Implementation Of Railway Crack Detection And Monitoring System

V. Elanangai

Abstract - In this paper problem about a railway analysis is detection of cracks in the structure. Indian railway is the fourth world largest railway network in the world and manual Inspection and detection of cracks on these railways tracks is very tedious process and consumes a lot of time and human resource. A large proportion of derailments and service disruptions are cause by track-related issues. Increases in axle loads, vehicles primary yaw suspension stiffness, wheel-rail iconicity and capacity have resulted in greater damage to the track. This work aims in designing railway track crack detection autonomous vehicle using Microcontroller, ultrasonic Sensors which detects the cracks along its path. Ultrasonic sensor detects the crack and objects and sends this information to the microcontroller and stop the train immediately.

Index Terms – Crack, Detection, Ultrasonic Sensors, Microcontroller, Proteus Software

1 INTRODUCTION

Detection of cracks is the major problem about a railway structure. Indian railway is the fourth world largest railway network in the world and manual Inspection and detection of cracks on these railways tracks is very tedious process and consumes a lot of time and human resource. A large proportion of derailments and service disruptions are Cause by track related issues. Increases in axle loads, vehicles primary yaw suspension stiffness, wheel-rail iconicity and capacity have resulted in greater damage to the track[1]. The aim is to design a detection system for crack in railway track using Microcontroller, ultrasonic Sensors which detects the cracks along its path. Ultrasonic sensor detects the crack and objects and sends this information to the microcontroller and stop the train immediately[2].

The proposed railway track monitoring system will automatically detects the crack in the railway track and obstacle without any human intervention. The ultrasonic sensor senses the object at a distance this is achieved by setting a threshold value for the sensor[3]. Once the object is detected within the distance the microcontroller sends a stop signal to the motor driver. The motor driver is used for driving the 12 volt motor which we consider as the train engine in our project. Once the stop signal is received by the motor driver the motor stops. A buzzer is alarmed whenever the ultrasonic sensor detects crack or any object in the train running path[6]. Whenever the fault or any obstacle is identified by the ultrasonic sensor the transmitter will send the signal to the receiver in the nearest station[7]. The receiver is connected to the display in the station in that it will display the fault and its location. Here the fault is crack in the railway track or any obstacle.

2 OVERALL SYSTEM VIEW

The supply of 12 volt dc is given to this hardware for its operation. By the help of ultrasonic sensor it will identify any crack in the railway track or any obstacle in the railway path. The ultrasonic sensor sense if there is any crack or obstacle present in the railway path it will give error signal to the microcontroller. The program is feed to the PIC microcontroller, according to this program microcontroller will gives the information to the vehicle setup. If the microcontroller receives any error signal from the ultrasonic sensor it will give stop signal to the vehicle setup. At the time buzzer will intimate by sound. After receiving the stop signal the supply given to the motor is stopped. Then the train will stop immediately. The information will send to the nearest station by zigbee transmitter .In the station receiver is connected to the pc or display, the error and its location is shown in the display.

3 PROPOSED DESIGN

The supply is given to the microcontroller for its operation. The programs are feed into the microcontroller according to the program the controller will work. Ultrasonic sensor will monitor the railway track by its ultrasonic waves, the waves are passes before certain distance from the loco unit. In the normal condition the signal sends by the sensor to microcontroller is normal signal or positive signal, in such case the train will run normally. If there is any fault is identified by the sensor here the fault is crack or any obstacle in the railway path. It will sends error signal or negative signal to the microcontroller. After receiving error signal from the controller, the supply is given to the motor driver is stopped. So the train will stop immediately. Once the fault is found buzzer will make alert sound and give indication to the loco pilot. At the same time the information is send to the nearest station through transmitter. In the station receiver section is connected to the pc. In that it will display which type of fault is occurred it will easy to recover the fault. After recovered the fault the device will rested manually by the loco pilot then the train will move. The above mentioned points are all above the circuit explanation of the proposed system which is shown below.

