GSM based Automatic Railway Gate control system with Real time Monitoring

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***Abstract*— The aim of this project is to establish railway gate in place of existing manual railway gate, to reduce maintenance expenditure, human mistake and accidents. More effectiveness necessary for improving safety. The proposed model has been designed using 8051microcontroller and GSM module to avoid railway accidents without man power. When the train reaches the sensors, the sensors can sends the signal to the micro controller and it activate the GSM module, it send the message to the another GSM module which is at the reception part. After receiving the signal to the micro controller it can activates the motors to close or open the gates. While designing the gates if there is any obstacle is obtain it can give the intimation, which we can be averaged the buzzer. Again it starts working when the train passes over the station automatically the gates will be opened.**

***Index Terms*— Automatic Railway gates, level crossing, sensors, 8051micro controller, GSM modules, motor.**

I. INTRODUCTION

Railroad is one of the transient mode which has an important role in moving passengers and freights. However railroad accidents are more dangerous than other transportation accidents in terms of severity and death rate etc. Now-a-days India is the country which having world's largest railway network. Over hundreds of railway running on track every day. As we know that it is surely impossible to stop, the running train at instant is some critical situation or emergency arises. Train accidents having serious repercussions in terms of loss of human life injury, damage to railway property. This includes the collision of trains at level crossings. In our country it is a progressive country. It has already enough economical problems which are ever been unsolved. To avoid all these things some sort of automatic and independent system comes. There are mainly two types of level crossings. They are manned level crossings and unmanned level crossings.

Railways being the cheapest mode of transportation are preferred over all the other means. When we go through the daily newspaper we come across many railway crossings. This is mainly due to carelessness in manual operations or lack of workers. Using simple electronic components we have tried out to automatic control of railway gates.

II. LITERATURE SURVEY

When the train was passed in one station then the information will comes to the station master by the phone the gateman will receive the call and then gates will be closed[1].To overcome problem of [1] Sensor technology is used[2].The two sensors are placed on both side of the gate upside and downside of the train direction with some distance like one sensor is place 5km distance from the gate for coming side of gate and another is placed at 1km from the gate. sensors are fixed both sides of the gate when the upside sensor gates activated the sensor gates activated thee sensed signal is sent to the microcontroller and the gates to be closed until the train crosses the gates and reaches after down sensor .when the down sensor activates the signal departures is sent to microcontroller motor turns is opposite direction and gates will be opened automatically. The disadvantage is when any person is moving at that place the gate is closed. To overcome this problems[2] by using IR Sensor and microcontroller. The two sensors are placed on either side of the gate to magnet sensors is fixed at upside and downside of the train direction. sensors are fixed both sides of the gate when the upside sensor gates activated the sensor gates activated thee sensed signal is sent to the microcontroller and the gates to be closed until the train crosses the gates and reaches after down sensor .when the down sensor activates the signal departures is sent to microcontroller motor turns is opposite direction and gates will be opened automatically [3].

III. PROPOSED METHOD

In proposed method GSM modules & IR sensor are used for railway gate controlling and Realtime monitoring of vehicles. In this proposed method we don't need man power and also we decreases the railroad related accidents with less money. The Transreceivers of GSM module used proposed block diagrams are shown in below.

