Automatic Railway Gate Controller by Using AT89C51

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Abstract

There are many railway crossings which are unmanned due to lack of manpower, needed to fulfill the demands. Hence, many accidents occur at such crossings, since there is no one to take care of the functioning of the railway gate when a train approaches the crossing. The objective of this paper is to manage the control system of railway gate using the microcontroller. The proposed model has been designed using IR and RF based circuit to avoid railway accidents occurring at unattended railway gates, if implemented detection of train approaching the gate can be sensed by means of two sensors placed on either side of the gate. In this paper we can provide the motor driver IC for gate control and LCD display to show the notifications, And also LEDs to indicate the signals [1]. As first sensor 1 interrupted RED signal indicate we required stopping vehicles, and gate is automatically closed. After cutting sensor 2 green signal indicating, that we can go and gate is automatically open.Our paper topic is to tell the importance of automatic railway gate control system [4]. In this paper, we detect the arrival of train and warn the road users about the arrival of train .If no obstacle is found a green signal is given for the train to pass, otherwise a red signal is given to slow down. After the obstacles are cleared, the gate is closed and train is passed .We will make sure that the train is passed and reopen the gate. The system deals with two things. Firstly, it deals with the reduction of time for which the gate is being kept closed. Secondly, to provide safety to the road users by reducing the accidents. In the automatic railway gate control system, 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 reduces the human labour.

Keywords: *Using IR and RF base circuit , Motor driver IC and LCD Display , LED to indicate the signals , first sensor interrupted RED signal indicate and second sensor found green signal.*

1. Introduction:

There are many railway crossings which are unmanned due to lack of manpower, needed to fulfill the demands. Hence, many accidents occur at such crossings, since there is no one to take care of the functioning of the railway gate when a train approaches the crossing [9]. The objective of this paper is to manage the control system of railway gate using the microcontroller. The proposed model has been designed using IR and RF based circuit to avoid railway accidents occurring at unattended railway gates, if implemented detection of train approaching the gate can be sensed by means of two sensors placed on either side of the gates.

In this paper, we can provide the motor driver IC for gate control and LCD display to show the notifications, And LEDs to indicate the signals. As first sensor 1 interrupted RED signal indicate we required stopping vehicles, and gate is automatically closed. After cutting sensor 2 green signal indicating, that we can go and gate is automatically open.

Our paper topic is to tell the importance of automatic railway gate control system. In this paper, we detect the arrival of train and warn the road users about the arrival of train .If no obstacle is found a green signal is given for the train to pass; otherwise a red signal is

given to slow down. After the obstacles are cleared, the gate is closed and train is passed .We will make sure that the train is passed and reopen the gate. The system deals with two things. Firstly, it deals with the reduction of time for which the gate is being kept closed. Secondly, to provide safety to the road users by reducing the accidents [4].

In the automatic railway gate control system, 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 reduces the human labour.

2. Related Work:

Our Paper is designed using AT89C51 microcontroller to avoid railway accidents happening at unattended railway gates. The paper utilizes two IR trans-receiver pair; one pair of IR trans-receiver is fixed at one side of the railway gate and similarly the other pair is fixed at the other side of the railway gate. In this paper we are providing the L293D motor driver IC for gate control i.e. opening and closing the gate and LCD display to show the notifications. And LEDs to indicate the signals that train is coming. As first sensor 1 interrupted RED signal indicate we required stopping vehicles, and gate is automatically closed using DC geared motor. After cutting sensor 2 green signal indicating, that we can go and gate is automatically opened also using DC geared motor [4].

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.

