ADVANCED RAILWAY TRACK FAULT DETECTION SYSTEM WITH REMOTE STATION MESSAGING SYSTEM USING GSM COMMUNICATION

Mr. Mohammed Shoeb[*1], Mr. Md Burhanuddin Awais[*2],

Mr. Md Abdul Gafoor[*3], Dr. Ravinder Korani[*4],

[*1, 2, 3] **B. Tech. Student Dept. of ECE, Shadan College of Engineering and Technology**

[*4] **Professor, Dept. of ECE, Shadan College of Engineering and Technology**

mr.shoebkhan26@gmail.com[*1], awaisburhan2402@gmail.com[*2], ghafoormohammed264@gmail.com*[3],

koranishadan@gmail.com[*4],

Abstract: The Transportation of train always depends on railway tracks (rails) only. If there is a crack in these rails, it creates a major problem. Most of the accidents in the train are caused due to cracks in the railway tracks, which cannot be easily identified. Also it takes more time to rectify this problem. In order to avoid this problem, we are using the crack detector robot, which detects the crack in the rails and gives an alarm. A robot is an apparently human automation, intelligent and obedient but impersonal machine. It is relatively, that robots have started to employ a degree of Artificial Intelligence (AI) in their work and many robots required human operators, or precise guidance throughout their missions. Slowly, robots are becoming more and more autonomous.

INTRODUCTION

An embedded system is a special purpose computer system that is designed to perform very small sets of designated activities. Embedded systems date back as early as the late 1960s where they used to control electromechanical telephone switches. The first recognizable embedded system was the Apollo Guidance Computer developed by Charles Draper and his team. Later they found their way into the military, medical sciences and the aerospace and automobile industries.

Today they are widely used to serve various purposes like:

➢ Network equipment such as firewall, router, switch, and so on.
➢ Consumer equipment such as MP3 players, cell phones, PDAs, digital cameras, camcorders, home entertainment systems and so on.
➢ Household appliances such as microwaves, washing machines, televisions and so on.
➢ Mission-critical systems such as satellites and flight control.
  The key factors that differentiate an embedded system from a desktop computer:
➢ They are cost sensitive.
➢ Most embedded systems have real time constraints.

➢ There are multitudes of CPU architectures such as ARM, MIPS, PowerPC that are used in embedded systems. Application-specific processors are employed in embedded systems.

➢ Embedded Systems have and require very few resources in terms of ROM or other I/O devices as compared to a desktop computer.

Existing System:

The finding of cracks in railways tracks takes time consumption due to manual checking. It reduces the accuracy too. This method of design is having limited intelligence.

Proposed System:

This system involves the design of crack finding robot for finding cracks in railway tracks. This system uses controller for interfacing the robotic vehicle and crack detection sensor. The sensing device senses the voltage variations from the crack sensor and then it gives the signal to the microcontroller. The microcontroller checks the voltage variations between measured value and threshold value and controls the robot according to it.

The robotic model is interfaced with the microcontroller with the help of motor driver IC. If any crack occurs in the rail, the robot will be stopped and then an alarm will be raised.

This project uses regulated 5V, 750mA power supply. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac out put of secondary of 230/18V step down transformer.

