AUTOMATIC RAILWAY GATE CONTROLLER

MINI PROJECT REPORT

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ABSTRACT

The aim of this project is to design an automatic railway gate controller using microcontroller. This mainly aims at preventing accidents at unmanned level crossings where large many accidents take place everyday.

The automatic railway gate controller makes use of two sensors placed at both sides of the gate placed at a particular distance. The sensor detects the arrival of train and sends signal to the microcontroller to close the gate and similarly the sensor at the other end detects the departure of the train and sends signal to the microcontroller to open the gate again for public use.

The usage of this automatic railway gate controller using microcontroller will largely reduce the accidents at unmanned level crossings and provide immense safety. This report deals with the designing and operation of this automatic railway gate controller.

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INTRODUCTION

At present scenario, in level crossings, the railway gate is operated normally by a gatekeeper after receiving the information about the train's arrival. When a train starts to leave a station, station master of the particular station delivers the information to the near by gate. The above said procedures are followed for operating the railway gates.

Semiautomatic railway gate operation is also followed in certain areas. Signals are located in the vicinity of the railway gate along with gate master board and a marker light. Our paper deals with automatic railway gate control (i.e.) gate operated with out gate keepers. It is implemented in unmanned level crossings at remote areas.

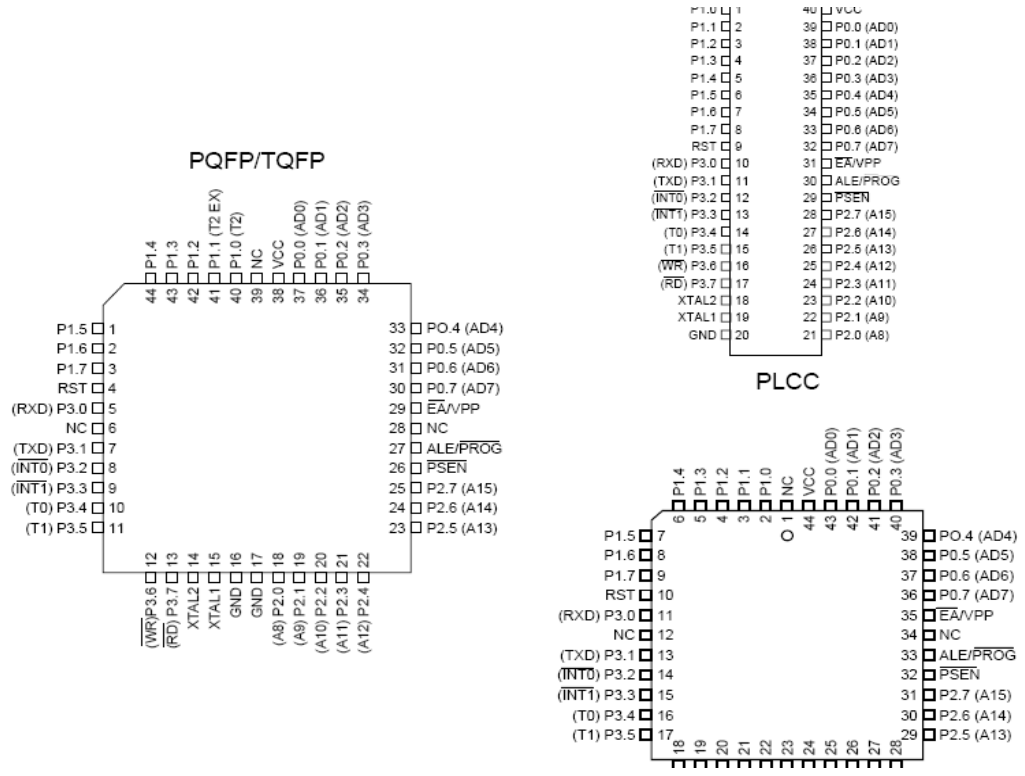
PRINCIPLE OF OPERATION

The arrival of train is detected by the sensor placed on either side of the gate at about 5km from the level crossing. Once the arrival is sensed , the sensed signal is sent to the microcontroller and it checks for possible presence of vehicle between the gates, again using sensors. Once, no vehicle is sensed in between the gate the motor is activated and the gates are closed. When no obstacle is sensed GREEN light is indicated, and the train is to free to move.

The departure of the train is detected by sensors placed at about 1km from the gate. The signal about the departure is sent to the microcontroller, which in turn operates the motor and opens the gate.

