

An Arduino based Method for Detecting Cracks and Obstacles in Railway Tracks

Prof. Shyam Agrawal¹, Pritam Bharane², Danish Khan², Sneha Fundkar², Sapna More², Akshay Khande², Sarika Ghait², Shrikant Vairale²

¹Assistant Professor, Department of Electrical Engineering, Siddhivinayak Technical Campus Shegaon, Maharashtra, India

²Student, Department of Electrical Engineering, Siddhivinayak Technical Campus, Shegaon, Maharashtra, India

ABSTRACT

Indian railways is the fourth largest railway community inside the international. despite the fact that there may be a outstanding boom in Indian railways, this machine remains plagued via some of issues which require immediately interest. on this paper we are thinking about the important problems that lead to injuries. primary issues encompass obstacles access on to the music and cracks at the tracks. to conquer this have proposed a checking out educate which uses ultrasonic sensor with a range of 100cms and put off is 30 cm. primarily based on the gap among impediment and the train, the train slows down. while the train is at a distance of 20cm we growth the delay so that you can sluggish down the educate and subsequently while it reaches to a distance of 15cm the teach automatically stops at some point of summer and iciness seasons the tracks may additionally expand and contract due to which cracks may additionally arise. the led and photodiode setup is located to trying out educate to hit upon cracks. here we're using arduino microcontroller. after crack detection the testing teach stops and the longitudinal and latitudinal positions are sent thru SMS to GSM and GPS.

Keywords: GPS Module, GSM Modem, IR Sensor, PIR Sensor, Ultrasonic Distance Meter.

I. INTRODUCTION

In these days world, shipping, being one in all the largest drainers of strength, its sustainability and safety are issues of paramount importance. in india, rail transport occupies a outstanding function in quenching the ever burge owing needs of a hastily growing financial system. however, in terms of the reliability and safety parameters, international standards have now not yet been virtually reached. even though rail delivery in india is growing at a fast tempo, the related safety infrastructure facilities have no longer saved up with the cited proliferation. the major hassle is the shortage of green and cost powerful technology to locate issues inside the rail tracks and the dearth of proper preservation.



Figure 1. Cracks in Railway tracks

Figure 1 indicates the cracks going on in railway tracks due to expansion and contraction. the right operation and renovation of shipping infrastructure has a top notch impact at the economic system. in this paper we've proposed a proto type of checking out teach for detecting barriers and cracks, that's just like

that of line following checking out educate. the trying out educate, gets records from surrounding area through set up sensors on the trying out train. the sensors used for obstacle detection are bump sensor, infrared sensor and ultrasonic sensor. the ultrasonic sensor may be very compact and has a totally excessive performance. the testing train uses ultrasonic sensors with microcontroller for its movements. ultrasonic sensor is maximum appropriate for obstacle detection because of its excessive ranging capability and occasional price[1]. it is connected to the the front part of the trying out train. whenever the checking out automobile is going on the desired direction the ultrasonic sensor transmits the ultrasonic waves constantly from its sensor head. on every occasion an obstacle comes ahead of it, the ultrasonic waves are reflected lower back from an item and that facts is passed to the microcontroller. the microcontroller controls the automobiles left, right, returned, front, based totally on ultrasonic indicators. as a way to control the rate of each motor, pulse width modulation is used (pwm) [10]. the basic components utilized in crack detection are ir led and photodiode. on this layout, the ir led and photodiode can be attached to the same facet of the tune to suggest the situation of the song. if any default is located it's going to ship the records to the nearby station. the proposed trying out educate is cost powerful, power intake is low and evaluation time is much less [2]. with this proposed machine the exact vicinity of the faulty rail sound may be easily placed, so that many lives can be saved. objectives of the paper

- ✓ to detect the cracks present on the railway tracks.
- ✓ to detect the obstacles entry on to the railway tracks.