Block Diagram:
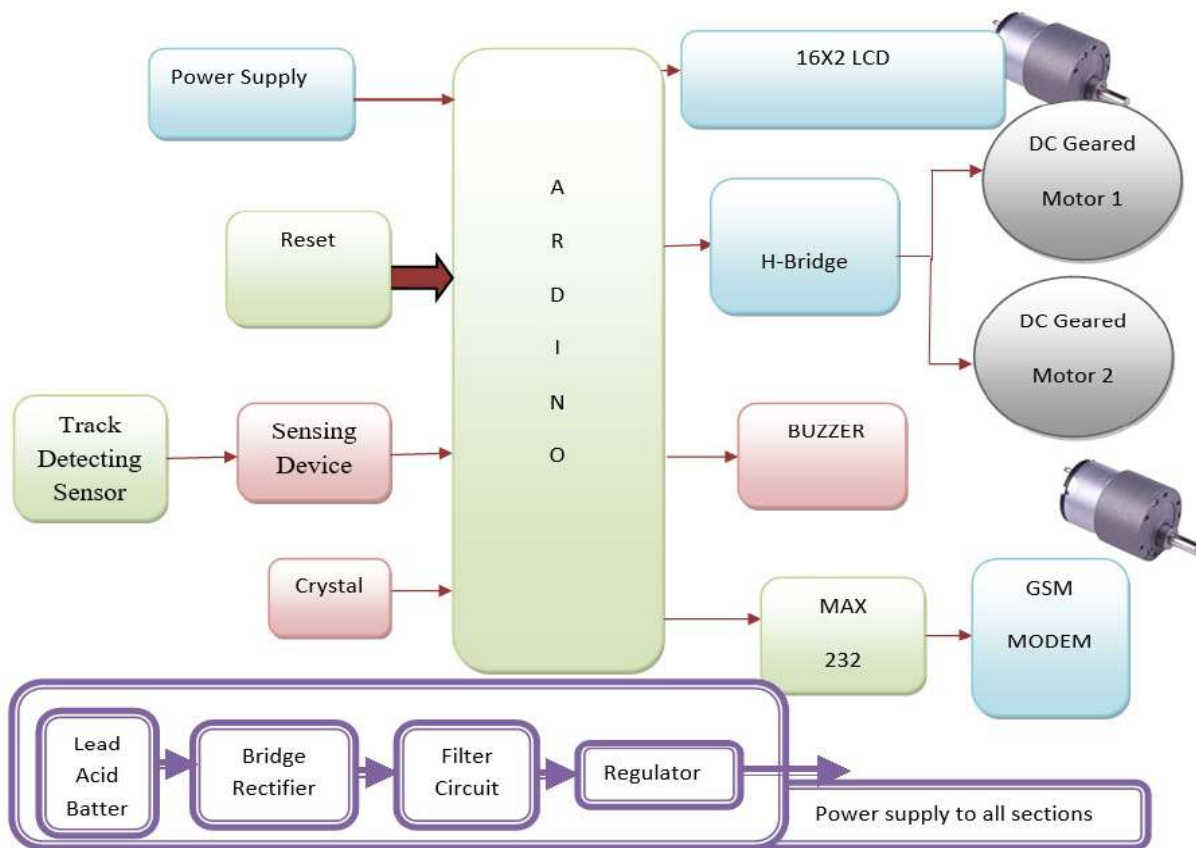
ARDUINO
Overview:

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. The Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode.

The board has the following new features:

1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible with both the board that uses the AVR, which operates with 5V and with the Arduino Due that operates with 3.3V. The second one is a not connected pin, that is reserved for future purposes.

- Stronger RESET circuit.
- Atmega 16U2 replace the 8U2.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

GSM
(GLOBAL SYSTEM FOR MOBILE COMMUNICATION)

GSM (GLOBAL SYSTEM FOR MOBILE COMMUNICATION) is the most popular standard for mobile telephony systems in the world. The GSM Association, its promoting industry trade organization of mobile phone carriers and manufacturers, estimates that 80% of the global mobile market uses the standard. GSM is used by over 1.5 billion people across more than 212 countries and territories. This ubiquity means that subscribers can use their phones throughout the world, enabled by international roaming arrangements between mobile network operators. GSM differs from its predecessor technologies in that both signaling and speech channels are digital, and thus GSM is considered a second generation (2G) mobile phone system. This also facilitates the wide-spread implementation of data communication applications into the system.

The GSM standard has been an advantage to both consumers, who may benefit from the ability to roam and switch carriers without replacing phones, and also to network operators, who can choose equipment from many

GSM equipment vendors. GSM also pioneered low-cost implementation of the short message service (SMS), also called text messaging, which has since been supported on other mobile phone standards as well. The standard includes a worldwide emergency telephone number feature (112).

Newer versions of the standard were backward-compatible with the original GSM system. For example, Release '97 of the standard added packet data capabilities by means of General Packet Radio Service (GPRS). Release '99 introduced higher speed data transmission using Enhanced Data Rates for GSM Evolution (EDGE).

G.P.S

History

The Global Positioning System (GPS) is a Global Navigation Satellite System (GNSS) developed by the United States Department of Defense. It is the only fully functional GNSS in the world. It uses a constellation of between 24 and 32 Medium Earth Orbit satellites that transmit precise microwave signals, which enable GPS receivers to determine their current location, the time, and their velocity. Its official name is NAVSTAR GPS. Although NAVSTAR is not an acronym, a few backronyms have been created for it. The GPS satellite constellation is managed by the United States Air Force 50th Space Wing. GPS is often used by civilians as a navigation system.