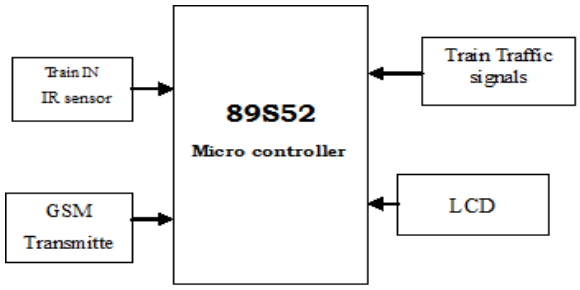


Diagram for Transmitter Section

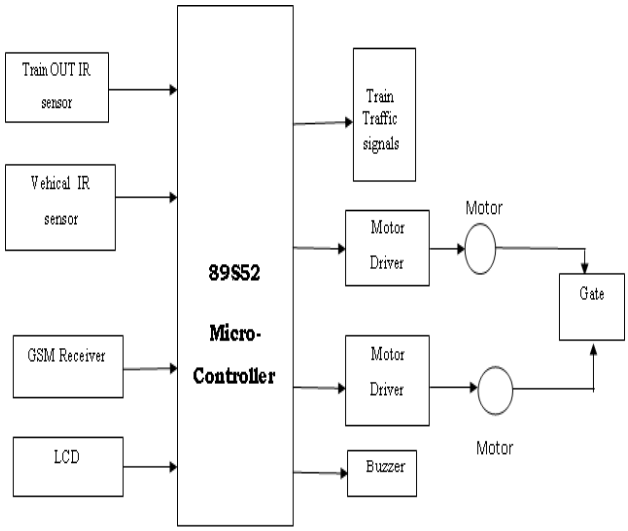


Diagram for Receiver Section

A. *GSM Transreciver*

GSM (or Global System for Mobile Communications) was developed in 1990. The first GSM operator has subscribers in 1991, the beginning of 1994 the network based on the standard, already had 1.3 million subscribers, and the end of 1995 their number had increased to 10 million!There were first generation mobile phones in the 70's, there are 2nd generation mobile phones in the 80's and 90's, and now there are 3rd gen phones which are about to enter the Indian market. GSM is called a 2ndgeneration, or 2G communications technology.In this project it acts as a SMS Receiver and SMS sender. The GSM technical specifications define the different entities that form the GSM network by defining their functions and interface requirements.

what is gsm

Global system for mobile communication (gsm) is a set of etsi standards specifying the infrastructure for a digital cellular service. The standard is used in approx. 85 countries in the world including such locations as europe, japan and Australia.

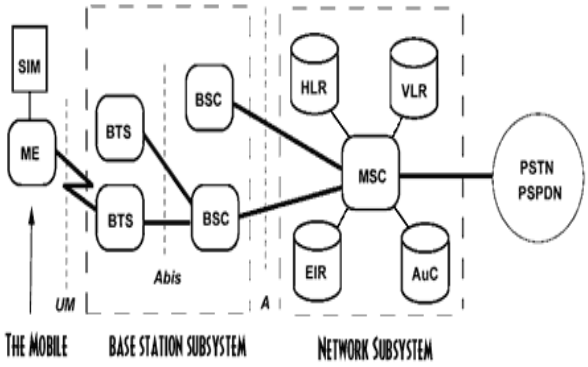
Gsm architecture

The GSM technical specifications define the different elements within the GSM network architecture. It defines the different elements and the ways in which they interact to enable the overall system operation to be maintained. The GSM network architecture is now well established and with the other later cellular systems now established and other new ones being deployed, the basic GSM network architecture has been updated to interface to the network elements required by these systems. Despite the developments of the newer systems, the basic GSM system architecture has been maintained, and the network elements described below perform the same functions as they did when the original GSM system was launched in the early 1990s.GSM network architecture elements

The GSM network architecture as defined in the GSM specifications can be grouped into four main areas:

- Mobile station (MS)
- Base-Station Subsystem (BSS)
- Network and Switching Subsystem (NSS)
- Operation and Support Subsystem (OSS)

A basic diagram of the overall GSM system architecture with the four major elements is shown below:



GSM Architecture

Practical circuit of GSM module

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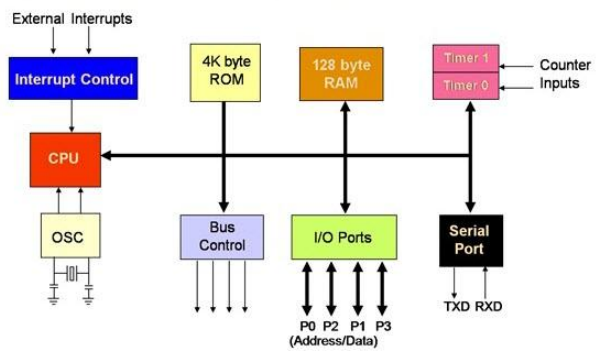
B. 8051 Microcontoller

A micro-controller can be compared to a small stand alone computer, it is a very powerful device, which is capable of executing a series of pre-programmed tasks and interacting with other hardware devices. Being packed in a tiny integrated circuit (IC) whose size and weight is usually negligible, it is becoming the perfect controller for robots or any machines requiring some kind of intelligent automation. Any microcontroller contains a memory to store the program to be executed, and a number of input/output lines that can be used to interact with other devices, like reading the state of a sensor or controlling a motor.

Nowadays, microcontrollers are so cheap and easily available that it is common to use them instead of simple logic circuits like counters for the sole purpose of gaining some design flexibility and saving some space. Some machines and robots will even rely on a multitude of microcontrollers, each one dedicated to a certain task. Most recent microcontrollers are 'In System Programmable', meaning that you can modify the program being executed, without removing the microcontroller from its place. Today, microcontrollers are an indispensable tool for the robotics hobbyist as well as for the engineer.

