RAILWAY TRACK FAILURE INSPECTION AND WARNING SYSTEM USING ZIGBEE AND MEMS

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ABSTRACT: Automatic Block Signaling is an advanced train safety system used to control railway traffic safely; it is essential to prevent trains from track failure and rock falling in tracks. In today's system the track failure identification is done manually. It is using manual systems operated by humans. The present system requires maintenance often and this will cause many inconvenience for the operator and officials. The present system is affected by the climatic changes. The communication between the railway stations are through telephones and this may be faulted during adverse climatic conditions. This project eliminates these and automates system entirely this project aims in the implementation of PIC Microcontroller for Train track failure System in railway lines tracks. MEMS are chosen for this application because MEMS is being used in many industrial automation systems. In this project a MEMS node governs the entry and exit of trains at each block. If the sensor system identifies any train track fault or any other interruption then the interruption will directly control the engine automatically

KEYWORDPIC 16F877A,Zigbee,MEMS,DCMotor,Motor Driver,LCDBuzzer,Embeddedc,MPLAB IDE

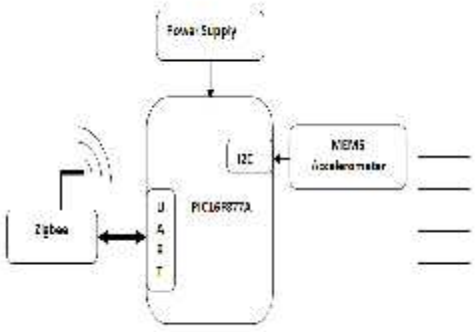
INTRODUCTION

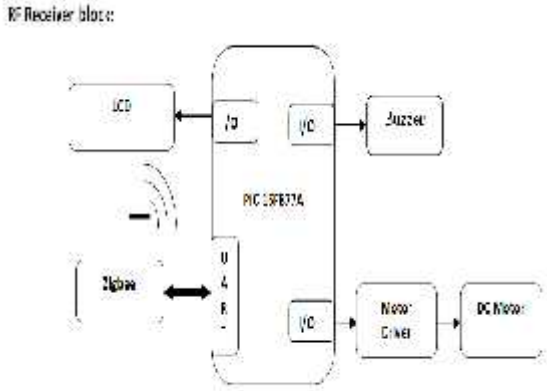
The communication between the railway stations are through telephones and this may be faulted during adverse climatic conditions. This project eliminates these and automates system entirely this project aims in the implementation of PIC Microcontroller for Train track failure System in railway lines tracks. MEMS are chosen for this application because MEMS is being used in many industrial automation systems. In this project a MEMS node governs the entry and exit of trains at each block. If the sensor system identifies any train track fault or any other interruption then the interruption will directly control the engine automatically.

Train accidents occur normally due to safety violations resulting from 'human errors or limitations' and 'equipment failures' loosing precious lives. The Ministry of Railways (Railway Board), Govt. of India has referred Ten Train Collisions in the past for developing an efficient Train Anti-Collision system and the need for research in this field. Konkan railways have proposed and implemented an Anti – Collision System. However, a severe bug was detected on testing, in which the system causes running trains to abrupt halt for no apparent reason. The system did not take any active inputs from existing Railway signalling system, and also lacked two way communication capability between the trains and the control centers or stations, hence was later decommissioned. The goal of this work is to design and implement a cost effective and intelligent full-fledged microcontroller and wireless based Train Anti Collision System to successfully prevent the train collisions. It aims to efficiently integrate into the existing signalling system and avoid accidents in manned as well as unmanned level crosses, without changing any of the existing system implemented in Indian Railway. Presently, emergency may be passed through traditional tele-communication systems like Walkie-Talkies or other communication devices, Collision avoidance systems on same track using IR modules and ACD by Konkan Railway. But each of these systems has their own advantages and disadvantages. In the traditional communication method, human error or carelessness may lead to severe disasters as noticed in the past. IR sensors have limitations in due to the geographic nature of the tracks. The ACD system also is found to be ineffective as it is not considering any active inputs from existing Railway signalling system, and also lacks two ways communication capability between the trains and the control centers or stations, hence has been later decommissioned. Later geographical sensors have also been used which makes use of satellites for communication. But the system is costly and complicated to implement. The proposed Train Anti Collision System consists of a 'self-acting' microcontroller and two way ZigBee based data communication system which works 'round-the-clock' to avoid train collisions and accidents at the level crosses thus 'enhances safety' in train operations by providing a 'NON-SIGNAL' additional 'safety overlay' over the existing signalling system. The system operates without replacing any of the existing signalling and nowhere affects the vital functioning of the present safety systems deployed for train operations. The proposed system gets data from the moving trains, control-centers/stations, Signalling Posts and level crossings. The efficiency of the system is expected to be considerably increased as the proposed system takes inputs from the signal posts and also from the level crossing gates. As more relevant data are included, it is expected that the present system may assist loco drivers in averting accidents efficiently. As no change is necessary to be made to the infrastructure of the existing system, the cost of implementation of this system is also less

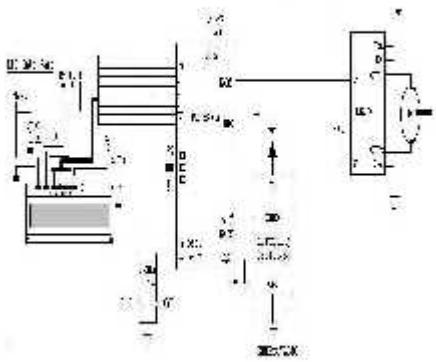
BLOCK DIAGRAM.

