RA Journal of Applied Research
||Volume||3||Issue||01||Pages-809-815||Jan-2017|| ISSN (e): 2394-6709
www.rajournals.in

Automatic Railway Gate Control system

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ABSTRACT: this project work aims at the design, development, fabrication and testing of working model entitled "automatic railway gate controller". It is basically related to radio communication and signalling system. An automatic railway gate controller is unique in which the railway gate is closed and opened or operated by the train itself by eliminating the chances of human errors the largest public sector in india is the railways. The network of indian railways covering the length and breath of indian railways covering the length and breath of our country is divided into nine railway zones for operational convenience. The railway tracks criss-cross the state highways and of course village road along their own length .the points or places where the railway track crosses the road are called level crossings. Level crossings cannot be used simultaneously both by road traffic and trains, as this result in accidents leading to loss of precious lives

Chapter: 1

INTRODUCTION OF AUTOMATED RAILWAY CROSSING SYSTEM

The objective of this project is to manage the control system of railway gate using the microcontroller. When train arrives at the sensing point alarm is triggered at the railway crossing point so that the people get intimation that gate is going to be closed. Then the control system activates and closes the gate on either side of the track once the train crosses the other end control system automatically lifts the gate. For mechanical operation of the gates 1.8 step angle stepper motors are employed. Here we are using embedded controller built around the 8051 family (AT89C52) for the control according to the data pattern produced at the input port of the micro controller, the appropriate selected action will be taken. The logic is produced by the program written in Embedded C language. The software program is written, by using the KEIL micro vision environment. The program written is then converted in HEX code after simulation and burned on to microcontroller using FLASH micro vision.

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1.1 Abstract

The objective of this project is to provide an automatic railway gate at a level crossing replacing the gates operated by the gatekeeper. 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 the presently existing system once the train leaves the station, the stationmaster informs the gatekeeper about the arrival of the train through the telephone. Once the gatekeeper receives the information, he closes the gate depending on the timing at which the train arrives. Hence, if the train is late due to certain reasons, then gate remain closed for a long time causing traffic near the gates.

By employing the automatic railway gate control at the level crossing the arrival of the train is detected by the sensor placed near to the gate. Hence, the time for which it is closed is less compared to the manually operated gates and also reduces the human labor. This type of gates can be employed in an unmanned level crossing where the chances of accidents are higher and reliable operation is required. Since, the operation is automatic; error due to manual operation is prevented.

Automatic railway gate control is highly economical microcontroller based arrangement, designed for use in almost all the unmanned level crossings in the country.

1.2 Working methodology

RA Journal of Applied Research
||Volume||3||Issue||01||Pages-809-815||Jan-2017|| ISSN (e): 2394-6709
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Present project is designed using 8051 microcontroller to avoid railway accidents happening at unattended railway gates, if implemented in spirit. This project utilizes two powerful IR transmitters and two receivers; one pair of transmitter and receiver is fixed at upside (from where the train comes) at a level higher than a human being in exact alignment and similarly the other pair is fixed at down side of the train direction. Sensor activation time is so adjusted by calculating the time taken at a certain speed to cross at least one compartment of standard minimum size of the Indian railway. We have

considered 5 seconds for this project. Sensors are fixed at 1km on both sides of the gate. We call the sensor along the train direction as 'foreside sensor' and the other as 'after side sensor'. When foreside receiver gets activated, the gate motor is turned on in one direction and the gate is closed and stays closed until the train crosses the gate and reaches aft side sensors. When aft side receiver gets activated motor turns in opposite direction and gate opens and motor stops. Buzzer will immediately sound at the fore side receiver activation and gate will close after 5 seconds, so giving time to drivers to clear gate area in order to avoid trapping between the gates and stop sound after the train has crossed.

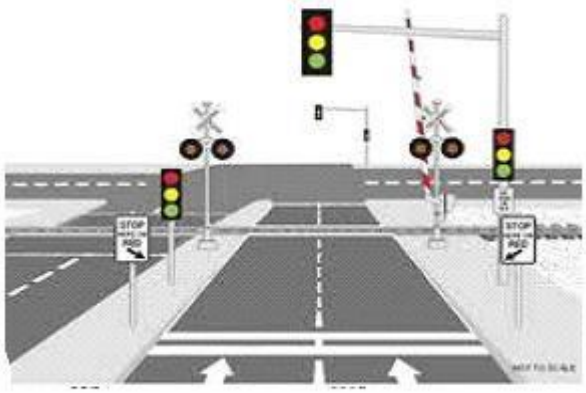

Fig. 1.2 working methodology

1.3 Working of gate control system

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 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. Also an indicator light has been provided to alert the motorists about the approaching train.