II. IMPLEMENTATION

A. Block diagram

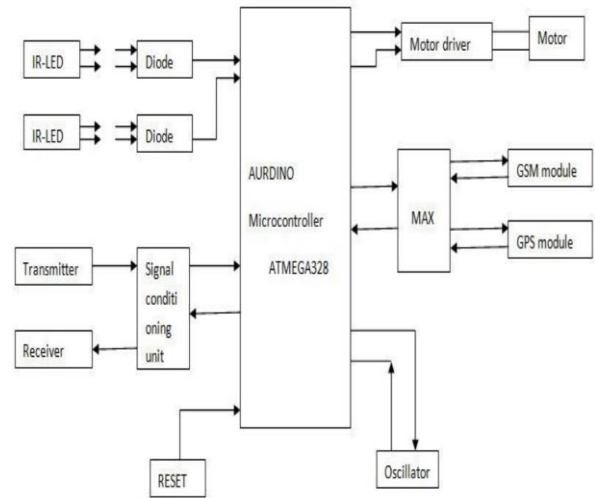


Figure 2. Block diagram

Figure 2 represents the block diagram description of the trying out automobile. the trying out automobile consists of four vehicles pushed by using a motor driving force [1]. the IR led, photodiode and ultrasonic sensor which is related to the arduino which in turn linked to motor driver runs and stops the motor. when the music is in non-stop with none cracks then output of ir led and photodiode may be high. while this output is excessive then ultrasonic sensor sends a cause pulse. this ultrasonic sensor constantly offers pulses till echo is obtained i.e., the teach stops progressively when the echo is acquired. the time this is received from the echo thru PWM counter is transformed into centimetres. the vehicle stops based totally on the duration that we've given. as an instance if the duration is less than 15 and greater than 10 then we set a delay of 20secs and while the automobile is at a period much less than 10 and greater five then we a set of approximately 100secs. if the period exceeds above 5cm then the automobile forestall routinely. those three conditions will be satisfied simplest when the item is present in its path in a stand nonetheless mode. the other situation is whilst there may be crack, then output of ir led and photodiode will be low and educate stops

robotically and a message is generated the usage of GSM and GPS and might be sent to the nearby station. by way of the usage of GPS we are able to determine range and longitudinal places. by means of this we are able to show the info of the location to the driving force through liquid crystal display show.

B. ARDUINO UNO MICROCONTROLLER

The arduino uno is a microcontroller board primarily based on the atmega328.arduino is an open-source electronics prototyping platform and it's miles supposed for designing, developing interactive gadgets or environments [3].arduino forums are noticeably inexpensive in comparison to different microcontroller systems. a simple arduinouno board has been proven in Figure 3

Technical Specification

1. move-platform the arduino software runs on windows, macintoshosx, and linux operating structures.
2. easy, clean programming surroundings the arduino programming surroundings is straightforward-to-use for novices and flexible enough for the superior customers.
3. source and extensible software program the arduino software program is posted as open supply open equipment, to be had for extension by experienced programmers. the language may be expanded through c++ libraries.
4. open source and extensible hardware

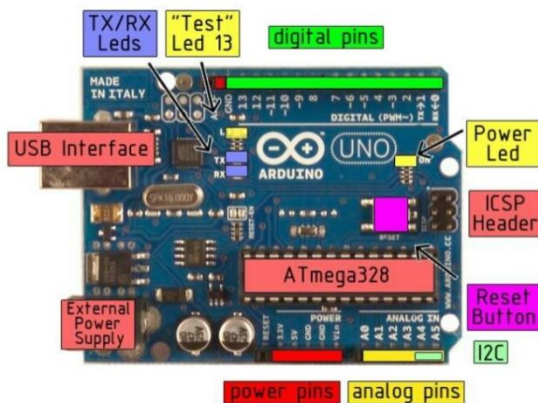


Figure 3. Basic Arduino UNO board

C. ULTRASONIC SENSOR

The arduino ultrasonic variety detection sensor with arduino calculates distance from gadgets. the output of an led alters with PWM according to how near an object is to the sensor. so closer the object the brighter the led [5]. this sensor works with the aid of sending an ultrasound pulse at around forty khz. it then receives the echo again and calculates the time taken in μsec . we are able to trigger a pulse as rapid as 20 instances a second and it is able to determine objects up to a few meters away and as near as 3cm. it desires a 5v strength deliver to run. arduino may be delivered to ultrasonic variety detection sensor the use of most effective 4 pins energy, ground, cause and echo. because it wishes 5v and arduino gives 5v, we will use this to electricity it. there are 2 units of five pins, 1 set we are able to use, the opposite is for programming the percent chip. supply module with 5v, the output could be 5v at the same time as impediment in variety, or 0v if not. the out pin of this module is used as a switching output when anti-robbery module [4].