MICROCONTROLLER -89C51

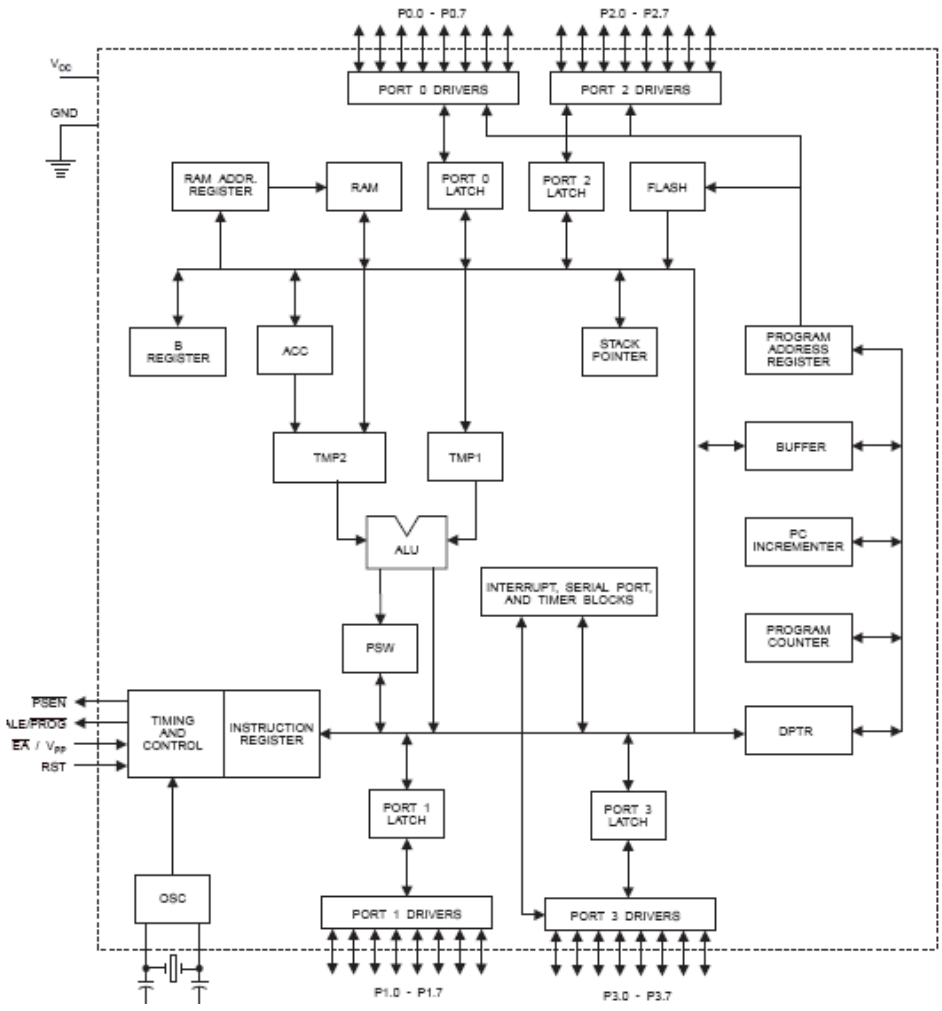
AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density nonvolatile memory technology and is Compatible with the industry-standard MCS-51 instruction set and pin 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.



The AT89C51 provides the following standard features: 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, two 16-bit timer/counters, a five vector

two-level interrupt architecture, a full duplex serial port, on-chip oscillator and clock circuitry. In addition, the AT89C51 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.

Block Diagram



Pin Description

VCC

Supply voltage.

GND

Ground.

Port 0

Port 0 is an 8-bit open-drain bi-directional I/O port. As an output port, each pin can sink eight TTL inputs. When 1s are written to port 0 pins, the pins can be used as high impedance inputs. Port 0 may also be configured to be the multiplexed lowered address/data bus during accesses to external program and data memory. In this mode P0 has internal pull-ups. Port 0 also receives the code bytes during Flash programming, and outputs the code bytes during program verification. External pull-ups are required during program verification.

Port 1

Port 1 is an 8-bit bi-directional I/O port with internal pull-ups. The Port 1 output buffers can sink/source four TTL inputs. When 1s are written to Port 1 pins they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 1 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. Port 1 also receives the low-order address bytes during Flash programming and verification.