CHAPTER. 2

Hardware of automated railway crossing gate

Descriptions

- **Microcontroller**
- **Stepper motor**
- **Components**
- **Sensors**
- **Flexible wire**

2.1 Microcontroller

Microcontrollers are "embedded" inside some other device (often a consumer product) so that they can control the features or actions of the product. Another name for a microcontroller, therefore, is "embedded controller."
Microcontrollers are dedicated to one task and run one specific program. The program is stored in ROM (read-only memory) and generally does not change. Microcontrollers are often low-power devices. A microcontroller has a dedicated input device and often (but not always) has a small LED or LCD display for output.
A microcontroller also takes input from the device it is controlling and controls the device by sending signals to different components in the device. For example, the microcontroller inside a TV takes input from the remote control and displays output on the TV screen. The controller controls the channel selector, the speaker system and certain adjustments on the picture tube electronics such as tint and brightness. The engine controller in a car takes input from sensors such as the oxygen and knock sensors and controls things like fuel mix and spark plug timing. A microwave oven controller takes input from a keypad, displays output on an LCD display and controls a relay that turns the microwave generator on and off. A microcontroller is often small and low cost. The components are chosen to minimize size and to be as inexpensive as possible. A microcontroller is often, but not always, ruggedized in some way. On the other hand, a microcontroller embedded inside a VCR hasn't been ruggedized at all. The actual processor used to implement a microcontroller can vary widely. The Micro controller (AT89C51) 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

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non-volatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C51 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 idea for writing the embedded program using KEIL software.

2.1.1Atmel 89c51 Microcontroller Description:

The AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash programmable and erasable read only memory (PEROM) based on the famous 8051 architecture. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pin out. 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 AT89C51 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

Features

The AT89C51 provides the following standard features:

- Compatible with MCS-51 Products
- Endurance: 1,000 Write/Erase Cycles
- 4K Bytes of In-System Reprogrammable Flash Memory
- 128 bytes of Internal RAM (128 x 8-bit)
- 32 Programmable I/O Lines
- Two 16-bit Timer/Counters
- Five vector two-level interrupt architecture
- A full duplex serial port
- Three-level Program Memory Lock
- Six Interrupt Sources

Block diagram:

