AUTOMATIC RAILWAY GATE CONTROL
USING MICROCONTROLLER

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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.) implemented in unmanned level crossings at remote areas. Detection of train approaching the gate can be sensed by means of four sensors placed on either side of the gate.

Train arrival and departure sensing can be achieved by means of Relay techniques. When the wheels of the train moves over, both tracks are shorted to ground and this acts as a signal to microcontroller (89C51) indicating train arrival. RED signal appears for the road user, once the train cuts the relay sensor placed before the 5Kms before the gate .A buzzer is made on as a pre cautionary measure for the road users.

Once micro controller senses that there are no vehicles inside, it automatically produces signal to operate motor through relay circuit and hence close the gate for passage of train. This can be implemented in manned level crossings also, as manual errors can be eliminated by automation.
INTRODUCTION:

At present scenario, in level crossings, the railway gate is operated normally by a gate keeper 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 without gate keepers. It is implemented in unmanned level crossings at remote areas.

SCHEMATIC DIAGRAM:

The arrival of the train to reach the level crossing is sensed by the sensor R1/R2 placed on either side of the gate at about 5 km from the level crossing. So the arrival is sensed by the either side of the sensor and then the sensed signal is sent to the microcontroller.

First we are calculating the velocity of the train by using IR sensor fixed in particular distance. Two set of IR sensors are placed before the gate. When the first set of IR sensor is interrupted we have to start the times and second set of IR sensor is interrupted we have to

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stop the times. By calculating this time we have to find the velocity of train using formula:

\[ V = \frac{\text{distance}}{\text{time}} \]

So we are find out when the train will reach the gate, then signal use given to the motor to close gate. Before closing of gate, buzzer indication is given to the load user. A light signal is also placed additionally on either side of the gate and the addition warning to the load user indicating the closure of the gates. The departure of the train is detected by sensors R3/R4 which is about a km from the gate. The signal about the departure of the train is send to the microcontroller which operates the motor and opens the gate across the level crossing.

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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 (0&5).

BLOCK DIAGRAM-TRANSMITTER:

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OPERATION:

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 automatically any drift in average frequency of master oscillator.

RECEIVER:

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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.

The limiter is inform of clipping devices, a circuit output tends to remain constant despite changes in the input signal. Output from the receiver is fed to microcontroller.

RELAY CIRCUIT:

![Relay Circuit Diagram]

DESCRIPTION:

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. Normally opened

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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.

CIRCUIT DIAGRAM:

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, an operating torque is developed which is applied on the ring part. The causes the moving part to travel and to finally close the contact.

TRANSCEIVER:

74LS47 is 3 state octal receiver, which is actually a latch used as buffer for connecting 7 segment to parts of microcontroller.

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FEATURES:
Octal bidirectional bus interface.
3 state buffer output.
PNP input for loading.
Hysteresis losses on all data inputs.

SPECIFICATIONS:
- Propagation delay: 8ms
- Total supply current: 58mA

DESCRIPTION:
OPERATION OF WORKING MODEL:
Railway gates are normally classified according to the no of train vehicles units (TVU) which is the number of trains run.

GATE CLASSIFICATION:
A class- more than 50000 or lakh TV mainly on high ways.
B class- less than 50000 but above 10000 TVU.
C class- less than 10000TVU.
D class- unimportant gates.

Normally in level crossings, the railway gate is operated normally by a gate keeper 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 operation (i.e.) gate operated with out gate keepers. It is implemented in unmanned level crossings at remote areas.

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

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signals are made GREEN so that they freely move through gate. Buzzer is OFF since there is no approach of train and users need not be warned.

TRAIN 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 alluminium 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.

WARNING FOR ROAD USERS:
At that moment the train arrival is sensed on either of the gate, road users are warned about the train approach by RED signal placed to caution the road users passing through the gate. RED signal appears for the road user, once the train cuts the relay sensor placed before the 5Kms before the gate. A buzzer is made on as a pre cautionary measure for the road users and that nobody should enter the gate at that moment.

4. 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.

