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AUTOMATED UNMANNED RAILWAY LEVEL CROSSING SYSTEM

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Abstract

In the rapidly flourishing country like ours, accidents in the unmanned level crossings are increasing day by day No fruitful steps have been taken so far in these areas. our paper deals with automatic railway gate operation (i.e.,) automatic railway gate at a level crossing replacing the gates operated by the gatekeepers, It deals with two things, Firstly it deals with the reduction of time for which the gate is being kept closed and secondly, to provide safety to the road users by reducing the accidents. By employing the automatic railway gate control at the level crossing the arrival of the train is detected by the sensors placed near to the gate. Hence, the time for which it is closed is less compared to the manually operated gates. The operation is automatic; error due to manual operation is prevented. Automatic railway gate control is highly microcontroller based arrangements, designed for use in almost all the unmanned level crossing in the train.

Keywords: ***Railway gate, level crossing.***

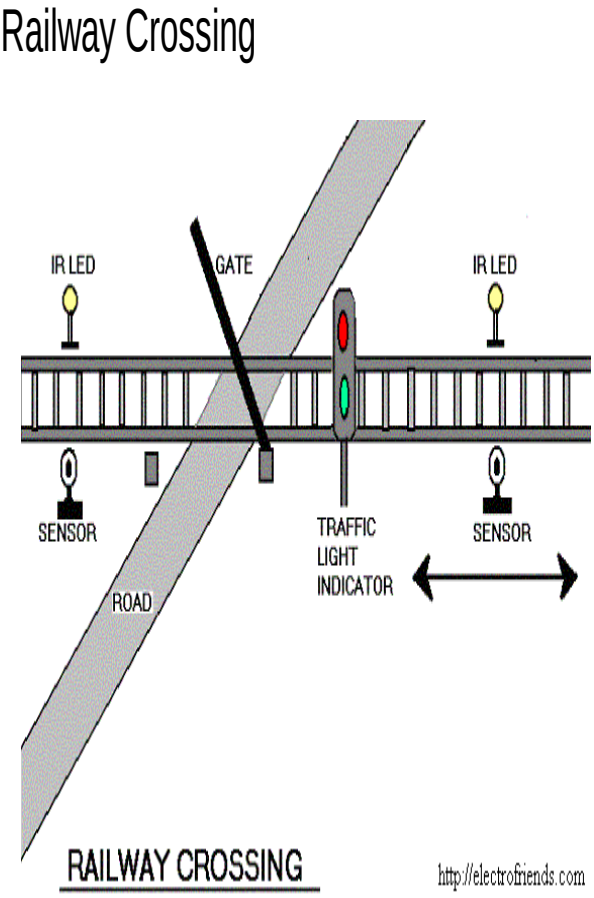
1. INTRODUCTION

The place where track and highway/road intersects each other at the same level is known as “level crossing”. There are mainly two types of level crossing they are Manned level crossing and Unmanned level crossing. Manned level crossing is classified into spl.Class, ’A’Class, ’B’Class, ‘C’Class. Unmanned level crossing is classified into ‘C’Class, ‘D’Class. 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 paper have 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. When the wheels of the train moves over, both tracks are shorted to ground and this acts as a signal to the microcontroller indicating train arrival. Also an indicator light has been provided to alert the motorists about the approaching train.

2. ACCIDENT AVOIDENCE DETAILS

When the train arrives in a particular direction the transmitter IR senses and generates appropriate signal, then at the same time the receiver IR receives the signal and generates an interrupt.

When the interrupt is generated the stepper motor rotates in clockwise direction. When the interrupt ends the stepper motor rotates in anti clock wise direction.



HARDWARE IMPLEMENTATION

Micro Controller

Totally 40-pin DIP package manufactured with CMOS Technology.

L293D (motor driver)

Racially L293D 16DIP /ULN 2003 IC is used to drive the stepper motor.