Microcontroller Architecture



It is a 8 bit microcontroller. It has 256 bytes internal memory. In that 128 bytes are used for saving of general instructions like Register banks, 16-bit addressable registers, general registers. Another 128 bytes are used for special function registers like TL0, TL1, ACC, B, PCON, SCON, buffers and etc. There are different addressing modes

Immediate addressing

Immediate addressing is so named because the value to be stored in memory immediately follows the operation code in memory. That is to say, the instruction itself dictates what value will be stored in memory This instruction uses immediate Addressing because the accumulator will be loaded with the value that immediately follows in this case 20 (hexadecimal).immediate addressing is very fast since the value to be loaded is included in the instruction. However, since the value to be loaded is fixed at compile-time it is not very flexible. Although the DPTR register is 16-bit, it can also be accessed as two 8-bit registers, DPH and DPL, where DPH is the high byte and DPL is the low byte. Although the DPTR register is 16-bit, it can also be accessed.

Direct Addressing

Direct addressing is so named because the value to be stored in memory is obtained by directly retrieving it from another memory location.This instruction will read the data out of internal RAM address 30(hexadecimal) and store it in the Accumulator. Direct addressing is generally fast since, although the value to be loaded.

Indirect Addressing

Indirect addressing is a very powerful addressing mode, which in many cases provides an exceptional level of flexibility. Indirect addressing is also the only way to access the extra 128 bytes of internal ram found on the 8052. Indirect addressing appears as

(SFR) Memory

special Function Registers (SFRs) are areas of memory that control specific functionality of the 8051's 32 input/output lines.Another SFRs allows the user to set the serial baud rate, control and access timers, and configure the 8051's interrupt system.

TIMER2 REGISTERS

Control and status bits are contained in registers T2CON and T2MOD for timer 2. The register pair (RCAP2H, RCAP2L) are the capture/reload registers for timer 2 in 16-bit capture mode or 16-bit auto-reload mode.

Program Counter and Data Pointer

The 89C52 contains two 16-bit registers: the program counter (PC) and the data pointer (DPTR), Each is used to hold the address of a byte in memory. The PC is the only register that does not have an internal address.

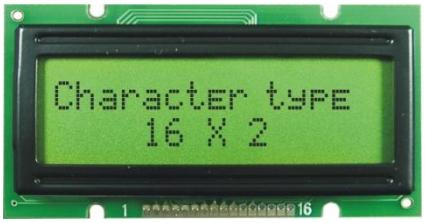
Interrupt Registers

The individuals interrupt enable bits are in the IE registers. Two priorities can be set for each of the six interrupt sources in the IP register. Interrupt register consists of two 8-bit registers. Function, the TL2 register is incremented every machine cycle.

For working purpose of any microcontroller VCC and Ground is important. Here 5V power supply is used. To do works in microcontroller we dump a program in to the microcontroller using RS 232 through transmitter and Receiver of MP. Here microcontroller works with a oscillation frequency is 11.0578MHz. For this generation of frequency here we are used crystal oscillator with two 0.033pf capacitors.

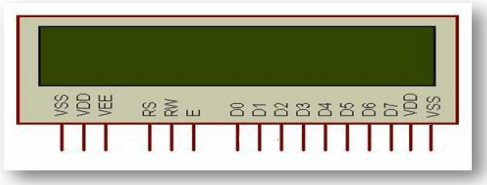
C. LCD (Liquid crystal Display)

LCD are used to display ASCII characters, special characters and graphics. LED is not indicate like this. An LCD can display all the above characters easily. The interfacing is relatively easy because refreshing of all the characters is done automatically by refreshing the controller circuit present in the LCD modules. They are commonly available in 16x1, 20x1, 20x2, 20x4 sizes. The first number indicates characters in a line and second number is number of lines in a display module.



16x2 LCD Module

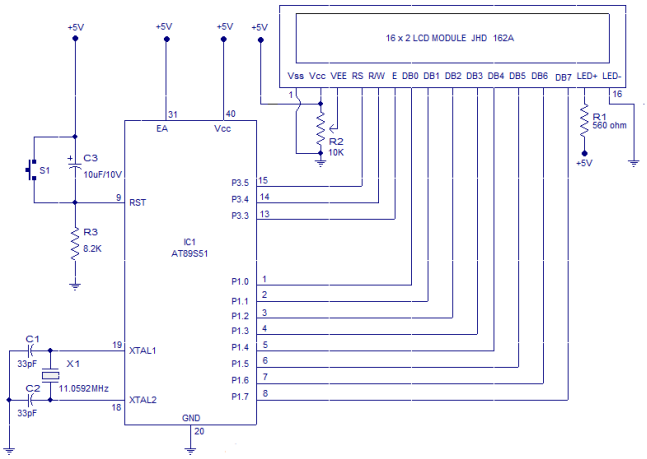
LCD modules usually have 14 pins. These pins are described below figure.