Figure 4. Ultrasonic sensor

Specifications

- Working Voltage: 5V (DC)
- Working Current: max 15 ma
- Operating frequency: 40HZ
- Output Signal: 0-5V (Output high when obstacle in range)
- Sentry Angle: max 15 degree
- Sentry Distance : 2cm - 500cm

High-accuracy: 0.3cm

Input trigger signal: 10us TTL impulse

Echo signal: output TTL PWL signal

Size: 45*20*15mm

MODULE RUNNING PRINCIPLE

1. Adopt io trigger through presenting at the least 10 μ s sequence of high level sign,

2. The module routinely sends eight 40 khz rectangular wave and routinely detect whether receive the

Returning pulse sign,

3. If there are signals returning via outputting excessive level and the time of high level continuing is the time of that from the ultrasonic transmitting to receiving. check distance = (excessive level time * sound velocity (340m/s) / 2.

D. WORLDWIDE GADGET FOR CELL (GSM)

A GSM modem is dedicated modem with a serial, USB, Bluetooth connection, or it may be cellular telephone that presents GSM modem skills. a GSM modem exposes an interface that permits software which includes now SMS to ship and receive message over the modem interface. the cell operated expenses for this message acquire and sending as though it was carried out without delay on a cellular telephone. to perform this assignment, a GSM modem need to assist an "prolonged at command set" for sending/receiving SMS messages [6]. a GSM modem is specialised type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, similar to a mobile Smartphone [7]. from the cellular operator angle, a GSM modem seems just like a mobile Cellphone. GSM modem comes with various interfaces, consisting of pcmcia kind 2USB, and serial. GSM modem is wi-fi, even as dial-up modem is stressed. a few GSM modems additionally has GPRS characteristic that allows transmission of information over TCP/IP .to transmit records the use of GSM modem, there are various methods can be used, inclusive OF SMS,CSD,GPRS/UMTS despite the fact that a normal cellular telephone can be used as GSM modem, it is relatively encouraged that a unique industrial grade

terminal for use as a GSM modem due to stability, and reliability [8]. requirements are

- ✓ SMS gateway this is to send and get hold of SMS
- ✓ telemetric this is to collect data from remote terminals
- ✓ call-lower back service for voip
- ✓ SMS utility, SMS solution, or SMS programme.
- ✓ automated reloading of pre-paid account with stkapi device to gadget conversation
- ✓ sending SMS from laptop
- ✓ automating business process
- ✓ vehicle monitoring with cellular broadcast feature or with incorporated GPS terminal.

Key Features

- ✓ GSM model
- ✓ dual band GSM 900/1800 mhz
- ✓ 160 characters SMS
- ✓ highly reliable for 24x7 operation with matched antenna
- ✓ status of modem indicated by led
- ✓ simple to use & low cost

Technical Specifications

Microcontroller : Atmega328

Operating Voltage : 5v

Input Voltage (Recommended) : 7-12v

Digital I/O Pins 14 :Pwmo/P

Analog Input Pins : 6

Dc Current Per I/O Pin : 40 Ma

Dc Current For 3.3v Pin : 50 Ma

Flash Memory :32 Kb

Sram : 2 Kb

EPROM : 1 Kb

Clock Speed : 16 Mhz

F. GEARED DC MOTOR

the dc motor works over a fair range of voltage. the higher the input voltage more is the rpm of the motor.in terms of voltage, we can write the equation as

rpm= k1 * v, where,

k1= induced voltage constant

v=voltage applied gears are used to growth the torque of dc motor on the rate of its pace. the tools mechanism works on the principle of conservation of angular momentum. the gear having smaller radius will cowl extra rpm than the only with larger radius. but, the bigger equipment will give greater torque to the smaller tools than vice versa. the assessment of angular pace among input gear (the only that transfers energy) to output equipment gives the gear ratio. while multiple gears are linked together, conservation of power is also followed.

