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Smart Railway System

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Abstract— *This is an approach towards an intelligent and automatic management of a railway transportation system in order to prevent hazards like collisions and Accidents. The system is designed as such that it is most viable for Indian Railway, however, it can also be easily implemented at any other railway infrastructure. The system features active obstacle detection at level crossings using long range infrared; Automatic and manual communication between trains and level crossings using global system for mobile communication (GSM) technology and lastly development of a web-based central control system to monitor locations and activities of trains using navigation technology and to communicate with the entire railway community as well as the country's emergency services. Our design includes the interaction of three separate sub-systems: central control system, level crossing system and train system. Implementation of such a system in Indian Railway will not only provide a comprehensive level of safety in railway transportation but also take India a step forward towards the much-anticipated dream by India government of creating a 'Digital India'.*

Keywords— Railway Cracks, GSM, IR and ultrasonic sensor, Automated Railway Signalling, Automated Railway Control..

I. INTRODUCTION

As we all know that the Railways plays an important role for transpotation in india. So as we know the conventional trains in india has so many drawbacks regarding to safety and facilities. So we have camed up with a new concept called "SMART RAILWAYS". In this Smart trains there some features which improves the trains facilities and improves passengers safety and uses some energy saving techniques. Railways being the cheapest mode of transportation are preferred over all the other means .When we go through the daily newspapers we come across many railway accidents occurring at unmanned railway crossings. This is mainly due to the carelessness in manual operations or lack of workers. We, in this project has come up with a solution for the same. Using simple electronic components we have tried to automate the control of railway gates. As a train approaches the railway crossing from either side, the sensors placed at a certain distance from the gate detects the approaching train and accordingly controls the operation of the gate. Also an indicator light has been provided to alert the motorists about the approaching train.

II. CIRCUIT DIAGRAM

2.1. Gate Control

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2.2. Solar Power

2.2.1. How Solar Panels Work

PV panels collect energy from the sun and convert it into electricity. PV systems convert sunlight directly into electricity. "Photo" refers to light and "voltaic" to electricity. A PV cell is made of a semiconductor material, usually crystalline silicon,

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which absorbs sunlight. You've seen PV cells at work in simple mechanisms like watches and calculators. You've probably even seen them for signs on the road. More complex PV systems produce solar electricity for houses and the utility grid.

2.3. PIR Sensor

A Passive Infraredsensor (PIR sensor) is an electronic device that measures infrared (IR) light radiating from objects in its field of view. PIR sensors are often used in the construction of PIR-based motion detectors (see below). Apparent motion is detected when an infrared source with one temperature, such as a human, passes in front of an infrared source with another temperature, such as a wall. All objects above absolute zero emit energy in the form of radiation. Usually infrared radiation is invisible to the human eye but can be detected by electronic devices designed for such a purpose. The term passive in this instance means that the PIR device does not emit an infrared beam but merely passively accepts incoming infrared radiation. "Infra" meaning below our ability to detect it visually, and "Red" because this color representsthe lowest energy level that our eyes can sense before it becomes invisible.

