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SOLAR BASED AUTOMATIC RAILWAY TRACK CRACKS AND DISCONTINUITIES DETECTION ROBOT

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Abstract

In India rail transport occupies a prominent position in providing the necessary transport infrastructure to sustain needs of a rapidly growing economy. Today, India possesses the fourth largest railway network in the world. 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.

However, in terms of the reliability and safety parameters, we have not yet reached truly global standards. The main problem about a railway analysis is detection of cracks in the structure. If these deficiencies are not controlled at early stages they might lead to a number of derailments resulting in a heavy loss of life and property.

This paper proposes a cost effective solution to the problem of railway track crack detection utilizing IR sensors which tracks the exact location of faulty track and sends message to nearby station using ZIGBEE TECHNOLOGY, which then mended immediately so that many lives will be saved.

Keywords: Automatic Rail crack detection Robot, Zigbee, Micro Controller, Solar Panel, IR Sensors.

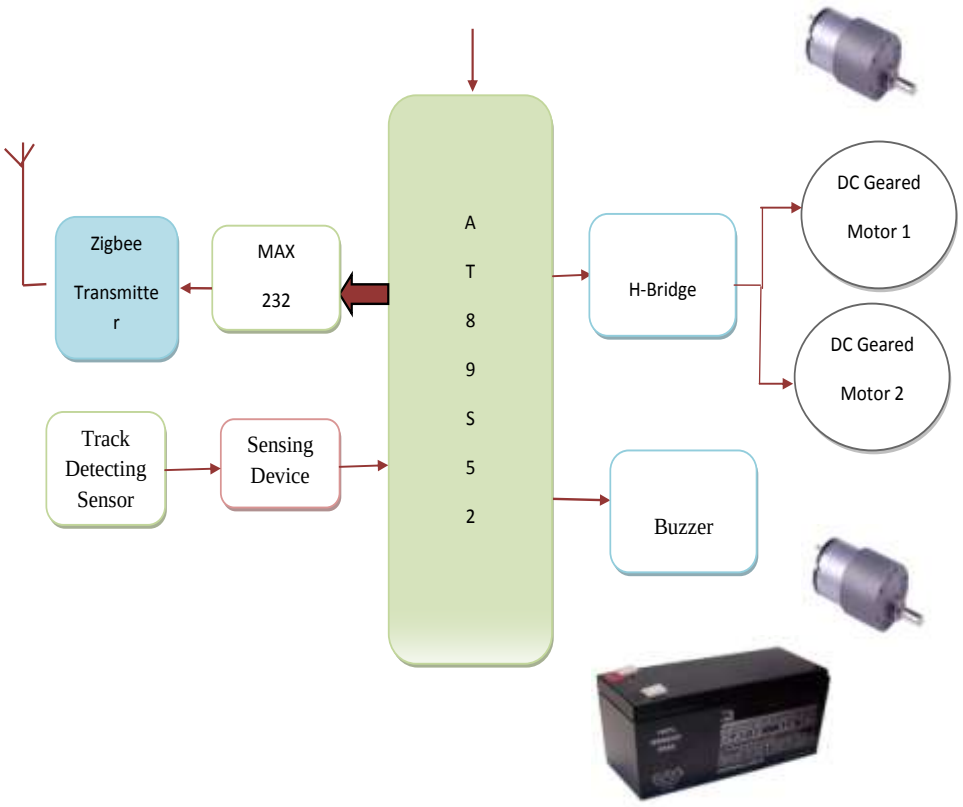
I.INTRODUCTION

In today's world transport is a key necessity because without transport, trade will come to a standstill. It would be impossible for products to be consumed in areas which are not in the immediate neighborhood of the production canters. Throughout the past, transport played a vital role in the expansion of trade. The Indian railway network today has a track length of 113,617 kilometers (70,598 mi) over a rate of 63,974 kilometers (39,752 mi) and 7,083 stations. It stands at fourth position when compared to those of the United States, Russia and China. The rail network is spread all across India, carrying over 30 million passengers and 2.8 million tons of freight daily. Even when there is a widespread and impressive network, the Indian rail is still in the emergent stage. The rail transport in India is

developing step by step. Our facilities are inadequate Compared to the international standards and as a result, there have been frequent derailments that have resulted in severe loss of valuable human lives and property as well. To demonstrate the severity of the problem, official statistics say that there have been 11 accidents in 2011 till the month of July alone, which leaves much to be desired. On further analysis of the factors that cause these rail accidents, recent statistics reveal that approximately 60% of all the rail accidents. 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.