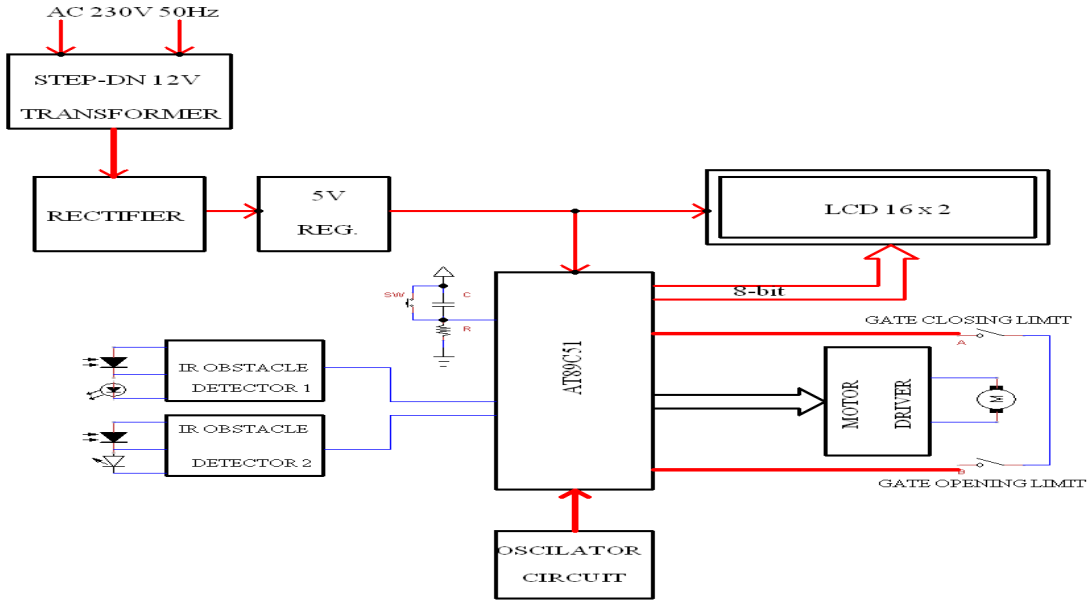

Fig 2.1 Block Diagram of "Automatic Railway Gate Ontroll"

The system model consists of the 230V 50Hz power supply which is given to the step down transformer of output voltage 12 volts. The output of step down transformer is given to LCD and the microcontroller AT89c51 through the rectifier and 5V resistor. An oscillator circuit is connected to the microcontroller AT89c51 as it is the requirement of the microcontroller we are using which provides an oscillator frequency [5]. Two IR obstacle sensors i.e. IR trans-receivers are connected as an input to the microcontroller AT89c51.And the microcontroller output is given to the LCD16x2 and the driver IC L293D.

This driver IC package will drive the DC geared motors to control the gate functioning. This gives the construction of the system model in next point we will see the actual working of the system.