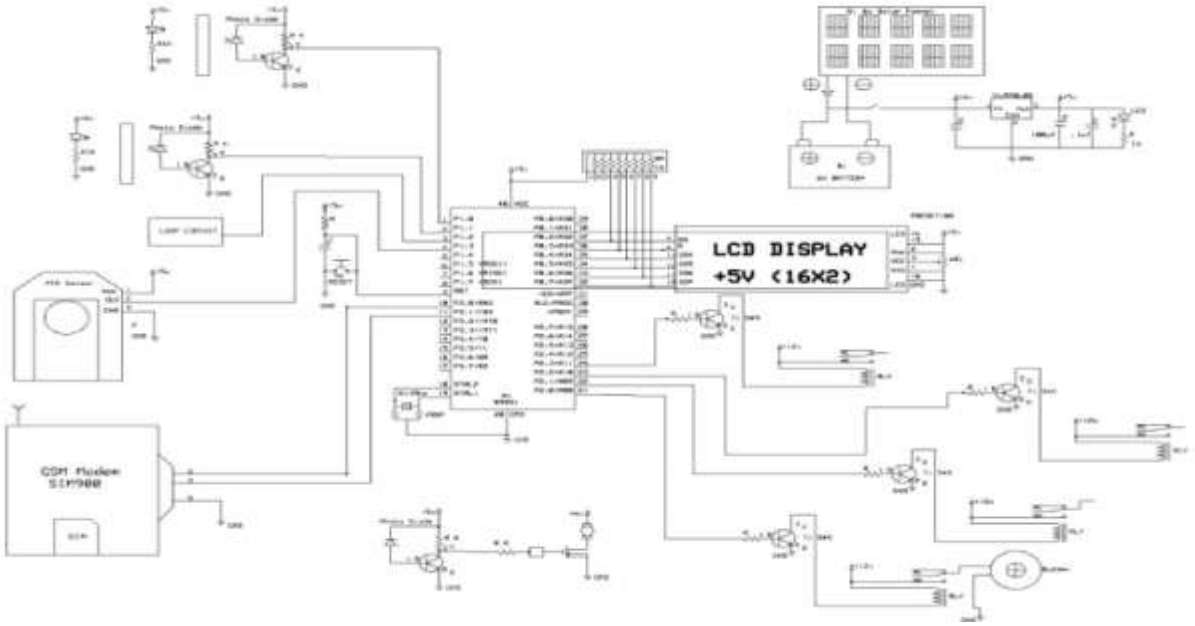

Fig. 1 Circuit Diagram

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2.7. Microcontroller 89s51

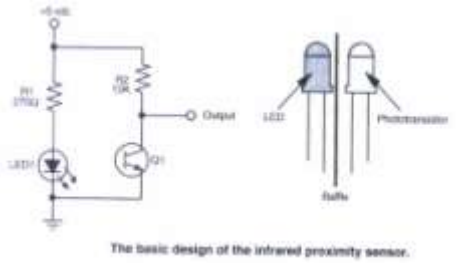
The AT89s51 is a low-power, high-performance CMOS 8-bit microcomputer with 4Kbytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89s51 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

2.8. Piezo Plate

Piezoelectricity is the ability of some materials (notably crystals and certain ceramics) to generate an electric potential. in response to applied mechanical stress. This may take the form of a separation of electric charge across the crystal lattice. If the material is not short-circuited, the applied charge induces a voltage across the material. The word is derived from the Greek piezein, which means to squeeze or press. The piezoelectric effect is reversible in that materials exhibiting the direct piezoelectric effect (the production of electricity when stress is applied) also exhibit the converse piezoelectric effect (the production of stress and/or strain when an electric field is applied). For example, lead zirconate titanate crystals will exhibit a maximum shape change of about 0.1% of the original dimension. The effect finds useful applications such as the production and detection of sound, generation of high voltages, electronic frequency generation, microbalances, and ultra fine focusing of optical assemblies. It is also the basis of a number of scientific instrumental techniques with atomic resolution, the scanning probe microscopies such as STM.

2.9. IR Sensor

The photo depicts the schematics for an infrared sensor which allows you to detect an object's distance from the robot. The big picture problem is attach this infrared sensor on both wings of the aerial robot. Attaching these sensors on the wing tips will help the robot navigate through the halls of any building. This tutorial shows you how to construct and test one infrared sensor and takes approximately 3 hours to complete.



The basic design of the infrared proximity sensor.

Figure 2: Principle of operation of the I.R. L.E.D. and Phototransistor:-

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A Photodiode is a p-n junction or p-i-n structure. When an infrared photon of sufficient energy strikes the diode, it excites an electron thereby creating a mobile electron and a positively charged electron hole. If the absorption occurs in the junction's depletion region, or one diffusion length away from it, these carriers are swept from the junction by the built-in field of the depletion region, producing a photocurrent. Photodiodes can be used under either zero bias (*photovoltaic mode*) or reverse bias (*photoconductive mode*). Reverse bias induces only little current (known as saturation or back current) along its direction. But a more important effect of reverse bias is widening of the depletion layer (therefore expanding the reaction volume) and strengthening the photocurrent when infrared falls on it. There is a limit on the distance between I.R. L.E.D. and infrared sensor for the pair to operate in the desired manner. In our case distance is about 5mm.