The GPS is made up of three parts: satellites orbiting the Earth; control and monitoring stations on Earth; and the GPS receivers owned by users. GPS satellites broadcast signals from space that are picked up and identified by GPS receivers. Each GPS receiver then provides three-dimensional location (latitude, longitude, and altitude) plus the time.

LIQUID CRYSTAL DISPLAY

LCD screen:

LCD screen consists of two lines with 16 characters each. Each character consists of 5x7 dot matrix. Contrast on display depends on the power supply voltage and whether messages are displayed in one or two lines. For that reason, variable voltage 0-Vdd is applied on pin marked as Vee. Trimmer potentiometer is usually used for that purpose. Some versions of displays have built in backlight (blue or green diodes). When used during operating, a resistor for current limitation should be used (like with any LE diode).
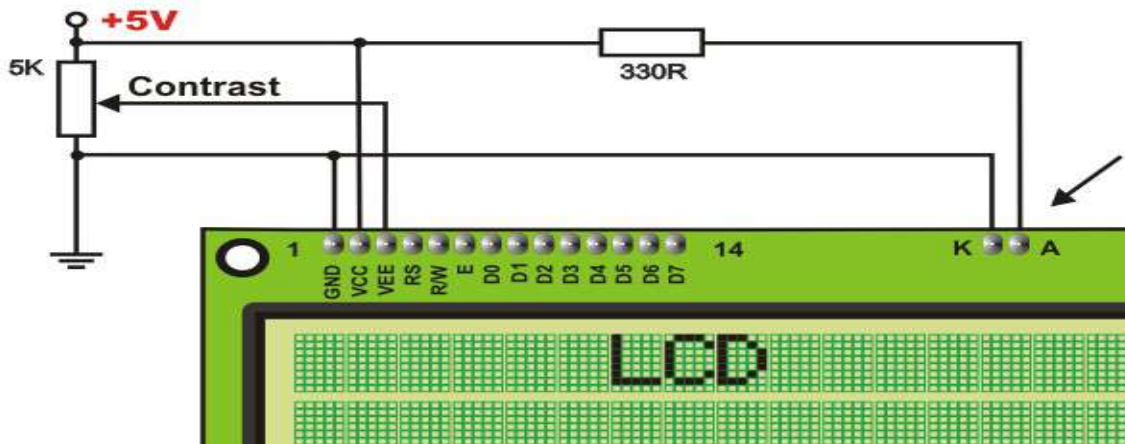
DC MOTOR

WORKING PRINCIPLE OF A DC MOTOR

A DC motor is an electric motor that runs on DC electricity. It works on the principle of electromagnetism. A current carrying conductor when placed in an external magnetic field will experience a force proportional to the current in the conductor.

OPERATION OF A DC MOTOR

There are two magnetic fields produced in the motor. One magnetic field is produced by the permanent magnets and the other magnetic field is produced by the electrical current flowing in the motor windings. These two fields result in a torque which tends to rotate the rotor. As the rotor turns, the current in the windings is commutated to produce a continuous

Torque output this makes the motor to run.
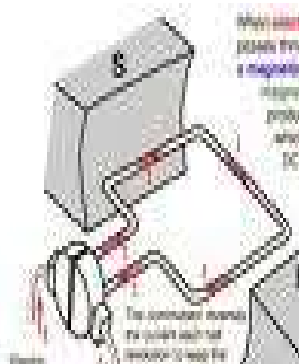
IR SENSOR

IR the same principle in ALL Infra-Red proximity sensors. The basic idea is to send infra red light through IR-LEDs, which is then reflected by any object in front of the sensor.

Then all you have to do is to pick-up the reflected IR light. **For detecting the reflected IR light, we are going to use a very original technique: we are going to use another IR-LED,** to detect the IR light that was emitted from another led of the exact same type. This is an electrical property of Light Emitting Diodes (LEDs) which is the fact that a led produce a voltage difference across its leads when it is subjected to light. As if it was a photo-cell, but with much lower output current. In other words, the voltage generated by the leds can't be - in any way - used to generate electrical power from light, It can barely be detected. that's why as you will notice in the schematic, we are going to use a Op-Amp (operational Amplifier) to accurately detect very small voltage changes.