BLOCK DIAGRAM



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II.LITERATURE SURVEY

With the advent of powerful digital signal processors, Image Processing techniques [2] have been explored to formulate solutions to the problem of railway crack detection. Though it provides good accuracy, this method uses technique like image segmentation, morphology and edge detection all of which take a lot of processing power and an extreme amount of time rendering the robot slow and thereby unsuitable. Recent research has investigated the use of microwave horn antennas for crack detection [3]. This technique was found to produce very accurate results in lab based testing. But, unfortunately it requires spectrum analyzers which are both costly and also can't be placed onboard a moving robot because of their delicacy. Eddy current based methods ([4], [5] and [6]) are used to tide over limitations associated with ultrasonic's and microwave techniques. However they have the problem of very slow overall speed which reduces the usability of the same. A vast majority of the work done in the field of crack detection uses the infrared sensing technique ([7], [8] and [9]). It is a well understood technique so much so that it was station. The detection of Cracks can be identified using IR rays and IR sensor.IR receiver is connected to the signal lamp and to the CAN controller. The electrified lamp is nothing but it sides of the tracks the electric lamp which is current flowing for the engines transportation [2],[9].But this type of system doesn't locate small cracks and the system is also costly.

III. HARDWARES

A: MICROCONTROLLER

(AT89S52) It has 40 pins and it is in dual in package It has 4 ports, 6 interrupts and 2 timers It has RAM of 128bytes and ROM of 4KB It is used for interfacing of the input and output modules Microprocessors and microcontrollers are widely used in embedded systems products. Microcontroller is a programmable device. The microcontroller used in this project is AT89S52. Atmel Corporation introduced this 89C51
Microcontroller. This microcontroller belongs to 8051 family. This microcontroller had 128 bytes of RAM, 4K bytes of on chip ROM, two timers, one serial port and four ports (each 8bits wide) all on a single chip. AT89S52 is Flash type 8051.

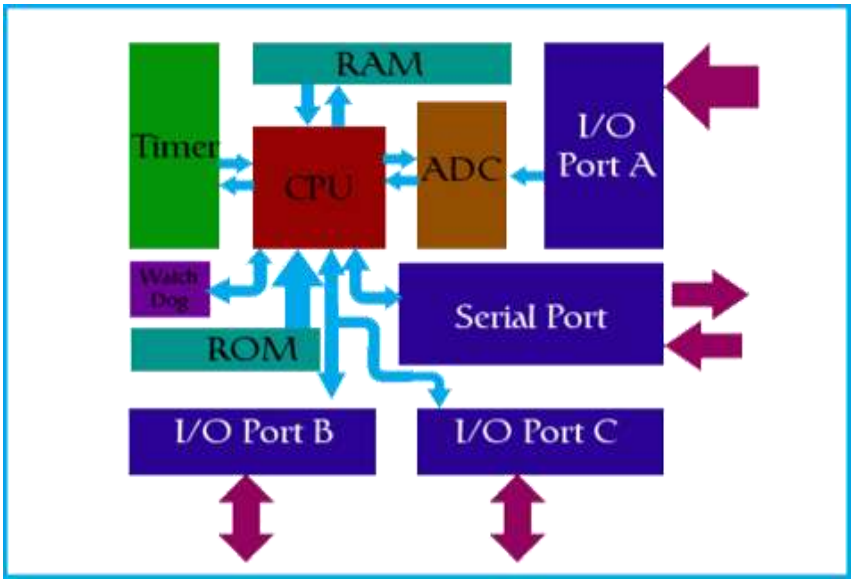

Figure-Block Diagram of Microcontroller (AT89S52)

The present project is implemented on KeilUvision. In order to program the device, Preload tool has been used to burn the program onto the microcontroller. The features, pin description of the microcontroller and the software tools used are discussed in the following sections.

FEATURES OF AT89S52

- Compatible with MCS-51® Products
- 8K Bytes of In-System Programmable (ISP) Flash Memory
- Endurance: 1000 Write/Erase Cycles
- 4.0V to 5.5V Operating Range
- Fully Static Operation: 0 Hz to 33 MHz
- Three-level Program Memory Lock
- 256 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Three 16-bit Timer/Counters
- Eight Interrupt Sources
- Full Duplex UART Serial Channel
- Low-power Idle and Power-down Modes
- Interrupt Recovery from Power-down Mode

B: ZIGBEE SYSTEM:

Based on the IEEE 802.15.4 Standard, Created by the ZigBee Alliance ZigBee module. The €1 coin, shown for size reference, is about 23 mm (0.9 inch) in diameter.

ZigBee is a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-2003 standard for wireless personal area networks (WPANs), such as wireless headphones connecting with cell phones via short-range radio.

The technology defined by the ZigBee specification is intended to be simpler and less expensive than other WPANs, such as Bluetooth. ZigBee is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking

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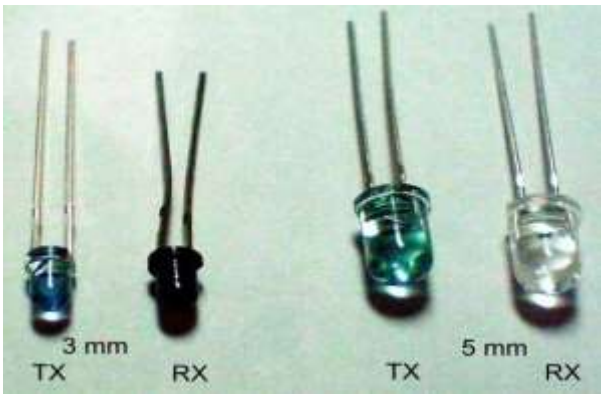
C. IR SENSOR