5. SIGNAL FOR TRAIN:
When path is clear, GREEN signal is produced for train, when there is any obstacle; signal is made RED for train in order to slow done its speed before 5km from gate.

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6. TRAIN DEPARTURE DETECTION:

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

FUTURE ENHANCEMENT:

In our technique though it has many merits, but still the power supply of 223V AC POWER is required for functioning of the motor. It can be avoided with the help of a battery charged by a Solar Cell. Since solar energy is an inexhaustible natural source of energy.

CONCLUSION:

The idea of automating the process of railway gate operation in level crossings has been undertaken. The response of which is the reduction of accidents within the gate. By this mechanism, gate keeper presence is not required. Microcontroller performs all the operations like sensing, software coding&closing e.t.c. The mechanism works on a simple principle and there is not much of complexity needed in the circuit.

APPENDIX

ALGORITHM:

1. Start
2. Set the variables
3. Make initial settings of the signals for the train and road users
4. Check the arrival of the train in either direction by the sensors .if train is sensed go to STEP5, otherwise repeat STEP4.
5. Make the warning signal for the road users and set the signal for train.
6. Close the gate and stop the buzzer warning
7. Change the signal for train.
8. Check the train departure by the sensors, if the train sensed goes to STEP10, otherwise go to STEP8.
9. Open the gate
10. Go to STEP3
11. Stop

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ASM PROGRAMME FOR AUTOMATIC RAILWAY GATE CONTROL

Org 0000

MOV P1, #00R
MOV SP, #50R
MOV Po, #00R
MOV a, #60d
SETb p3.0
SETb p3.1
SETb p3.2
SETb p3.3

LOOP: 

JB    p3.0, loop

JNB   p3.0, loqp
Ljmp ford
LOOP: 

JB    p3.1, loop1

JNB   p3.1, loop2
Ljmp revs
FORD  

1 call delay
1 call delay
1 call delay
Dec a
Mov ro, a
Ljmp returning, next
Mov a, #60d
1 jmp loop1
Next: jb p3.2, ford
Loop3: jnb p3.2, loop3
Mov b, #35d
Sub b a, b
Jnc loop4
1call htd
Mov a, #60d
1 jmp loop1

LOOP4: 

setb p1.2
2 call htd
2 call dell
2call close
Mov a, #60d

LOOP5: 

jb p3.1, loop5

LOOP6: 

jnb p3.1, loop6
Clr p1.2
2 call open
Mov p0, #00h
2jmp loop1

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REVS
2 call delay
2 call delay
2 call delay
Dec a
Mov ro, a
Cjne ro, #00h, next
Mov a, #60d
2jmp loop1

NEXT1: jb p3.3, revs

GOOP: jnb p3.3, goop
Mov b,#35d
Subb a, b
Jnc goop
2 call htd
Mov a, #60d
2jmp loop1
GOOP1: setb p1.2

2 call htd
2 call dell
2 call close
Mov a, #60d

GOOP3: jb p3.0, goop

GOOP4: jnb p3.0, goop4
Clr p1.2
2 call open
Mov p0, #00h
2jmp loop1

HTD: mov a, r0
Mov b, #64h
Div ab
Mov p2, a
Mov a, b
Mov b, #0ah
Div ab
Swap a
Orl a, b
Mov p0, a
Ret

DELAY: mov r7, #0FFh

GOO1: mov r6,#0FFh

GOO: djnz r6, goo
Djnz r7, gool

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CLOSE: setb p1.0
  Set p1.1
  1call delay
  1call delay
  1call delay
  1call delay
  1call delay
  Clr p1.0
  Clr p1.1

OPEN:  set p1.1
  Clr p1.0
  2call delay
  2call delay
  2call delay
  2call delay
  2call delay
  Clr p1.0
  Clr p1.1

DELL;  1call delay
  1call delay
  1call delay
  1call delay
  1call delay
  1call delay
  1call delay
  1call delay
  1call delay
  1call delay
  1call delay
  1call delay
  1call delay
  1call delay
  Ret

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