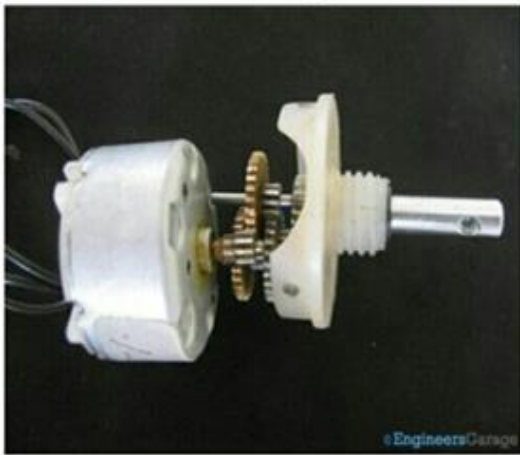


Figure 5. Gear mechanism to dc motor

G. PUSH-PULL FOUR CHANNEL DRIVER

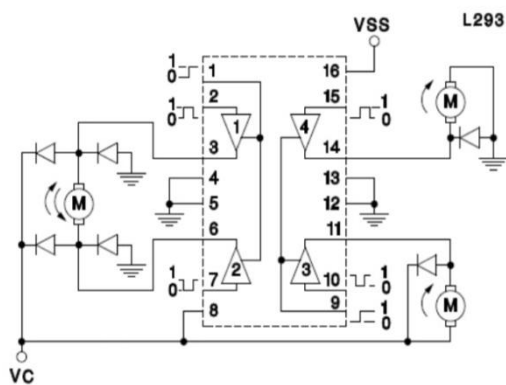


Figure 6. Block diagram of load driver L293

Each channel is managed by means of a ttl-well matched common sense enter and each pair of drivers (a the l293 and l293d are quad push-pull drivers able to turning in full bridge) is ready with an inhibit enter which turns off all 4 transistors. output contemporary is 1a or 600ma in step with channel respectively. a separate deliver enter is furnished for

the common sense in order that it is able to be run off a decrease voltage to lessen dissipation. additionally the l293d consists of the output clamping diodes in the ic for entire interfacing with inductive masses. each devices is available in 16-pin batwing dip programs. they're additionally to be had in power s0ic and hermetic DIL programs.

Features

- ✓ output current 1a per channel (600ma for l293d)
- ✓ peak output current 2a per channel (1.2a for l293d)
- ✓ inhibit facility
- ✓ high noise immunity
- ✓ separate logic supply
- ✓ over-temperature protection

H. MOTOR DRIVER

motor driver ics are ordinarily utilized in self sustaining robotics best. also maximum microprocessors function at low voltages and require a small quantity of current to operate even as the cars require a relatively higher voltages and current. as a consequence modern can not be furnished to the cars from the microprocessor. that is the primary want for the motor driver ic. while the motor is implemented superb voltage on both sides then the voltage from both the perimeters brings the motor shaft to a halt. depending upon the values of the input and enable the vehicles will rotate in both clockwise or anticlockwise direction with complete velocity (when enable is excessive) or with much less velocity (when allow is supplied with pwm). Let us count on for left motor whilst enable is excessive and enter 1 and enter 2 are high and coffee respectively then the motor will pass in clockwise route. so the behaviour of the motor depending at the input situations are shown in table 1

Table 1

Input 1	Input 2	Enable 1,2	Result
0	0	1	Stop
0	1	1	Anti-clockwise rotation
1	0	1	Clockwise rotation
1	1	1	Stop
0	1	50% duty cycle	Anti-clockwise rotation with half speed
1	0	50% duty cycle	Clockwise rotation with half speed