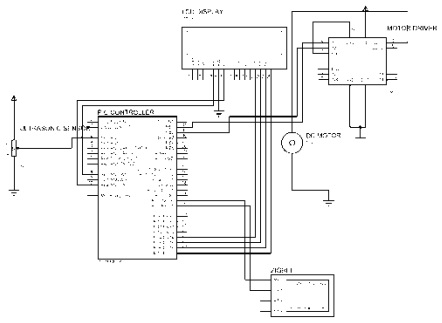

Fig. 1. Circuit Diagram of Proposed System

3.1 Microcontroller

PIC 16F877 is one of the most advanced microcontroller from Microchip. This controller is widely used for experimental and modern applications because of its low price, wide range of applications, high quality, and ease of availability. It is used for controlling motors . The PIC 16F877 features all the components which modern microcontroller normally have. The figure of a PIC 16F877 chip is shown below.

The PIC16FXX series has more advanced and developed features when compared to its previous series. The important features of PIC16F877 series is given below.

3.2 Power Supply

Almost all basic household electronic circuits need an unregulated AC to be converted to constant DC, in order to operate the electronic device. Every device have a power supply limit and the every circuits inside these devices will supply a constant DC voltage within the limit. That is, all the active and passive electronic devices will have a certain DC operating point, and this point must be achieved by the source of DC power. Thus a common requirement for all this phases will be the DC power supply. All low power system can be run with a battery. But, for long time operating devices, batteries could prove to be costly and complicated. The appt method is to use an regulated power supply a combination of a transformer, rectifier and a filter.

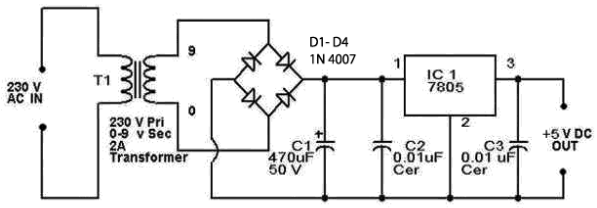

Fig. 2. Circuit Diagram of Power Supply

3.3 Transformer

Electrical power transformer is a static device which transforms electrical energy from one circuit to another without any direct electrical connection and with the help of mutual induction between two windings. It converts power from one circuit to another by not changing the frequency and may be in different voltage level. This is a very short and simple definition of transformer, as we will go through this portion of tutorial related to electrical power transformer.

3.4 Rectifier

It reduces ripple on a direct DC voltage by connecting capacitors in parallel to the load resistance. This method may be suitable for low power applications, but not for applications which need a steady and smooth DC supply.

3.5. Full wave rectifier

Full wave rectifier circuit uses 2 diodes, one for each half of the wave. A multiple winding transformer is used whose secondary winding is split equally into two halves with a common center tapped connection. Here every diode conducts when its anode terminal is positive with respect to the transformer center point C and produces an output during both half-cycles. Full rectifier advantages are flexible compared to that of half wave rectifier.

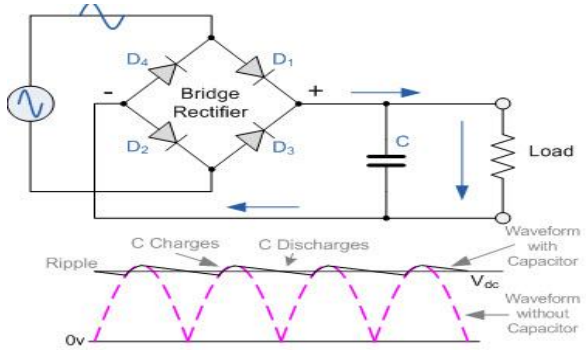

Fig. 3. Circuit Diagram And Waveform Of Full Wave Rectifier With Capacitor

3.6 Regulator

Regulator stabilizes the voltage automatically to a constant level. If the input voltage changes also output voltage will be constant. It may be classified as electromechanical or electronic. It can also be classified as AC regulators or DC regulators.

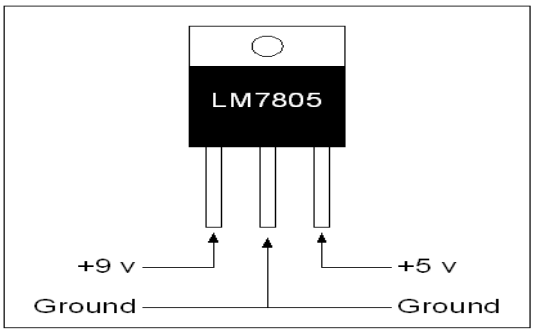

Fig. 4. Regulator

When the input supply voltage Vin increases the output voltage V load also increases. Increase in load voltage causes a reduced voltage of the Vbe as the zener voltage Vzener is constant. This reduction in Vbe causes a decrease in the level of conduction which will further increase the collector-emitter resistance of the transistor and thus causing an increase in the transistor Vce and reduces the output voltage Vout. Thus, the output voltage remains constant. If the input voltage decreases also the operation doesnot change.