STEPPER MOTOR

This is used to open and close the gates automatically when it is rotated clock wise or anticlockwise direction.

Stepper motor requires 500m amps current, so use the uln2003 or L293D drivers to drive the stepper motor.

SOFTWARE IMPLEMENTATION

Keil software

3. BLOCK DIAGRAM DESCRIPTION

The block diagram consists of six major blocks, they are IR sensors, Microcontroller, L293D, Stepper motor, gate and power supply

3.1 IR SENSORS

Two IR sensor pairs (331,333) are used for transmitting and receiving signals.

3.1.1 IR CIRCUITS

This circuit has two stages: a transmitter unit and a receiver unit. The transmitter unit consists of an infrared LED and its associated circuitry.

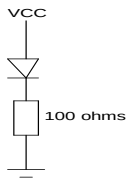
3.1.2 IR TRANSMITTER

The transmitter circuit consists of the following components:

1. Resistors
2. IR LED

The IR LED emitting infrared light is put on in the transmitting unit. Infrared LED is driven through transistor BC 548.

Transmitter



3.1.3 IR RECEIVER

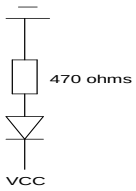
The receiver circuit consists of the following components:

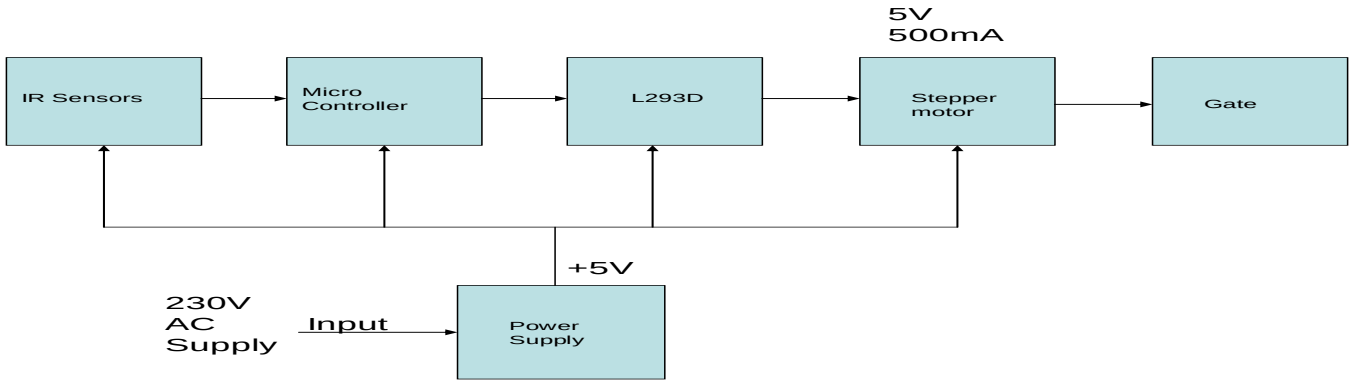
1. Resistors.
2. IR LED.

The receiver unit consists of a sensor and its associated circuitry. In receiver section, the first part is a sensor, which detects IR pulses transmitted by IR-LED. Whenever a train crosses the sensor, the output of IR sensor momentarily transits through a low state.

As a result the monostable is triggered and a short pulse is applied to the port pin of the 8051 microcontroller. On receiving a pulse from the sensor circuit, the controller activates the circuitry required for closing and opening of the gates and for track switching. The IR receiver circuit is shown in the figure below.

Receiver





3.2 MICROCONTROLLER

It is designed using 8051 microcontroller to avoid railway accidents happening at unattended railway gates.

The Micro controller is a low power; high performance CMOS 8-bit micro controller with 4K bytes of Flash programmable and erasable read only memory (PEROM). The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel is a powerful microcomputer, which provides a highly flexible and cost-effective solution to many embedded control applications. By using this controller the data inputs from the smart card is passed to the Parallel Port of the pc and accordingly the software responds. The IDE for writing the embedded program used is KEI L software

FEATURES OF MICROCONTROLLER

The AT89C52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89C52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes.