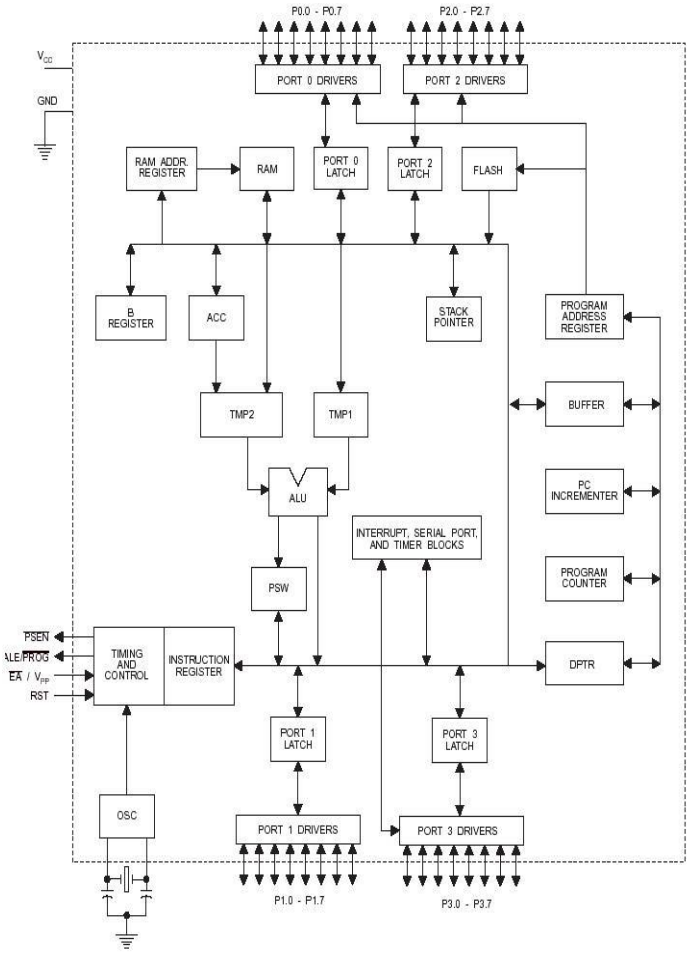

Fig: 2.1.1 Block Diagram of AT89c51 Microcontroller

2.2 Stepper motor:

Stepper motors convert electrical energy into precise mechanical motion. These motors rotate a specific incremental distance per each step. The number of steps executed controls the degree of rotation of the motor's shaft. This characteristic makes step motors excellent for positioning applications. For example, a 1.8° step motor executing 100 steps will rotate exactly 180° with some small amount of non-cumulative error. The speed of step execution controls the rate of motor rotation. A 1.8° step motor executing steps at a speed of 200 steps per second will rotate at exactly 1 revolution per second.Stepper motors can be very accurately controlled in terms of how far and how fast they will rotate. The number of steps the motor executes is equal to the number of pulse commands it is given. A step motor will rotate a distance and at a rate that is proportional to the number and frequency of its pulse commands.

Basic Stepper Motor System

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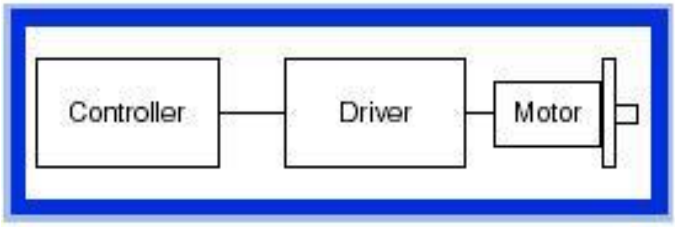

Fig: 2.2.1 Basic stepper motor system

The diagram above shows a typical step motor based system. All of these parts must be present in one form or another. Each component's performance will have an effect on the others. By altering the frequency of the pulse train, the pulse generator can instruct the motor to accelerate, run at a speed, decelerate or stop. A pulse generator must be present otherwise the motor will not move. Next is the motor driver. The driver takes the pulses from the pulse generator and determines how and when the windings should be energized. The windings must be energized in a specific sequence to generate motion. Finally there is the step motor itself. A step motor has two primary parts; the rotor, the moving piece, and the stator, the stationary piece. The stator contains coils of wire called windings. The rotor spins on bearings or bushings inside the stator. All step motors operate through the principle of the rotor following a rotating magnetic field created by sequencing the flow of current through the stator windings. Each NMB step motor has two phases, which are groups of electrically connected windings. As current is passed through each phase, the motor takes "steps" or small movements to keep in synchronism with the magnetic field. The degree of rotation per step depends on the style of driver used and the construction of the motor.We have used hybrid stepper motor because its most suitable for our task.

2.2.1 Construction and Operating the Hybrid STEP MOTOR

Depicts a 1.8° hybrid step motor. The rotor contains a permanent magnet similar to those found in permanent magnet step motors. Hybrid rotors are axially magnetized, one end polarized north and the other polarized south. Both the rotor and the stator assemblies of hybrid motors have tooth-like projections. To understand the rotor's interaction with the stator, examine the construction of a 1.8° (the most common resolution) hybrid step motor.

The two cups are oriented so that the teeth of the top cup are offset to the teeth of the bottom cup by 3.6°. Second, the stator has a two-phase construction. The winding coils, 90° apart from one another, make up each phase. Each phase is wound so that the poles 180° apart are the same polarity, while the poles 90° apart are the opposite polarity. When the current in a phase is reversed, is the polarity, meaning that any winding coil can be either a north pole or a south pole. As shown in fig. 1b below, when phase A is energized, the windings at 12 o'clock and 6 o'clock are north poles and the windings at 3 o'clock and 9 o'clock are south poles.