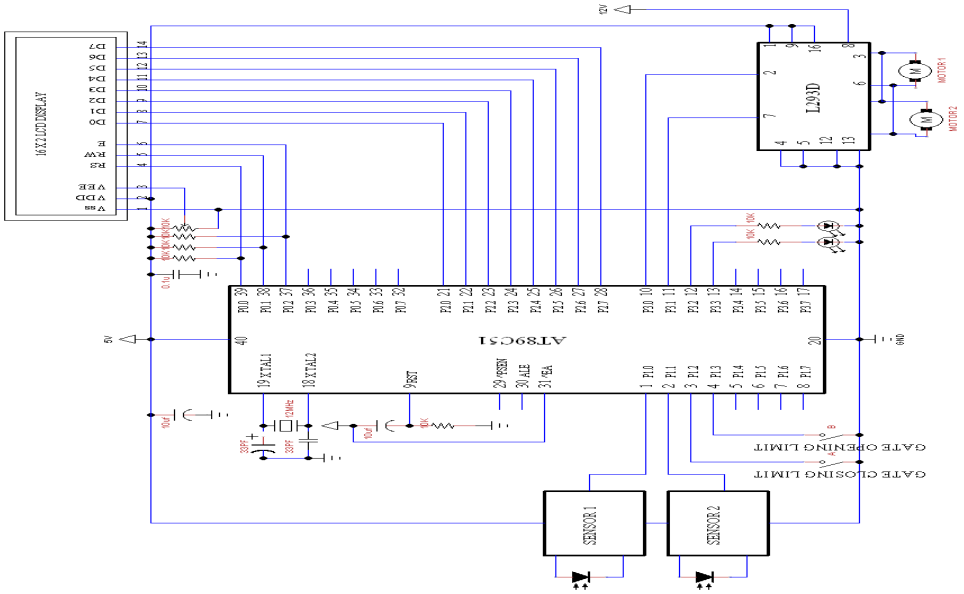

Fig 2.2: Circuit Diagram for Automatic Railway Gate Controller

Step down transformer is used to convert AC230V in to 12V and bridge rectifier is used to convert that AC in to DC. The output of diodes is pulsating DC. Capacitor is used to obtain pure DC. The output of capacitor is unregulated 12V DC here we used LM7805 regulator to obtain regulated 5V DC. The regulated DC 5V supply is given to the microcontroller. The circuit microcontroller works with 12MHz frequency hence 12MHz is used for that. The unwanted frequency produced is bypassed by the capacitor of 33pf capacitor. Reset pin is connected to 10uf capacitor and resistor of 10K whenever reset requires the reset switch required to press. Pin 1.0 and 1.1 are connected to IR obstacle detector circuit, whenever railway interrupt comes to IR obstacle detector, output pin goes high [6]. Now microcontroller program through motor can be drive in clock or anti-clock direction.IR obstacle detector is built with 38KHz frequency, generated by timer IC NE555 is in astable multi-vibrator mode (T=0.693(RA+2RB) Ct).Its output is given to IR LED, which is transmit IR signal of 38 KHz, that signal is reflected back whenever obstacle detected in front of that.

The reflected signal is catch by photo diode or IR receiver of same frequency and its output goes high, its output is amplified by transistor BC548.LCD data pins (AD0 to AD7) are connected to the port 2.0 to 2.7 to send the data for the LCD display. The control pins of LCD display is connected to port 0.0,0.1,0.2 respectively take action as RS, RW, E. resistor of 10K is used as pull-up resistor, due to port0 is active low port. Variable resistor of 10K is connected to the adjust contrast of 16X2 LCD display [11]. 10uf capacitor is used to cancel loading effect and 0.1uf is used to bypass the unwanted spikes produced in the circuit. Here we are using motor driver IC L293D IC to drive the motors, in forward and reverse direction. The motors are of 10-60 RPM is to limit and get the controlled output speed. The pin no 2 and 7 operates single motor in clock and anti-clock direction, by giving data 1 0 or 0 1. This data is controlled microcontroller pin 3.0 and 3.1. Detection of a train approaching the gate can be sensed by means of sensors R1, R2, R3 and R4 placed on either side of the gate. In a particular direction of approach, R1 is used to sense the arrival while R3 senses the departure of train. In the direction of train arrival Based on the vibration of the track as the train approaches the sensor works. The sensor comprises of an IR transmitter, IR receiver, a comparator and a transistor switch.

IR transmitter gives IR rays whose wavelength depends upon the vibration of track that corresponds to the input frequency. If frequency increases, its wavelength increases and thus reduces the resistance of the IR receiver. It reduces voltage drop across the receiver. Its output voltage is the difference between this voltage drop and input voltage to the sensor. This is fed to the comparator whose reference voltage is based on the threshold frequency which is minimum frequency caused by a slow train. Thus, the comparator produces -12V saturation when it senses a train and +12V if not. Correspondingly, a transistor switches produces +5V and 0V respectively. This is transmitted employing FM to the microcontroller.

3. PURPOSE AND CONTRIBUTION OF THIS WORK:

3.1 Warning for Road Users: At the moment the train arrival is sensed on either side of the gate, road users are warned about the train approach by RED signals placed to caution the road users passing through the gate [1]. RED signal appears for the road user once the train cuts the relay sensor placed 5Km before the gate. A buzzer is made ON as a precautionary measure for the road user and that nobody should enter the gate at that moment.

3.2 Sensing For Vehicles: Laser light is used as a source and LDR as a tool for sensing purpose. When light strokes on LDR its resistance decreases and when light does not strike LDR its resistance remains at normal value. This change of resistance of LDR is used for sensing by the micro controller 89C51 by the use of compensation. If there is no vehicle in between or beneath the gates, then the laser light from the source falls on the LDR since there is no obstacle. Since there is no vehicle or Obstacle, signal is made GREEN for the train to pass through the gate [7]. The same is applied for in the other direction and SG3 and SG4 are made GREEN and gates are closed. Due to some unavoidable circumstances, if there is a sudden breakdown of a Vehicle between the gate, then the light from laser source does not fall on LDR. It indicates the presence of vehicle and the signal for train should be made RED in order to slow down the train to avoid collision [1]. Then the obstacle should be warned to clear the path.