Port 2

Port 2 is an 8-bit bi-directional I/O port with internal pull-ups. The Port 2 output buffers can sink/source four TTL inputs. When 1s are written to Port 2 pins they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 2 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. Port 2 emits the high-order address

byte during fetches from external program memory and during accesses to external data memory that uses 16-bit addresses (MOVX @ DPTR). In this application, it uses strong internal pull-ups when emitting 1s. During accesses to external data memory that use 8-bit addresses (MOVX @ RI), Port 2 emits the contents of the P2 Special Function Register.
Port 2 also receives the high-order address bits and some control signals during Flash programming and verification.

Port 3

Port 3 is an 8-bit bi-directional I/O port with internal pull-ups. The Port 3 output buffers can sink/source four TTL inputs. When 1s are written to Port 3 pins they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 3 pins that are externally being pulled low will source current (IIL) because of the pull-ups. Port 3 also serves the functions of various special features of the AT89C51 as listed below: Port 3 also receives some control signals for Flash programming and verification.

RST

Reset input. A high on this pin for two machine cycles while the oscillator is running resets the device.

ALE/PROG

Address Latch Enable output pulse for latching the low byte of the address during accesses to external memory. This pin is also the program pulse input (PROG) during Flash programming. In normal operation ALE is emitted at a constant rate of 1/6 the oscillator frequency, and may be used for external timing or clocking purposes. Note, however, that one ALE

Port Pin Alternate Functions

P3.0 RXD (serial input port)

P3.1 TXD (serial output port)

P3.2 INT0 (external interrupt 0)

P3.3 INT1 (external interrupt 1)

P3.4 T0 (timer 0 external input)

P3.5 T1 (timer 1 external input)

P3.6 WR (external data memory write strobe)

P3.7 RD (external data memory read strobe)

PSEN

Program Store Enable is the read strobe to external program memory. When the AT89C51 is executing code from external program memory, PSEN is activated twice each machine cycle, except that two PSEN activations are skipped during each access to external data memory.

EA/VPP

External Access Enable. EA must be strapped to GND in order to enable the device to fetch code from external program memory locations starting at 0000H up to FFFFH. Note, however, that if lock bit 1 is programmed, EA will be internally latched on reset. EA should be strapped to VCC for internal program executions. This pin also receives the 12-volt programming enable voltage (VPP) during Flash programming, for parts that require 12-volt VPP.

XTAL1

Input to the inverting oscillator amplifier and input to the internal clock operating circuit.

XTAL2

Output from the inverting oscillator amplifier.

Oscillator Characteristics

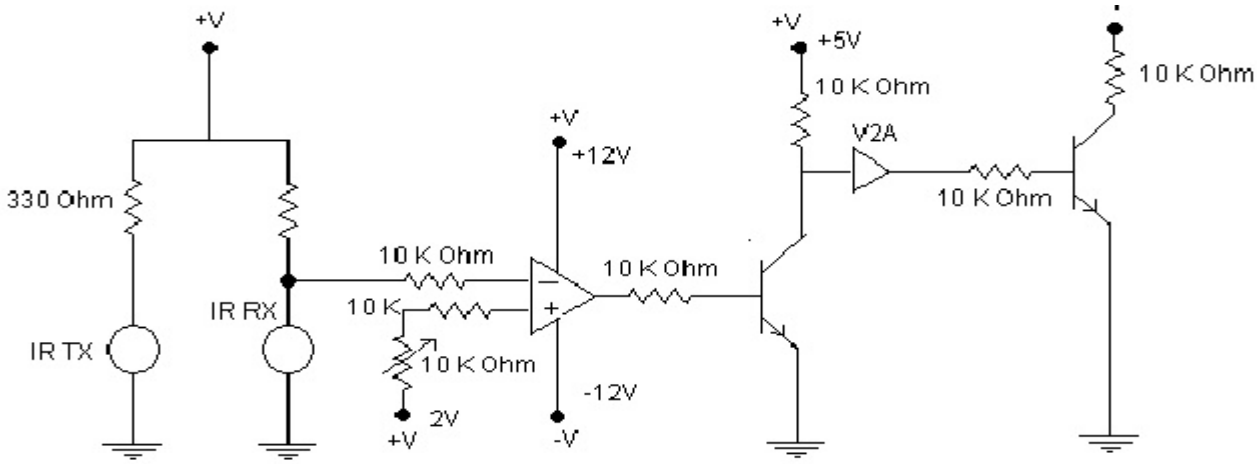
XTAL1 and XTAL2 are the input and output, respectively, of an inverting amplifier which can be configured for use as an on-chip oscillator. Either a quartz crystal or ceramic resonator may be used. To drive the device from an external clock source, XTAL2 should be left unconnected while XTAL1 is driven. There are no requirements on the duty cycle of the external clock signal, since the input to the internal clocking circuitry is through a divide-by-two flip-flop, but minimum and maximum voltage high and low time specifications must be observed.