LOW RANGE, ALWAYS ON IR PROXIMITY SENSOR
DESIGNED BY IBRAHIM KAMAL - IKA@IKALOGIC.COM
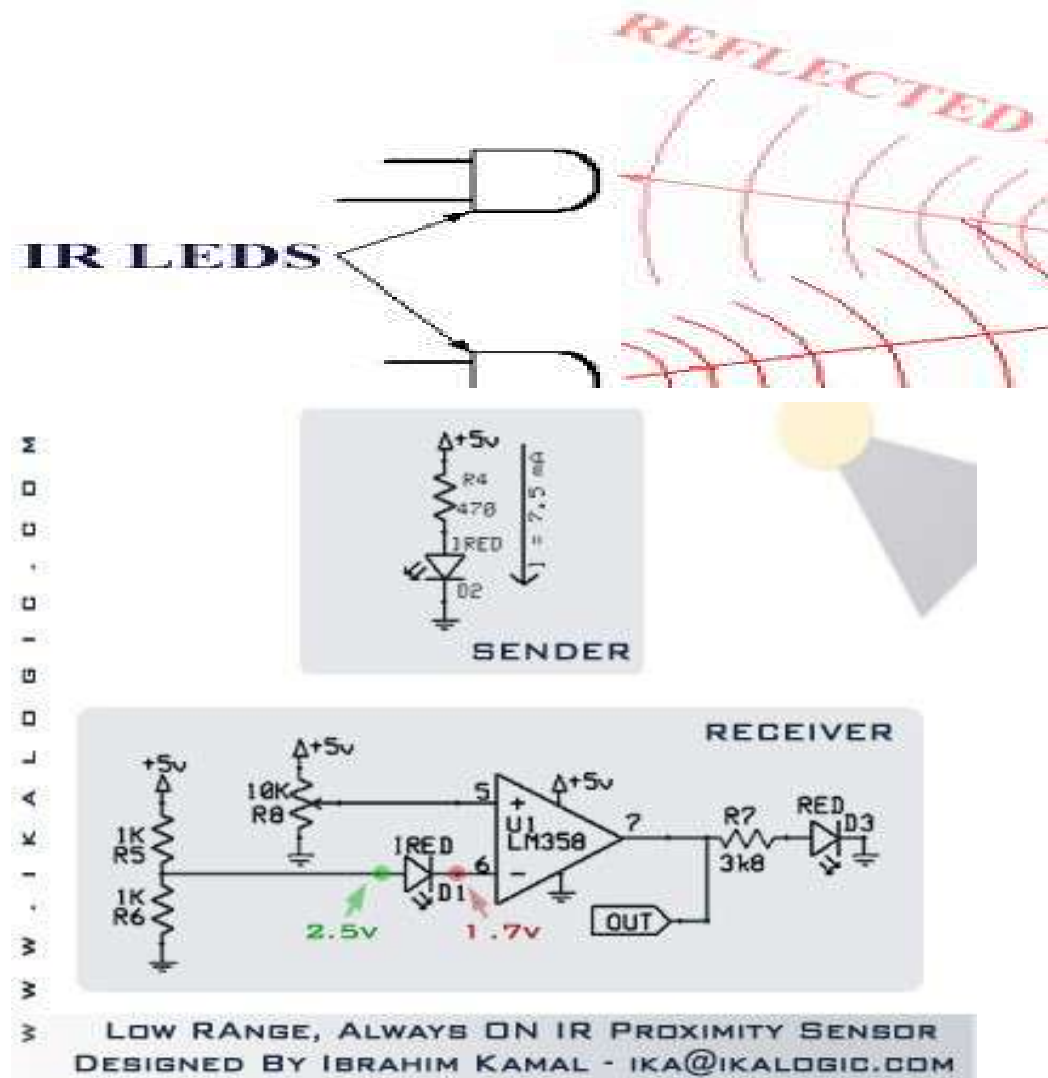
The sender is composed of an IR LED (D2) in series with a 470 Ohm resistor, yielding a forward current of 7.5mA. **The receiver** part is more complicated, the 2 resistors R5 and R6 form a voltage divider which provides 2.5V at the anode of the IR LED (here, this led will be used as a sensor). When IR light falls on the LED (D1), the voltage drop increases, the cathode's voltage of D1 may go as low as 1.4V or more, depending on the light intensity. This voltage drop can be detected using an Op-Amp (operational Amplifier **LM358**).

You will have to adjust the variable resistor (POT.) R8 so the the voltage at the positive input of the Op-Amp (pin No. 5) would be somewhere near 1.6 Volt. if you understand the functioning of Op-Amps, you will notice that the output will go High when the volt at the cathode of D1 drops under 1.6. So the output will be High when IR light is detected, which is the purpose of the receiver.