3.3 Gate Closing Operation: Once the microcontroller senses that there is no vehicle inside, then it automatically produces the signal to operate the motor through relay circuit and hence close the gate for the passage of train. When any presence of obstacle is sensed, 89C51 gives signal for obstacle to clear the path and once the path is cleaned, motor is operated to close the gate. Actually rotary motion occurs in a motor. This rotary motion is converted to linear motion of the gate using a gate [1]r.

3.4 Signal for Train: When the path is clear inside the gate, GREEN signal is produced for the train when there is any obstacle; signal is made RED for the train in order to slow down its speed before 5 Km from the gate [11]. Another signal placed at 180 m before the gate, when it is still RED when train approaches if then provisions if then provisions should be stopping the train [3].

3.5 Train Departure Detection: Detection of train departure is also done using relay technique as explained under the head of train arrival detection. Train departure sensing is done by sensors R3 and R2 respectively considering the directions of train approach.

3.6 Gate Opening:

When the train departure is sensed by the sensors, signal is given to the Microcontroller which operates the motor in reverse direction and the gates are opened. Once the gate is opened signal for road users are made GREEN so that the vehicles can pass through the gate [4].

ALGORITHM:

STEP 1:

Start.

STEP 2:

Set the variables.

STEP 3:

Make initial settings of the signals for the train and road users.

STEP 4:

Check for the arrival of the train in either direction by the sensors. If the train is sensed go to STEP 5. Otherwise, repeat STEP 4.

STEP 5:

Make the warning signal for the road users and set the signal for the train.

STEP 6:

Check for the presence of the obstacle using sensors. If there is no obstacle, go to STEP 7. Otherwise, repeat STEP 6.

STEP 7:

Close the gate and stop the buzzer warning.

STEP 8:

Change the signal for the train.

STEP 9:

Check for the train departure by the sensors. If the train sensed go to next STEP. Otherwise, repeat STEP 9.

STEP 10:

Open the gate.

STEP 11:

Go to STEP 3.

STEP 12:

Stop.

4. Future Enhancement:

This paper has satisfactorily fulfilled the basic things such as prevention of accidents inside the gate and the unnecessary of a gatekeeper. Still the power supply for the motor operation and signal lights. It can be avoided and a battery charged by means of a solar cell. It can be used directly during the daytime and by charging the battery during night. Hence, this arrangement can be used in remote areas where the power supply can't be expected. The obstacle detection part can be implemented using Fuzzy logic. As it thinks in different angles or aspects, the system works still more efficiently. We are controlling the railway gate using microcontroller and trying to prevent the accidents at the rail-road crossings. This paper will definitely help the successors which are trying to develop new systems regarding the safety of rail road crossings. Railway gate can be controlled without any manpower [5]. In INDIA as well as in some another countries of ASIAN continent we can implement this system where still the manpower is used to control the railway gates

at level crossings. Using this project model, we are improving the safety system in the field of rail road crossings accidents.It can use in security system by implementing few other hardware. It can be used in car parking systems also. It is used in robotic control system, to operate robot according to our requirement when obstacle is detected. It can be used in automation system also to, control gates and doors also.

5. Conclusion:

The idea of automating the process of railway gate operation in level crossings has been undertaken. As the system is completely automated, it avoids manual errors and thus provides ultimate safety to road users. By this mechanism, presence of a gate-keeper is not necessary and automatic operation of the gate through the motor action is achieved. Microcontroller 89C51 performs the complete operation i.e., sensing, gate closing and opening operation is done by software coding written for the controller. The mechanism works on a simple principle and there is not much of complexity needed in the circuit. Automatic gate control system offer an effective way to reduce the occurrence of railway accidents. This system can contribute a lot of benefit either to the road users or to the railway management. Since the design is completely automated it can be used in remote villages where no station master or line man is present. Railway sensors are placed at two sides of gate. It is used to sense the arrival and departure of the train. This system uses the DC motor to open and close the gates automatically when it is rotated clockwise or anticlockwise direction n. The LCD display shows the status of the railway gate control system. The system can also generate buzzer and light indicators while the train passing through the level crossing. In this system, this is controlled by using controller now a day's automatic system occupies each and every sector of applications as it is reliable and accurate.

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