The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power Down Mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next hardware reset.

3.2.1 Keil Micro vision Integrated Development Environment.

Keil Software development tools for the 8051 micro controller family support every level of developer from the professional applications engineer to the student just learning about embedded software development. The industry-standard Keil C Compilers, Macro Assemblers, Debuggers, Real-time Kernels, and Single-board Computers support ALL 8051-compatible derivatives and help you get your projects completed on schedule.

The source code is written in assembly language .It is saved as ASM file with an extension. A51.the ASM file is converted into hex file using keil software. Hex file is dumped into micro controller using LABTOOL software. At once the file is dumped and the ROM is burnt then it becomes an embedded one.

3.3 L293D PUSH-PULL FOUR CHANNEL DRIVER WITH DIODES

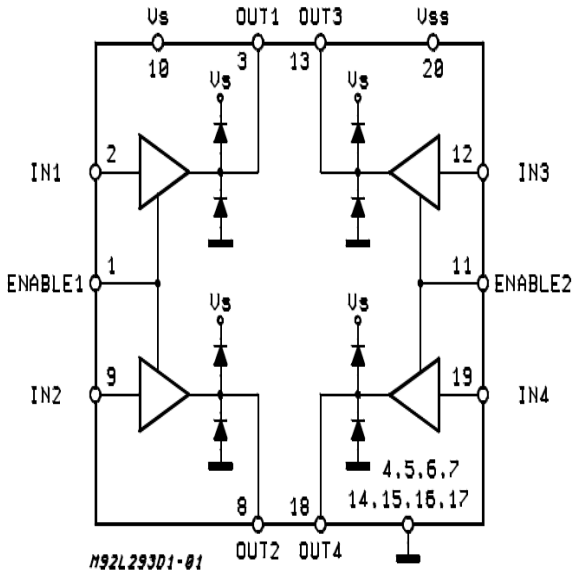
- 600ma output current capability per channel
- 1.2a peak output current (non repetitive) per channel
- enable facility
- over temperature protection
- logical "0" input voltage up to 1.5 v
- (high noise immunity)
- internal clamp diodes

The Device is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays solenoids, DC and stepping motors) and switching power transistors.

To simplify use as two bridges each pair of channels is equipped with an enable input. A separate supply input is provided for the logic, allowing operation at a lower voltage and internal clamp diodes are included.

This device is suitable for use in switching applications at frequencies up to 5 kHz. The L293D is assembled in a 16 lead plastic package which has 4 center pins connected together and used for heat sinking. The L293DD is assembled in a 20 lead surface mount which has 8 center pins connected together and used for heat sinking.

BLOCK DIAGRAM



3.3.2 ADVANTAGES AND DISADVANTAGES OF L293D

ADVANTAGES

Efficient way of speed control of DC motor.
Produces more torque.
Produces less noise.

DISADVANTAGES

It is not applicable for AC motor.

APPLICATIONS

Industries.
Traction.
Home appliance.

3.4 STEPPER MOTOR

The stepper tutorial deals with the basic final stage drive circuitry for stepping motors. This circuitry is centered on a single issue, switching the current in each motor winding on and off, and controlling its direction. The circuitry discussed in this section is connected directly to the motor windings and the motor power supply, and this circuitry is controlled by a digital system that determines when the switches are turned on or off.

