

Energy Efficient Railway Track Monitoring System Using Arduino

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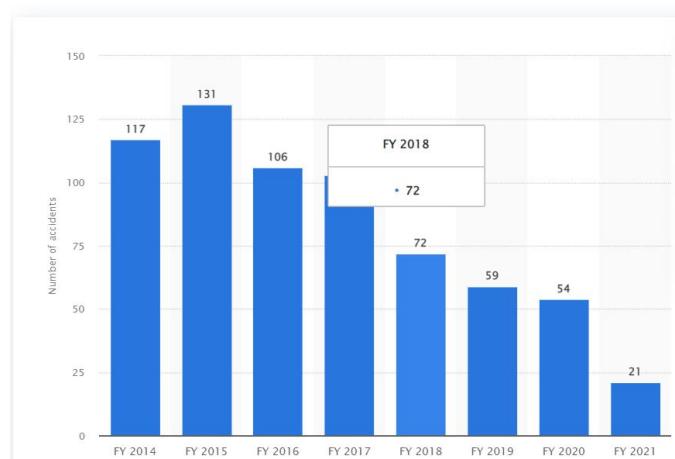
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Abstract: We construct this project with Arduino Microcontroller that takes core of data transmission turbulence transducer to the engine control room, Zigbee, GPS, GSM module, Transmitter, Receiver and Turbulence Sensor is used for energy efficient instead of IR and Ultrasonic Sensor. This project potentially compromises the physical requirement of Gunn man for constant safety check also saves the time and money for identification of crack. This project also ensures, not only safety of humans but also life of animals.

Keywords: Railway Track Monitoring

I. INTRODUCTION

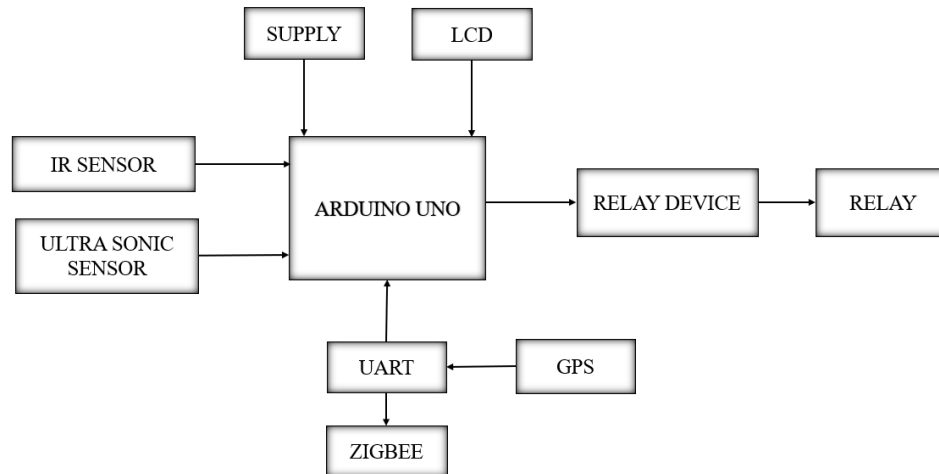
Railway transportation service is the cheap and the major convenient mode of passenger transport and also for long distance and suburban traffic. This project potentially compromises the physical requirement of Gunn man for constant safety check, also saves the time and capital for identification of any disruption. This project also ensures, not only the safety of humans but also the life of animals. The main aim of project is to design the railway crack detection using IR sensor and object using Shock sensor. In previously existing system, the work is to be done manually, but the proposed system has a robot which will run along with the train. The primary cause is identified as cracks in rail track, unidentified objects, motive wrecking, natural destructions causing derailment.



II. METHODOLOGY

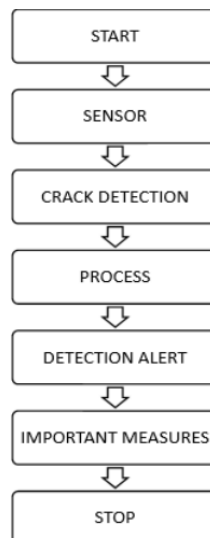
The project is aimed to design crack design system using Ultra sonic and IR sensor. The block diagram shown below, which includes Microcontroller(Arduino), Ultra sonic sensor, Motor driver, Motor, GPS Module, when crack is detected the coordinates is obtained and alerted to the closest station. It is executed by Zigbee connectivity which can be upgraded to Walkie-Talkie communication when implemented in real time. IR transducer potentially eliminates all the physical components in the path way.