The windings at 12 and 6 would attract the teeth of the magnetically south end of the rotor, and windings at 3 and 9 would attract the teeth of the magnetically north end of the rotor.

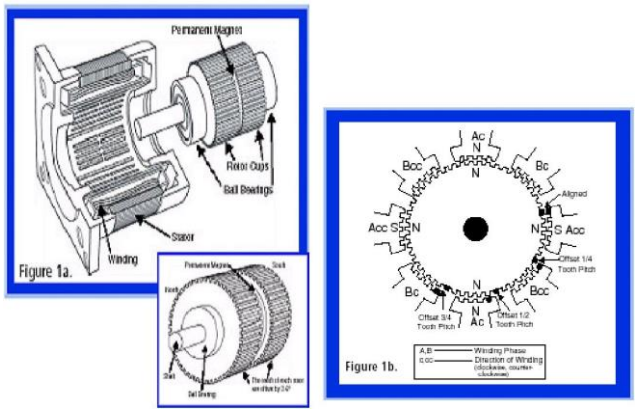

Fig: 2.2.2 Stepper motor

Stepper Motor Advantages:

Accuracy & Repeatability – Ability to position accurately.

Responsiveness & Quick Acceleration – Step motors have low rotor inertia, allowing them to get up to speed quickly. Step motors an excellent choice for short, quick moves.

Excellent torque for their size – Step motors have the highest torque per cubic inch of any motor.

Positioning Stability – Unlike other types of motors, step motors can be held completely Motionless in their stopped position.

2.3 Components

List of components

- Capacitor
- Resistor

2.3.1 CAPACITORS:

An electrolytic capacitor is a type of capacitor typically with a larger capacitance per unit volume than other types, making them valuable in relatively high-current and low-frequency electrical circuits. This is especially the case in power-supply filters, where they store charge needed to moderate output

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voltage and current fluctuations, in rectifier output, and especially in the absence of rechargeable batteries that can provide similar low-frequency current capacity. They are also widely used as coupling capacitors in circuits where AC should be conducted but DC should not; the large value of the capacitance allows them to pass very low frequencies.The electrolytic capacitor was invented in 1886 by Charles Pollack. It was largely responsible for the development of mains-powered radio receivers, since it permitted the filtering of the 50-60 hertz power supplied to residences, after it was rectified to power the radio tubes. This was not practical without the small volume and low cost of electrolytic capacitors.

2.3.2 Resistor

Resistors limit current. In a typical application, a resistor is connected in series with an LED:

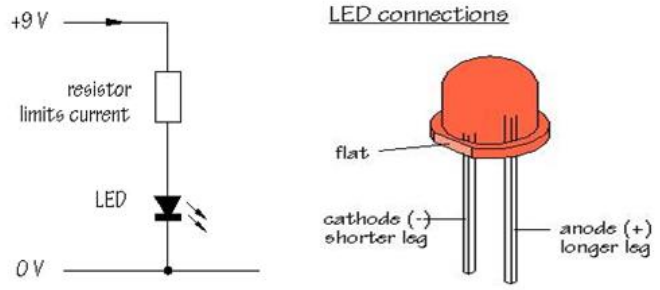

Fig: 2.3.2 construction of resistor

Enough current flows to make the LED light up, but not so much that the LED is damaged. Later in this Chapter, you will find out how to calculate a suitable value for this resistor. (LEDs are described in detail in Chapter 5.)

Resistors are used with transducers to make sensor subsystems. Transducers are electronic components which convert energy from one form into another, where one of the forms of energy is electrical. A light dependent resistor, or LDR, is an example of an input transducer. Changes in the brightness of the light shining onto the surface of the LDR result in changes in its resistance. As will be explained later, an input transducer is most often connected along with a resistor to make a circuit called a potential divider. In this case, the output of the potential divider will be a voltage signal which reflects changes in illumination.

2.3.3 POWER SUPPLY:

To run the electronic gadget at home it is provided by some power supply. The microcontroller used (at89c51) requires 12v D.C supply. The DTMF receiver used (mt8870) requires 5v D.C. so design of these regulated power supply is also an important part in hardware design. The A.C power supply from mains is taken and regulated using the rectifiers. For design of a regulated power supply components used are:

- Transformer.
- Diodes.
- Rectifiers.
- Regulated IC chips.
- Capacitive filters.