Idle Mode

In idle mode, the CPU puts itself to sleep while all the on chip peripherals remain active. The mode is invoked by software. The content of the on-chip RAM and all the special functions registers remain unchanged during this mode. The idle mode can be terminated by any enabled interrupt or by a hardware reset. It should be noted that when idle is terminated by a hard ware reset, the device normally resumes program execution, from where it left off, up to two machine cycles before the internal reset algorithm takes control. On-chip hardware inhibits access to internal RAM in this event, but access to the port pins is not inhibited. To eliminate the possibility of an unexpected write to a port pin when Idle is terminated by reset, the instruction following the one that invokes Idle should not be one that writes to a port pin or to external memory.

OPERATION

IR SENSING CIRCUIT:



Infra red transmitter sensor gives the infra red rays, this wavelength depends upon the input frequency of the sensor. If frequency is high, wavelength is high .IR receiver sensor resistance depends upon the receiving IR signal. if receiver receives signal from transmitter, the resistance of the resistor will be low .If receiver does not get signal from the transmitter, its resistance will be high .so we get some voltage drop across the receiver depends on the resistance of the receiver.

Comparator compares the signal given to the inverting and non inverting terminal ,it will give output in terms of saturation level .if inverting terminal input is high ,then comparator output will be at negative saturation(-12v).if noninverting terminal input ,comparator output saturation is positive(+12v).one input of comparator is from IR sensor and other input is reference signal . So we have to convert +12v to -12v pulse into TTL logic

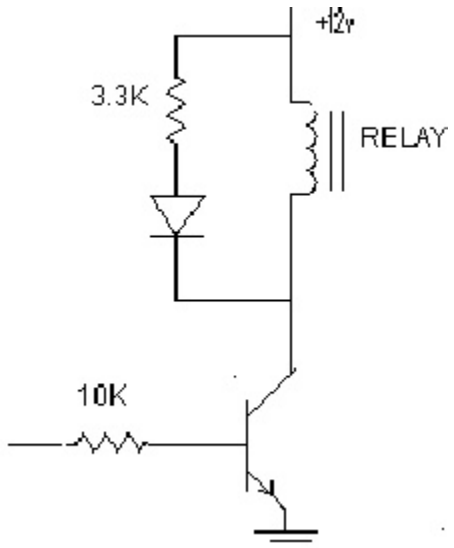
TRANSMITTER

Output from IR section is fed to FM transmitter. In FM transmitter ,reactance modulator operates on tank circuit of LC oscillator .it is isolated from the buffer ,whose output goes through an amplitude limiter to power amplification by power amplifier .a fraction of output is taken from limiter and is fed to a mixer ,which also receives signal from crystal oscillator resulting from different signal ,which has the frequency usually about one twentieth of the master oscillator frequency ,is amplified and fed to phase discriminator. Its output is connected to reactance modulator and provides DC voltage to correct it automatically any drift in average frequency of master oscillator.

RECIEVER

RF amplifier is always used in FM receiver. Its main purpose is to reduce noise figure, which could otherwise be a problem because of large bandwidth needed for FM .RF section tunable circuit is connected to antenna terminals. It is there to select the wanted frequency and reject all other unwanted frequencies. An amplifier output is fed to the mixer at whose input at another tunable circuit is present. The mixer is the non linear device having two sets of input terminals and one set of output terminals nonlinear circuit will have several frequencies in its output, including the difference between the two input frequencies. The difference frequency here is the IF and is the one to which output circuit of the mixer is tuned.