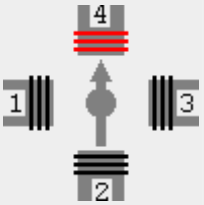
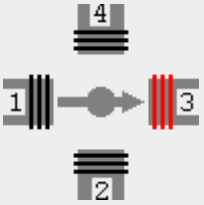
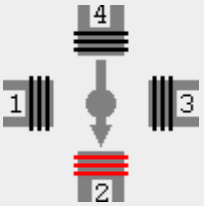
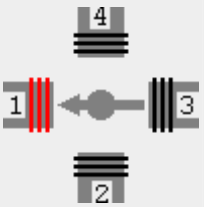
This section covers all types of motors, from the elementary circuitry needed to control a variable reluctance motor, to the H-bridge circuitry needed to control a bipolar permanent magnet motor. Each class of drive circuit is illustrated with practical examples, but these examples are not intended as an exhaustive catalog of the commercially available control circuits, nor is the information given here intended to substitute for the information found on the manufacturer's component data sheets for the parts mentioned.

This section only covers the most elementary control circuitry for each class of motor. All of these circuits assume that the motor power supply provides a drive voltage no greater than the motor's rated voltage, and this significantly limits motor performance. The next section, on current limited drive circuitry, covers practical high-performance drive circuits.

3.4.1 Stepping Sequences for a Four-Phase Unipolar Permanent Magnet Stepper Motor

This kind of motor has four coils which, when energized in the correct sequence, cause the permanent magnet attached to the shaft to rotate.

There are two basic step sequences. After step 4, the sequence is repeated from step 1 again.

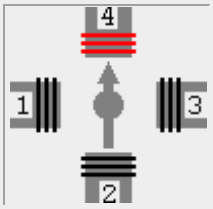
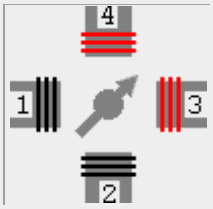
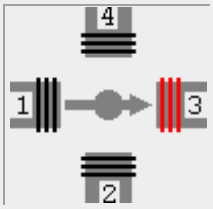
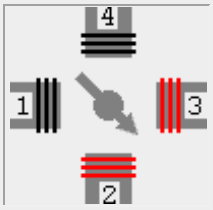
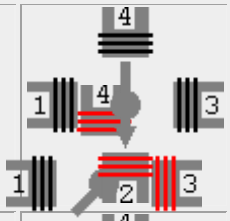
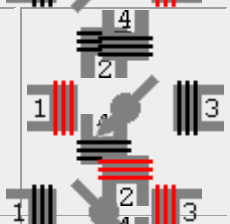
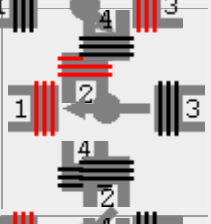
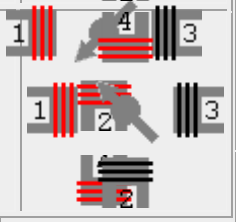
Step	Coil 4	Coil 3	Coil 2	Coil 1	
a.1	on	off	off	Off	
a.2	off	on	off	Off	
a.3	off	off	on	Off	
a.4	off	off	off	On	

Reversing the order of the steps in a sequence will reverse the direction of rotation.

Here are some possible connection diagrams and some software

3.4.2 Single-Coil Excitation - Each successive coil is energized in turn.

This sequence produces the smoothest movement and consumes least power.

Step	Coil 4	Coil 3	Coil 2	Coil 1	
a.1	**on**	off	off	Off	
b.1	**on**	**on**	off	Off	
a.2	off	**on**	off	Off	
b.2	off	**on**	**on**	Off	
a.3	off	off	**on**	Off	
b.3	off	off	**on**	**On**	
a.4	off	off	off	**On**	
b.4	**on**	off	off	**On**	
b.4	on	off	off	On	

3.4.3Two-Coil Excitation - Each successive pair of adjacent coils is energized in turn.

This is not as smooth and uses more power but produces greater torque

The excitation of Coil 1 is always the inverse of the excitation of Coil 3.

So, with the right circuit the excitation of Coil 4 is always the inverse of the excitation of Coil 2. You can generate this sequence with only two data lines. **Interleaving** the two sequences will cause the motor to **half-step.**

4. APPLICATIONS

- Real time transport systems.