The next condition would be the effect of the output load change in regard to the output voltage. Thus input current increases slightly and compensates for the decrease in the load resistance R load.

The output voltage of the series regulator is Vout = Vzener – Vbe. The load current Iload of the circuit will be the maximum emitter current. If the load current is zero or has no value, then the current drawn from the supply can be emitter follower written as Izener + Ic(min). Such an voltage regulator is more efficient than a normal zener regulator. Thus it has a resistor and zener diode . They has to supply the base current of the transistor.

4 SIMULATION RESULTS

4.1 Simulation Circuit In Faulty Condition

The simulation was carried out in proteus software. Railway track monitoring and crack detection. The supply of 5 volt dc is given to this microcontroller for its operation. By the help of ultrasonic sensor it will identify any crack in the railway track or any obstacle in the railway path. The ultrasonic sensor senses the object at a distance this is achieved by setting a threshold value for the sensor. Once the object is detected within the distance the microcontroller sends a stop signal to the motor driver. The program is feed to the pic microcontroller, according to this program microcontroller will gives the information to the vehicle setup. If the microcontroller receives any error signal from the ultrasonic sensor it will give stop signal to the vehicle setup. At the time buzzer will intimate by sound. In the display it will show crack detect. The above mentioned points are all about the simulation circuit and its operation.

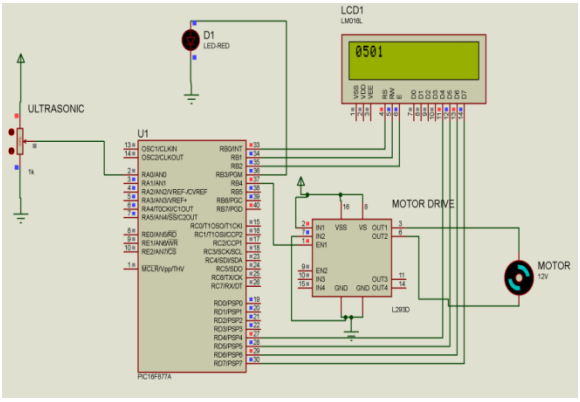

Fig. 5. Simulation Circuit In Faulty Condition

The normal condition the display will show the threshold value above 500, which means it was in normal condition.

4.2. Circuit In Normal Condition

The faulty condition the display will shows the threshold value below 500, which means some fault is occurred.

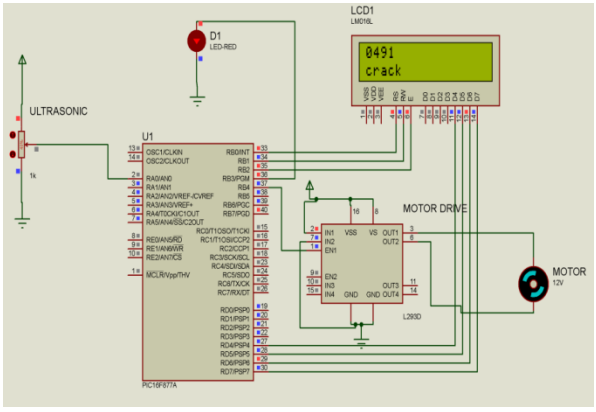

Fig. 6. Simulation Circuit In Normal Condition

5 CONCLUSION

Using this technology we can detect obstacles in front of the train from a longer distance and we can stop the train in time to stop the collision which would prevent accidents and save lives, crack in railway tracks can also be detected which would prevent the train from derailment. All the proposed system

concepts was visualized in hardware form and their outputs were checked.

6 FUTURE ENHANCEMENT

As we have said that this work can be implement in railways department for the safety purpose of the passenger and to avoid the accidents due to rail collision. Here we identify the fault and send information to the nearest station. Along with the information if we add GPRS in this setup means we can find the exact location of the faulty part or obstacle in the railway path.

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Author Details:

V. Elanangai, Research Scholar, Sathyabama Institute of Science and Technology, Chennai – 119, India.

Email: elanangai123@gmail.com