RELAY CIRCUIT



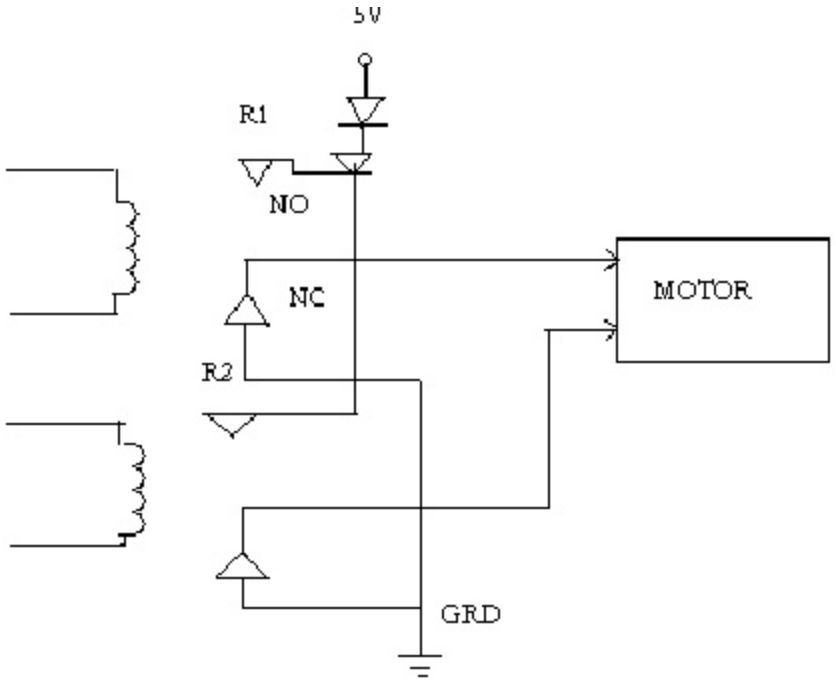
A relay is switch worked by electromagnet .it is useful if we want a small current in one circuit to control another circuit containing a device such as lamp or electric motor which requires a large current or if we wish several differential switch contacts to be operated simultaneously. There are two types of relays

1) normally closed
2) noemally opened

We are using normally opened type relay. When controller output from the PC is high, transistor will be in ON state, so relay is energized in the reverse condition relay is deenergized.

MOTOR OPERATION

Railway gate is automatically operated by means of a motor obtains the voltage from the regulated power supply .forward and reverse operation of the motor is achieved by changing the polarity of armature terminals and hence the closing and opening operations of motor can be achieved.



Forward and reverse operation of the motor is achieved by using two electromagnetic relays. Electromagnetic relays contain an electromagnet and moving part .the relay coils act as electro magnet and there are three terminals namely normally open, commonly and normally closed. When the relay is energized an actuating quantity exceeds a certain determined value, anoperating torque is developed which is applied on the ring part .The causes the moving partto travel and to finally close the contact.

PROCEDURE OF WORKING

INITIAL SIGNAL DISPLAY:

Signals are placed near gate each at a specified distance. Train may be approaching gate at either direction so all four signals are made RED initially to indicate gate is OPENED and vehicles are going through gate. The road user signals are made GREEN so that they freely move through gate.

ARRIVAL DETECTION:

Detection of train approaching the gate can be sensed by means of sensors R1, R2, R3&R4 placed on either side of the gate. In particular direction of approach, R1 is used to sense the arrival; R3 is used to sense the departure of the train. In the same way R4&R2 senses arrival and departure in the other direction. Train arrival and departure sensing can be achieved by means of relay technique. A confined part of parallel track is supplied with positive voltage and ground. As wheels of the train, is made up of aluminium which is a conducting material, it shorts two parallel tracks. When the wheels of the train moves over it, both tracks are shorted to ground and this acts as a signal to microcontroller (89C51) indicating train arrival. The train detection in the other direction is done in the same way by the sensors R1 & R4. These sensors are placed five kilometers before the gate.

GATE CLOSING OPERATION:

Once micro controller senses that there is no vehicle inside, it automatically produces signal to operate motor through relay circuit and hence close the gate for passage of train.

TRAIN DEPARTURE DETECTION:

Detection of train is also done using relay techniques as explained the head of trainarrival detection. Sensor R3&R2 respectively considering direction of train approach do traindeparture

GATE OPENING OPERATION:

Once micro controller senses that there is no vehicle inside, it automatically produces signal to operate motor through relay circuit and hence open the gate for passage of road vehicles.

APPLICATIONS

The automatic railway gate controller thus can be used in unmanned level crossings to reduce the occurrence of accidents. Since the design is completely automated it can be used in remote villages where no station master or line man is present. Also it saves lot of time as it is automated whereas manual systems take time for the line man to inform the station master to close and open the gate which will consume a considerable amount of time. Also since it is completely automated there are very less chances for errors to occur. Thus this design finds its applications in many cases.

REFERENCES

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