5. ADVANTAGES

- Accident avoidance.
- Human Resource.
- Safety and quality of services

6. CONCLUSION

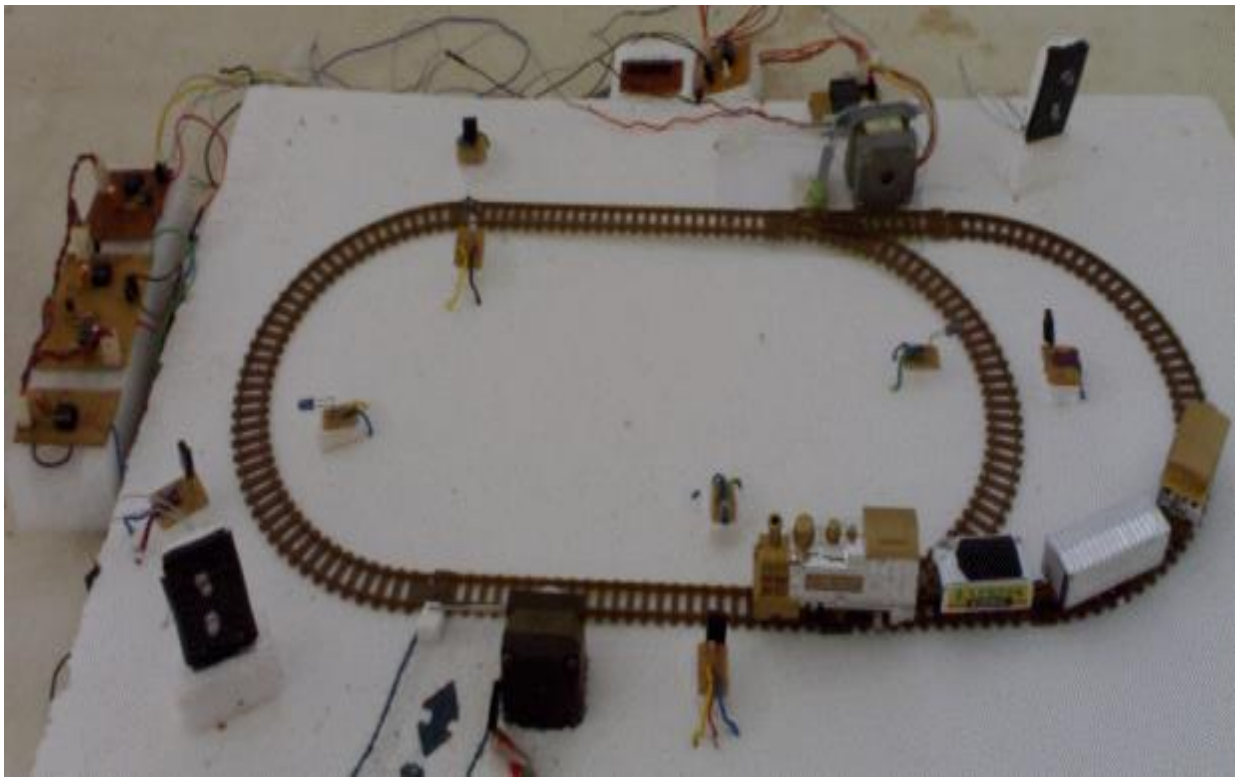
The accidents are avoided at places where there is no person managing the railway crossing gates.

Here we use the stepper motor to open and close the gates automatically when it is rotated clockwise or anticlockwise direction.

When the train arrives in a particular direction the transmitter IR senses and generates appropriate signal, then at the same time the receiver IR receives the signal and generates an interrupt.

When the interrupt is generated the stepper motor rotates in clockwise direction. When the interrupt ends the stepper motor rotates in anti clock wise direction

Railway Track



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