Rf Transmitter Block



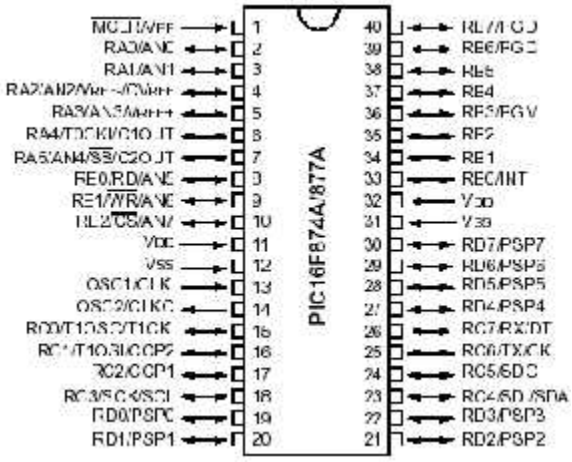


CIRCUIT DAIGRAM



2.PIC MICRO CONTROLLER

The microcontroller that has been used for this project is from PIC series. PIC microcontroller is the first RISC based microcontroller fabricated inCMOS (complementary metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory.



Various microcontrollers offer different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in pic16F877a is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are other features of PIC 16F877.

ZIGBEE

ZigBee and IEEE 802.15.4 are standards-based protocols that provide the network infrastructure required for wireless sensor network applications. 802.15.4 defines the physical and MAC layers, and ZigBee defines the network and application layers.

For sensor network applications, key design requirements revolve around long battery life, low cost, small footprint, and mesh networking to support communication between large numbers of devices in an interoperable and multi-application environment

UART(Universal Asynchronous Receiver/Transmitter)

A**Universal Asynchronous Receiver/Transmitter**, abbreviated **UART**(is a piece of computer hardware that translates data between parallel and serial forms. UARTs are commonly used in conjunction with communication standards such as EIA, RS-232, RS-422 or RS-485.

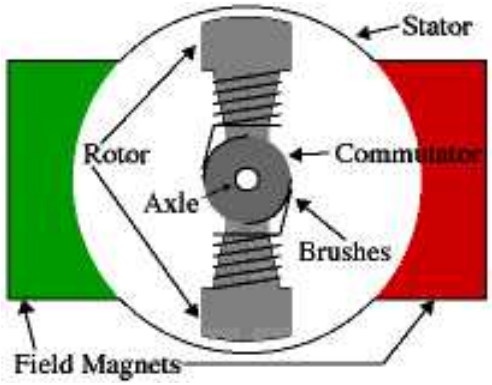
A UART is usually an individual (or part of an) integrated circuit used for serial communications over a computer or peripheral device serial port. UARTs are now commonly included in microcontrollers. A dual UART, or **DUART**, combines two UARTs into a single chip. Many modern ICs now come with a UART that can also communicate synchronously; these devices are called **USARTs** (universal synchronous/asynchronous receiver/transmitter).

MEMS(Microelectromechanical system)

An accelerometer is a device for measuring acceleration and gravity induced reaction forces. Single- and multi-axis models are available to detect magnitude and direction of the acceleration as a vector quantity. Accelerometers can be used to sense inclination, vibration, and shock. They are increasingly present in portable electronic devices.Modern accelerometers are often small micro electro-mechanical systems (MEMS), and are indeed the simplest MEMS devices possible, consisting of little more than a cantilever beam with a proof mass (also known as seismic mass). Mechanically the accelerometer behaves as a mass-damper-spring system; the damping results from the residual gas sealed in the device. As long as the Q-factor is not too low, damping does not result in a lower sensitivity.

DC MOTOR

The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.



DC motor has six basic parts -- axle, rotor (a.k.a., armature), stator, commutator, field magnet(s), and brushes. In most common DC motors (and all that BEAMers will see), the external magnetic field is produced by high-strength permanent magnets[1]. The stator is the stationary part of the motor -- this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotor (together with the axle and attached commutator) rotates with respect to the stator. The rotor consists of windings

(generally on a core), the windings being electrically connected to the commutator.

EMBEDEDCA general definition of embedded systems is: embedded systems are computing systems with tightly coupled hardware and software integration, which are designed to perform a dedicated function. In some cases, embedded systems can function as standalone systems.

One class of embedded processors focuses on size, power consumption, and price. Therefore, some embedded processors are limited in functionality, i.e., a processor is good enough for the class of applications for which it was designed but is likely inadequate for other classes of applications.Real-time systems are defined as those systems in which the overall correctness of the system depends on both the functional correctness and the timing correctness. The timing correctness is at least as important as the functional correctness

CONCLUSION

In this project, an anti-collision system for trains have been designed, simulated and tested. The simulation has been done using proteas and testing has been carried out using the developed prototype. It has been estimated that if the system is implemented in railways, two trains accidently on the same track but in opposite direction at 120kmph may stop automatically with a safe distance of 920m. Hence it is expected that, major train mishaps can be prevented and human life saved if this system is implemented

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