- Extra high radiant power and radiant intensity
- High reliability
- Low forward voltage
- Suitable for high pulse current operation
- Standard T-1¾ (Ø 5 mm) package
- Angle of half intensity $\phi = \pm 17°$
- Peak wavelength $\lambda p = 940$ nm
- Good spectral matching to Si photo detectors



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IR obstacle sensors: This sensor is fitted in front of train engine to detect any obstacle present on track with in the line of sight. It sends appropriate signal to train control system, which in-turn stops train immediately if an obstacle is detected.
IR curve detection sensors: This sensor is fitted to left side of train engine. An obstacle is placed near the curves to the left of the track. When train nearer a curve, obstacle is detected by this sensor and curve detection signal is sent to the train control block which in-turn controls the train speed in curve

D. LIQUID CRYSTAL DISPLAY

A liquid crystal display (LCD) is a thin, flat panel used for electronically displaying information such as text, images, and moving pictures.
Its uses include monitors for computers, televisions, instrument panels, and other devices ranging from aircraft cockpit displays, to every-day consumer devices such as gaming devices, clocks, watches, calculators, and telephones Among its major features are its lightweight construction, its portability, and its ability to be produced in much larger screen sizes than are practical for the construction of cathode ray tube (CRT) display technology.

E. DC GEARED MOTOR
60RPM 12V DC motors with Metal Gearbox
25000 RPM base motor
6mm shaft diameter
Gearbox diameter 37 mm.
Motor Diameter 28.5 mm
Length 63 mm without shaft
Shaft length 15mm
300gm weight
38kgcm torque
No-load current = 800 mA (Max), Load current = up to 9.5 A (Max)

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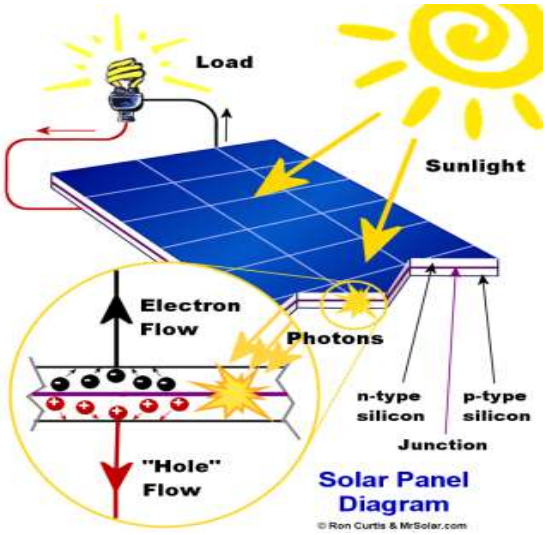
F. SOLAR PANNEL



SOLAR CELL:

Solar power is the conversion of sunlight into electricity, either directly using photovoltaic (PV), or indirectly using concentrated solar power (CSP). Concentrated solar power systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. Photovoltaic converts light into electric current using the photoelectric effect. A solar panel (photovoltaic module or photovoltaic panel) is a packaged interconnected assembly of solar cells, also known as photovoltaic cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications. Because a single solar panel can only produce a limited amount of power, many installations contain several panels. This is known as a photovoltaic array. A photovoltaic installation typically includes an array of solar

panels, an inverter, batteries and interconnection wiring. Photovoltaic systems are used for either on- or off-grid applications, and on spacecraft.

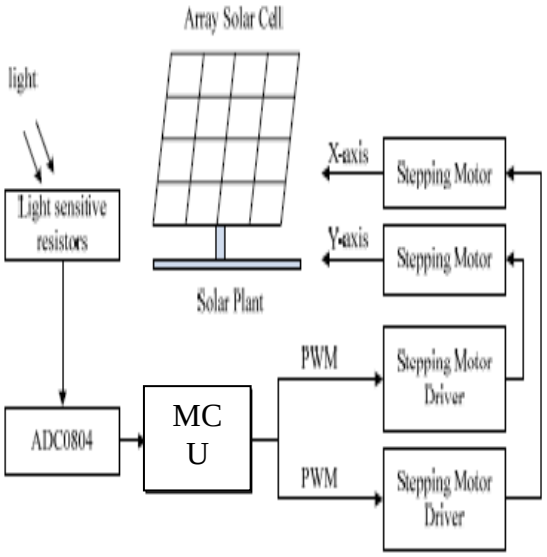


Fig. 2. System architecture of the solar tracking system.

IV.WORKING PROCEDURE

Our transmitter part(robot) will be moving on the track. For the controller at that side we have interfaced a sensing device to detect any crack in the track. Here the sensing device is IR sensor which follows line of sight. When that is missing it gives indication to the controller about the faulty track So that the controller sends the same information to the remote station through zigbee.To come and take necessary action.

V.CONCLUSION

The proposed broken rail detection system automatically detects the faulty rail track without any human intervention. There are many advantages with the proposed system when compared with the traditional detection techniques. The advantages include less cost, low power consumption and less analysis time. By this proposed system the exact location of the faulty rail track can easily be located which will mended immediately so that many lives can be saved.

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