Pin representation of LCD

In the above figure Vcc and Vss are supply pins and VEE (Pin no.3) is used for controlling LCD contrast. Pin No.4 is Rs pin for selecting the register, there are two very important registers are there in side the LCD. The RS pin is used for their selection as follows. If RS=0, the instruction command code register is selected, allowing the user to send data to be displayed on the LCD. R/W is a read or writes Pin, which allows the user to write information to the LCD or read information from it. R/W=1 when reading R/W=0 when writing.

The LCD to latch information presented to its data pins uses the enable (E) pin. The 8-bit data pins, D0-D7, are used to send information to the LCD or read the contents of the LCD's internal registers. To display letters and numbers, we must send ASCII codes for the letters A-Z, and number 0 -9 to these pins while making RS=1. Interfacing of LCD to Microcontroller is shown in figure.

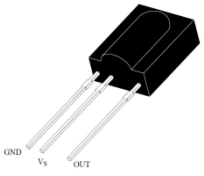


Interfacing of LCD to 89s51

D. IR Sensor

IR transceiver is used here for determining the arrival and departure of train. This is done by using IR Transceiver in which presence of train is detected as logical zero. The Infrared Emitting Diode (IR333/H0/L10) is a high intensity diode, molded in a blue. An infrared sensor is an electronic device that emits and/or detects infrared radiation in order to sense some aspect of its surroundings. Infrared sensors can measure the heat of an object, as well as detect motion. Many of these types of sensors only measure infrared radiation, rather than emitting it, and thus are known as passive infrared (PIR) sensors.

In a typical infrared sensor like a motion radiation enters the front and reaches the sensor itself at the center of the device. This part may be composed of more than one individual sensor, each of them being made from pyro electric materials, whether natural or artificial. These are materials that generate an electrical voltage when heated or cooled.



IR sensor

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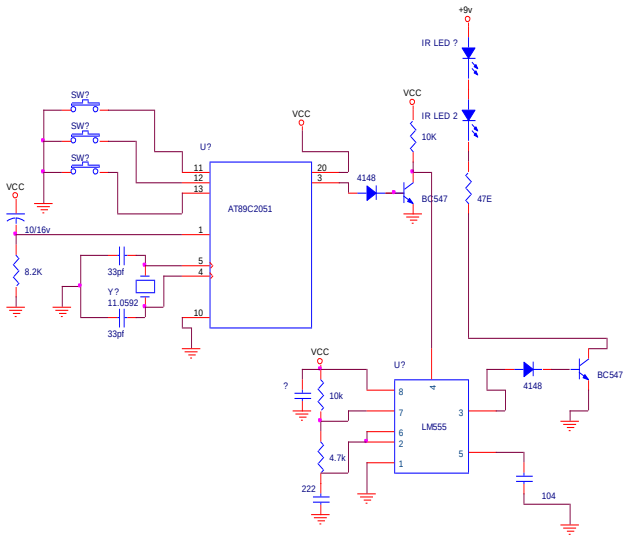
IR Transmitter

The device is spectrally matched with phototransistor, photodiode and IR receiver module. It finds applications in IR units, smoke detectors, free air transmission systems etc. The program written in the micro controller gets the data from the port pin transfers appropriate code to the serial buffer 89c52. The serial buffer transmits the data to the receiver unit via TXD pin of the micro controller with the following parameter the transmission speed is 300bps,

IR modulator

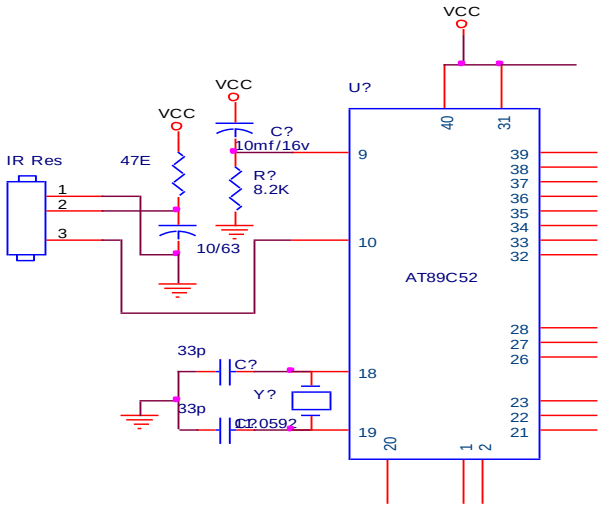
The IR modulator is an Astable multivibrator generates 35 KHz frequency while receiving a bit0 from the TXD pin of the micro controller. By receiving bit1 at pin4 i.e. RST of 555. The data from TXD pin of micro controller is inverted with the help of BC547 transistor. Ultimately bit0 at the TXD pin of the micro controller generates 35 KHz IR frequencies, the frequency is emitted by the IR LED with the help of BC547 driver transistor, and its base is connected to 555 output.