2.10. Relay Driver IC ULN2803

The eight NPN Darlington connected transistors in this family of arrays are ideally suited for interfacing between low logic level digital circuitry (such as TTL, CMOS or PMOS/NMOS) and the higher current/voltage requirements of lamps, relays, printer hammers or other similar loads for a broad range of computer, industrial, and consumer applications. All devices feature open–collector outputs and freewheeling clamp diodes for transient suppression.

The ULN2803 is designed to be compatible with standard TTL families while the ULN2804 is optimized for 6 to 15 volt high level CMOS or PMOS.

2.11. Relay

The basis for relays, is the simple electromagnet The simplest relay, is the Single Pole, Single Throw (spst) relay. It is nothing more than an electrically controlled on-off switch. It's biggest property, is the ability to use a very small current, to control a much larger current. this is desireable because we can now use smaller diameter wires, to control the current flow through a much larger wire, and also to limit the wear and tear on the control switch.

2.12. LCD

A liquid crystal display (LCD) is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals. The basic function of the LCD is to display the action performed by the microcontroller. The LCD used here is 16X2 character LCD display. The figure shows the pin diagram and pin description.

2.13. Power Supply

This unit will supply the various voltage requirements of each unit. This will be consists of transformer, rectifier, filter and regulator. The rectifier used here will be Bridge rectifier. It will convert 230 V AC into desired 5V/12V DC.

III. ADVANTAGES

1. Energy efficient
2. More safety
3. Energy loss is less
4. Running cost is less
5. Proper fault indication

IV. FUTURE SCOPE

1. To modernization of one of the major government sector of India.
2. The system features active obstacle detection at level crossings using long range infrared.
3. Due to this system the energy can be saved to a great extent and also the cost of the railway system.
4. Due to this system accidents can be reduce to a great extent.

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V. APPLICATIONS

1. For railway gate control.
2. Car parking gate control.
3. Building Gate control.

VI. INDUSTRIAL AREA GATE CONTROL CONCLUSION

1. Most important, safety of people is the top priority. Apart from safety we have also managed to save life of people.
2. By implementing solar system huge amount of energy can be saved on platforms in railway system.
3. Due to LED screen-timer it will psychologically make people feel positive about waiting in a row at the crossing.

REFERENCE

[1] "Design and Implementation of Wireless Security System for Railway Tracks", by Mehaboon Mujawar Sangam.Borkar.

[2] "Development of a Smart Railway System for Bangladesh" by Masharul Bin Mahfuz*, Zohair Mehtab Ali, Md. Shakhawat Hossain, Avijit Das.

[3] "Software Reliability Optimization for Automatic Train Operating System" by Zengkun LI, Xibin ZHAO.

[4] "Smart Control in a DC Railway by Multi Agent System (MAS)" by Soukaina Boudoudouh and Mohammed Maâroufi.

[5] "Robust Railway Crack Detection Scheme (RRCDS) Using LED-LDR Assembly Selvamraju Somalraju, Vigneshwar Murali published in ICRTIT-2012.

[6] K. Vijayakumar, S.R. Wylie, J. D. Cullen, C.C. Wright, A.I. AIShamma'a, "Noninvasive rail track detection system using Microwave sensor", Journal of App. Phy., 2009.

[7] Transverse crack detection in rail head using low frequency eddy currents, Patent US6768298.

[8] R.J. Greene, J.R. Yates,E.A. Patterson, "Rail Crack Detection: An Infrared Approach to In-service Track Monitoring", SEM Annual Conference 2006.

[9] Richard J. Greene, John R. Yates and Eann A. Patterson, "Crack detection in rail using infrared methods", Opt. Eng. 46, 051013, May 2007.