Trans former:

A transformer is required to couple the mains to the actual power supply circuit. This is required to isolate the mains from the actual regulated power supply circuit and the other part of the kit. This isolation eliminates the dame of the kit to any power supply variations or from a faulty shock.

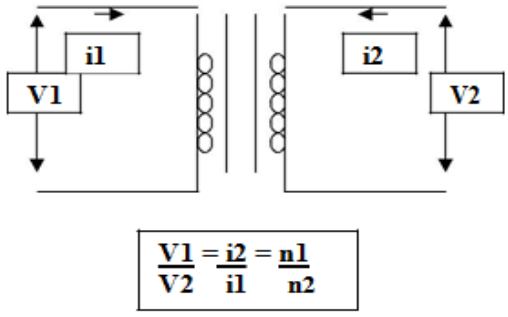

Fig.2.3.3 Transformer

Diodes:

In bride rectifier four diodes are used. The specifications of diodes are chosen as:

PIV > input voltage. Si diode is better.

Power dissipation is kept fixed with respect to current through the diode. Junction capacitance need not be considered for frequencies kHz.

RECTIFIERS:

Rectification is a process of conversion of AC to DC. Here, the AC of Transformer output is given to the rectifier input, which converts it to DC Output. Basically, bridge rectifiers or diodes arranged in bridge called Diode Arrangements are used for power supply design.

A bridge rectifier makes use of four diodes in a bridge arrangement to achieve Full-wave rectification. This is a widely used configuration, both with Individual diodes wired

RA Journal of Applied Research
||Volume||3||Issue||01||Pages-809-815||Jan-2017|| ISSN (e): 2394-6709
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as shown and with single component bridges where The diode bridge is wired internally.

2.4Sensor

- IR circuit

This circuits has 2 stages: A transmitter unit and a receiver unit. The transmitters consist of an infrared led and its associated circuitry.

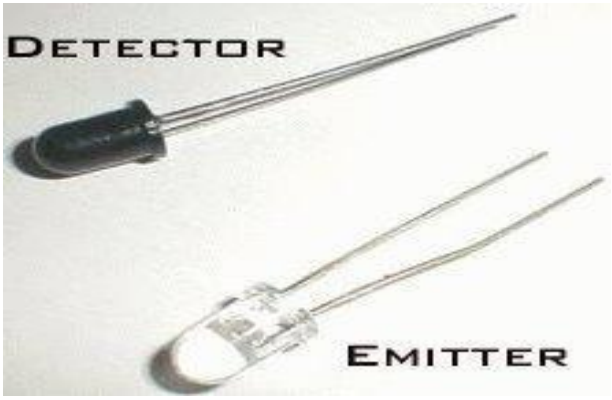

Fig 2.4 IR circuit

2.4.1 IR transmitter

An electroluminescent IR LED is a product which requires care in use. IR LEDs are fabricated from narrow band heterostructures with energy gap from 0.25 to 0.4 eV. Infra red transmitter emits IR rays in planar wave front manner. Even though Infrared rays spreads in all directions, it propagates along straight line in forward direction. IR rays have the characteristics of producing secondary wavelets when it collides with any obstacles in its path.

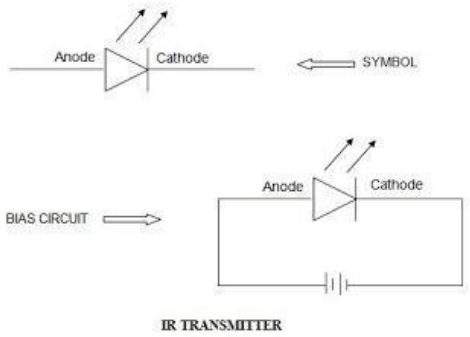

Fig: 2.4.1 IR circuit

When IR rays gets emitted from LED, it moves in the direction it is angled. When any obstacle interferes in the path, the IR rays get cut and it produces secondary wavelets which propagates mostly in return direction or in a direction opposite to that of the primary waves, which produces the net result like reflection of IR rays

2.4.2 IR receiver

Infrared photo receiver is a two terminal PN junction device, which operates in a reverse bias. It has a small transparent window, which allows light to strike the PN junction. A photodiode is a type of photo detector capable of converting light into either current or voltage, depending upon the mode of operation. Most photodiodes will look similar to a light emitting diode. They will have two leads, or wires, coming from the bottom. The shorter end of the two is the cathode, while the longer end is the anode.