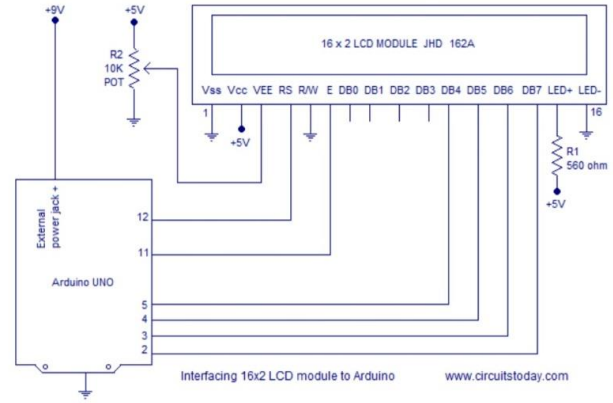


Figure 8. Circuit diagram

Circuit Diagram

The circuit diagram of interfacing LCD to arduino for displaying a text message is shown in Figure 8. RS pin of the LCD module is hooked up to digital pin 12 of the arduino. r/w pin of the LCD is grounded. enable pin of the LCD module is attached to digital pin eleven of the arduino. the LCD module and arduino are interfaced in the 4-bit mode. that means simplest four of the digital enter lines (db4 to db7 of the liquid crystal display are used). this method is quite simple, requires much less connections and you can nearly make use of the whole potential of the liquid crystal display module. digital lines db4, db5, db6 and db7 are interfaced to virtual pins 5, 4, three and a pair of of the arduino. the 10k potentiometer is used for adjusting the comparison of the display. 560 ohm resistor r1 limits the current via the again mild led. the arduino may be powered thru the external electricity jack furnished on the board. +5v required in a few different components of the circuit can be tapped from the 5v source on the arduino board. the arduino can be also powered from the pc thru the USB port.

III. CONCLUSION

on this paper we've got designed a cost effective, low-energy embedded system, which facilitate better protection standards for rail tracks for stopping railway injuries because of cracks and barriers on railway tracks. The prototype of checking out vehicle can efficaciously hit upon cracks and limitations on railway tracks. the result shows that this new modern technology will increase the reliability of protection systems in railway shipping. by enforcing those features in real time application, we will keep away from injuries as much as about 70%.

IV. REFERENCES

- [1]. Akhil N, Dinu Mohan , Fayis P, SijaGopinath "Railway Crack Detection System" International Research Journal of Engineering And Technology (IRJET), Volume: 03, Issue: 05 ,May-2016, ISSN: 2395-0072.
- [2]. S. Ramesh "Detection of Cracks and Railway Collision Avoidance System", International Journal of Electronic and Electrical Engineering ISSN 0974 - 2174 Volume 4, Number 3, 2011.
- [3]. Dr.B.Paulchamy, T.Sivamani, S.Viswanathan, R.Sugumaran, M.Ramadoss, S.Sakthivel "Automated Visual Inspection of Detecting Cracks and Obstacles on Rail Road Track Using Robot and Automatic Gate Control" International Journal of Innovative Research in Technology & Science (IJIRTS), ISSN: 2321-1156.

- [4]. Prof.P.Navaraja "crack detection system for railway track by using ultrasonic and PIR sensor", International Journal of Advanced Information And Communication Technology IJAICT Volume -1, Issue-1, May 2014, ISSN 2348 –9928,
- [5]. Mr.Prashanth.addagatla , Mr.G.Koteswar Rao "a modern method for detecting cracks in railway tracks by the efficient utilization of LDR and LED system" International Journal of Engineering Science Invention ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726.
- [6]. Parag Nikhar, Rakesh Pise, AvinashShelar "IR Sensor Based Crack Detection of Railway Track Using GSM & GPS System" International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 5 Issue 3, March 2017, ISSN: 2321-9653
- [7]. Pravinram R, Prasath R, Nanda Gopal R, Hari babuS,"Railway Track Crack Detecting Robot using IR and GSM" International Journal for Scientific Research & Development| Volume. 4, Issue 02, 2016 | ISSN (online): 2321-0613.
- [8]. F.-S. BAI Y.-L. LIU, "Design of Fault Monitoring Alarm System for Networks Based on GSM SMS," pp. 45-67, 2010.
- [9]. A.R.Ali, E. Imran Zualkernan, and FadiAloul, "A Mobile GPRS-Sensors Array for Air Pollution Monitoring," vol. 8, pp. 415-422, 2010.
- [10]. Ravi Shankar Shekhar, PurushottamShekhar, Ganesan P, "Automatic Detection of Squats in Railway Track", IEEE Sponsored 2nd International Conference on Innovations in Information Embedded and Communication Systems. Volume. 3, Issue. 6, page. 413-413 December 2015.