Interface IR transmitter to 89s52

IR Receiver

The IR LED converts the incident IR radiations to an equivalent electric current which when passed through a resistor results in a certain amount of voltage drop. This value of voltage will depend upon the intensity of incident IR radiations or in other words, the distance between IR transmitter and receiver. The receiver is connected in reverse bias the circuit.



Interface IR Receiver to 89s52

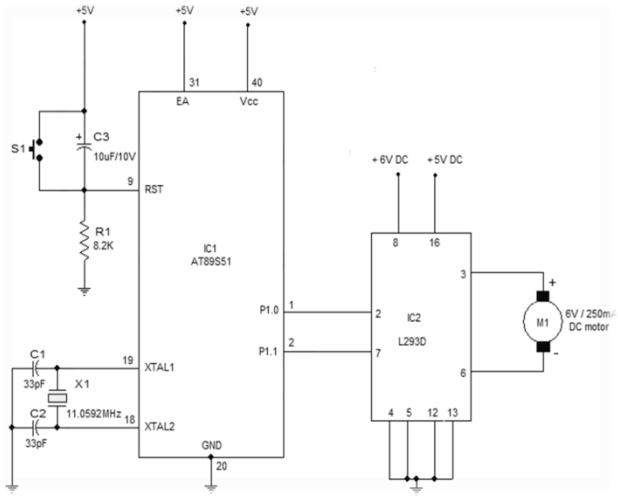
E. Motor circuit

Almost every mechanical movement that we see around us is accomplished by an electric motor. Motors take electrical energy and produce mechanical energy.

A direct current (DC) motor is a fairly simple electric motor that uses electricity and a magnetic field to produce torque, which causes it to turn. At its most simple, it requires two magnets of opposite polarity and an electric coil, which acts as an electromagnet. The repellent and attractive electromagnetic forces of the magnets provide the torque that causes the motor to turn.

Principle of operation

This DC or direct current motor works on the principal, when a current carrying conductor is placed in a magnetic field, it experiences a torque and has a tendency to move. This is known as motoring action.



Interfacing of motor to 89s52

If the direction of current in the wire is reversed, the direction of rotation also reverses. When magnetic field and electric field interact they produce a mechanical force, and based on that the working principle of dc motor established.

IV. METHODOLOGY

Present project is designed using 8051 microcontroller to avoid railway accidents happening at unattended railway gates, if implemented in spirit.

In this project two GSM modules are used to checking the result purpose. One GSM module is placed at railway signal pole. That pole is placed 5km far away from the railway gate. Suppose the train crosses the railway signal pole the sms is transmitted to the GSM receiver. This is done by the process is we are placed a IR sensor at the signal pole, so when train crosses the signal pole IR sensor circuit activated it sends the signal to microcontroller. The microcontroller activate the GSM module and GSM module send message to given numbers.

Another GSM module is placed at the railway gate. When a message received GSM receiver module, the signal given to the microcontroller. The microcontroller in continuous monitoring situation, if the signal is receiving or not. If signal is received it activates the interfacing components like as motor, IR sensors. Upto the signal not received the motors and IR sensors not in working conditions.

Now, the signal received then microcontroller activates the motors and IR sensors. Motor is running in clock wise direction. So, the gate is closing situation. Here we are represents real time monitoring system that is monitoring of vehicles using IR Transreceivers. When any obstacle is occurred during the railway gate is down in position, the gate will pause one second. If train is crosses the railway gate the gates are automatically open using train out IR sensor circuit.

V. CONCLUSION

From the above discussion and information of this system we, upto now surely comes to know that it is highly reliable effective and economical at dense traffic area, sub urban area and the route where frequency of trains is more.

As it saves some auxiliary structure as well as the expenditure on attendant it is more economical at above mentioned places than traditional railway crossing gate system. We know that though it is very beneficial but it is also impossible to install such system at each and every places, but it gives certainly a considerable benefit to us, thereby to our nation.

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