A photodiode consists of PN junction or PIN structure. When a 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. Thus holes move toward the anode, and electrons toward the cathode, and a photocurrent is produced.

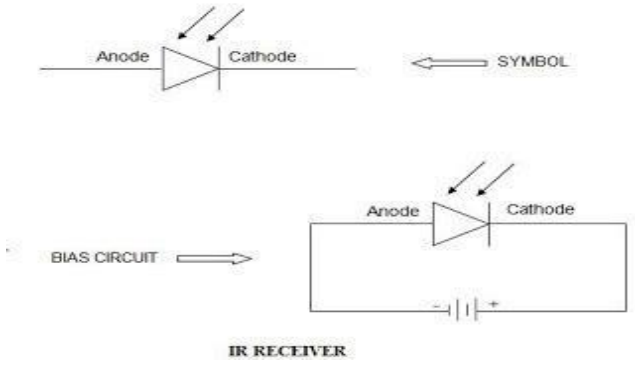

Fig: 2.4.2 IR receiver

2.5 Flexible wire

These cables have multi faceted role in our daily lives. These find application in Household Wiring, Industrial Wiring, Multipurpose / Temporary Wiring in the form of extension leads etc. as well as in appliances.

Fig: 2.5.1 flexible wire

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||Volume||3||Issue||01||Pages-809-815||Jan-2017|| ISSN (e): 2394-6709
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CHAPTER: 3

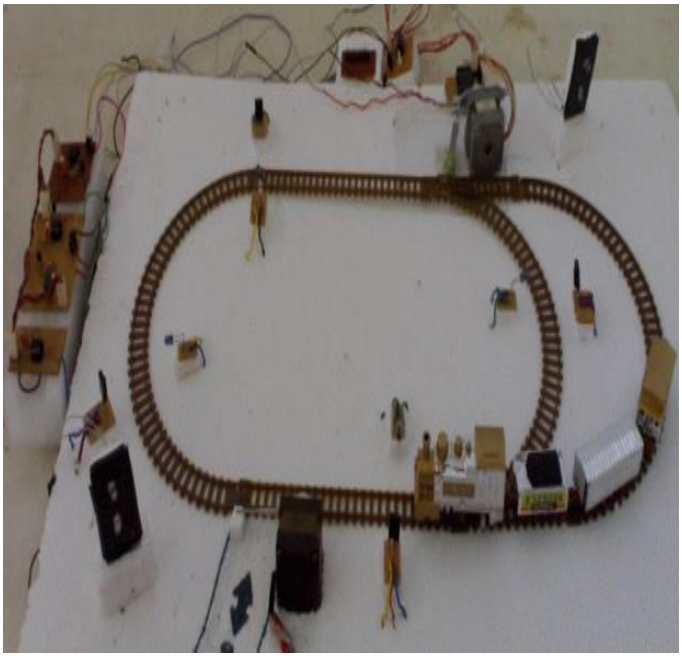
software system of automated railway crossing
Introduction:

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 Kiel 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.

Keil development tools for the 8051 Microcontroller Architecture support every level of software 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, Single-board Computers, and Emulators support all 8051 derivatives and help you get your projects completed on schedule We can use this software to run our task, first we will make program in C language. This program will use in this software to run our task.



CONCLUSION

The project work" Automatic Railway Gate Control", Now a days so many accidents are happen at railway gate because of manual control.

To avoid this severe accidents we have to change manual work to this latest technology (Automatic Railway Gate Control), we can avoid maximum number of accidents.

The limitation of this project is the use of IR sensors. Hence, any obstacle in the way of the sensor will be detected. Another important limitation is that this project does indeed close and open the gate but it cannot control the crossing of cars and vehicles.

It only controls the gate. To combat this problem pressure sensors can be used as extension to the present work.

We are using IR sensors but it is better to use load sensors. We have not used load sensors because it was not economically feasible. As a future scope of work, our system can be implemented in real time by fixing the current limitations using new technologies

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