III. BLOCK DIAGRAM



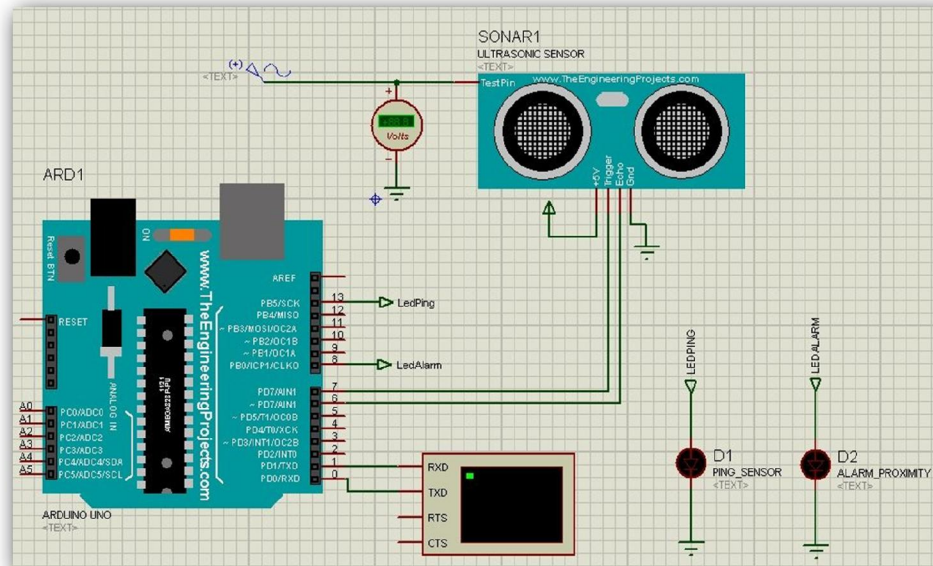
Process of Rail Track System:

1. The tracks are monitored continuously using sensor that can detect cracks.
2. This is done by Ultra sonic sensor which can work efficiently compared to other similar sensors.
3. When the fault is detected the sensor passes the message to the Arduino controller.
4. The controller will assess the process and execute accordingly.
5. The process include obtaining GPS coordinates and transmission through Zigbee Protocol.
6. As the information is received to the control centre of the train and emergency brake is applied.
7. Information is also sent to command centre to resolve the faulty track.



IV. ARCHITECTURE

4.1 Construction Circuit



4.2 Arduino

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, 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. Arduino Uno has a number of facilities for communicating with a computer, another Arduino board, or other microcontrollers.

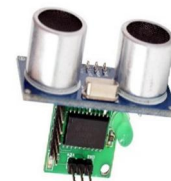


4.3 Ultrasonic Sensor

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear)

A. Features

- Working Voltage: 4.5-5.5V
- Rated Current: 10-40mA
- Interface: UART (TTL)
- Detecting Range: 2cm - 4.5m
- TTL output



4.4 IR Sensor

An infrared sensor (IR sensor) is a radiation-sensitive optoelectronic component with a spectral sensitivity in the infrared wavelength range 780 nm to 50 μm . The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR.

A. Features

- Output voltage: 0 or 5V_{DC}
- Easy to assemble and use
- Onboard detection indication
- Effective distance range of 2cm



4.5 Zigbee

ZigBee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. ZigBee is typically used in low data rate applications that require long battery life and secure networking.

A. Features

- Supply voltage: 5v DC
- Detection range: (10-30) m
- RS232 Output
- TTL UART also provided
- Frequency: 2.4GHz
- Tx and Rx Status LEDs
- Low power



V. APPLICATION

- **Automatic Crack Checking:** Rail crack detection is a process of detecting a crack in the structures using either successive radiometric or geometric information. The driving force is obtained from the pull effect of the train. The optical sensor will detect the obstacle or crack and stops the train automatically.
- **Wireless Application:** WAP Protocol is used to access real time data tracking from the command center. WAP can be compatible over mobile devices and other digital gadgets.
- **Track Damage Detection Application:** Track faults are the primary cause for accidents. Potential methods to avoid accidents are Ultra sound, camera set up, IR sensor etc. Ultrasonic sensor detects the crack in track not by receiving the echo from the track. If the echo sound is received no crack is detected. Hence, the GPS is un-activated.

VI. CONCLUSION

As per the study existing model would be time and capital consuming. The proposed model not only overcomes the above issue but also ensure utmost accuracy which also supports energy saving and expenses. Thereby the life and the damage to property is neglected with significant

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