If the +ve input's voltage is higher than the -ve input's voltage, the output goes High (5v, given the supply voltage in the schematic), otherwise, if the +ve input's voltage is lower than the -ve input's voltage, then the output of the Op-Amp goes to Low (0V). It doesn't matter how big is the difference between the **+ve** and **-ve** inputs, even a 0.0001 volts difference will be detected, and the the output will swing to 0v or 5v according to which input has a higher voltage.

SOFTWARE DESCRIPTION

Arduino IDE compiler:

Arduino is an open-deliver electronics platform based mostly on smooth-to-use hardware and software utility. Arduino boards can observe inputs - slight on a sensor, a finger on a button, or a Twitter message - and flip it into an output - activating a motor, turning on an LED, publishing a few components online. You could tell your board what to do by sending a hard and fast of commands to the microcontroller at the board. To do so that you use the Arduino programming language (based totally mostly on Wiring), and the Arduino software (IDE), based on Processing.

Over the years Arduino has been the brain of lots of obligations, from regular gadgets to complex medical gadgets. A worldwide community of makers - college students, hobbyists, artists, programmers, and specialists - has collected spherical this open-deliver platform, their contributions have brought as much as a terrific amount of available know-how that can be of terrific assist to novices and experts alike.

Arduino has become born on the Ivrea interaction format Institute as a clean tool for instant prototyping, geared towards university college students without a historic past in electronics and programming. As quickly as it reached a miles wider community, the Arduino board started converting to conform to new dreams and traumatic situations, differentiating its provide from smooth eight-bit boards to merchandise for IoT

Programs, wearable, three-d printing, and embedded environments. All Arduino boards are without a doubt open-deliver, empowering clients to assemble them independently and ultimately adapt them to their unique dreams. The software program, too, is open-supply, and its miles growing thru the contributions of customers globally.

The advantages of the Arduino IDE utility are

1.   much less steeply-priced

2.   The clean smooth programming surroundings

3.   Extensible software program application utility and hardware

CONCLUSION

In order to improve the safety for transportation in railways this robot will help efficiently, which facilitates better safety standards of railway tracks for reducing rail accidents due to unrelieved cracks and obstacle on railway tracks. This robot is designed not only to detect cracks and objects but to work efficiently and accurately which leads to reduce the time and provides better results. this robot will help to find out the cracks and objects and the information of detection will be forwarded to the authority mobile numbers quickly By using GPS it will get the exact location of the crack or object and sends the message using GSM, and the buzzer will produce a beep sound whenever the crack or object detected. So by implementing this robotic vehicle will avoid accidents to a great extent and can save many human lives.

FUTURE WORKS

Further improvement can be done by making use of advanced sensors, SIM, microcontrollers to make it full proof.

REFERENCES

[1] Henrique Oliveira Member, IEEE, and Paulo Lobato Correia, Senior Member, IEEE "Automatic Road Crack Detection and Characterization", IEEE TRANSACTION ON INTELLIGENT TRANSPORTATION SYSTEM, VOL.14, NO. 1, MARCH 2013.

[2] Lad, P., & Pawar, M.(2016) " Evolution of Railway track crack Detection system" 2016 2nd IEEE International Symposium on Robotics and Manufacturing Automation (ROMA). doi:10.1109/roma.2016.7847816.

[3] Rijoy Paul, Nima Varghese, Unni Menon, Shyam Krishna, "Railway Track Crack Detection Rijoy", International Journal of Advanced Research and Development, Volume3, Issue3(2018).

[4] Rizvi Aliza raza, Khan Pervez Rauf, Ahmad shafeeq, "Crack Detection Railway Track Using Image Processing", International Journal of Advanced Research, Ideas and Innovations in Technology, volume3, Issue4 (2017).www.ijariit.com.

[5] Anand S. Muley, Siddhant B. Patil2, Prof. A.H.Shelar, "Railway Track Crack Detection based on GSM Technique", International research journal of engineering and technology (IRJET), Volume: 04 Issue: 01/jan-2017.

[6] Rizvi, P. Khan and D. Ahmad, "Crack Detection In Railway Track Using Image Processing", International Journal of Advance Research, Ideas and Innovations in Technology., vol. 3, no. 4, 2017. [6] MAX232x EIA-232 Drivers / Receivers. SLLS047M– February 1989 – Revised November 2014 http://www.ti.com/lit/ds/symlink/max232.pdf

[7] MAX232 datasheet. http://www. Engineersgarage.com/electronic- components/max232- datasheet.