR obstacle sensors
- LCD display based tracking details.
- To avoid the accidents at a single track.
- Efficient design.

8. Applications

- It used in railway departments to reduce the accidents.

9. Conclusion

The proposed Arduino-based rail detection system can detect rail cracks, including small cracks, automatically without human intervention. The proposed system has many advantages over traditional detection techniques. Advantages include a fast detection and reporting system, lower cost, low energy consumption and shorter analysis time. Also, the easy availability of components and the simplicity of the idea make the proposed system ideal for large-scale implementation with very little initial investment. Therefore, it can work effectively and efficiently in operation. With this proposed structure, we can easily avoid the accidents caused by rail side crack, which will help us save many lives.

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