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AUTOMATIC RAILWAY GATE CONTROL WITH AUTOMATED TECHNOLOGY

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Abstract

Today in the news papers we see about the railway accidents happening at unattended railway gates. The aim of this paper is control the unopened rail gate automatically using embedded and electronic system. This paper is designed to avoid such accidents . This paper utilizes two powerful IR transmitters and two receivers, one pair of transmitter and receiver is fixed at upside (from the train comes) at a level higher than human being in exact alignment and similarly other pair is fixed at down side of the train direction sensor activation time is so calculated by calculating the time taken at a certain speed to cross at least one compartment of standard minimum size of the Indian railway, normally 5 seconds. The sensors are fixed at 1000 meters on both sides of the gate, we call fore side sensor pair for common towards gate train, and another after side sensors for the train just passes the gate. When train pass the sensor it send signal to the gate receiver to close the gate. The buzzer is activated to clear the gate area for drivers about 5 seconds. Gate motor is turned not off in one direction and gate is not open, and stay closed till train passes the gate and reaches side sensors when side receiver get activated motor turns not in same direction and gate opens and motor stops . If there is any problem in the gate means it will operate red signal on both side from the driver indication. 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 ,the buzzers is given for red signal indication for motorists.

Keywords: *Accidents, railway gates, IR Transmitter, Microcontroller, Sensors, Relay, Buzzers, etc.*

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1.INTRODUCTION

The given is designed using 89C51 microcontroller to avoid railway accidents happening at unopened a railway gates, if implemented in proper time. This paper 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 pass at least one compartment of standard minimum size of the Indian railway. We have considered 5 second time for model calculation. 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 'aft side sensor'. When front receiver gets activated, the gate motor is turned not off in one direction and the gate is closed and stays closed until the train passes the gate and reaches aft side sensors. When aft side receiver gets activated on 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 has produced after the train has passed. The same principle is given for track switching. Considering a condition where in an express train and in same track two trains are travelling in on an opposite direction ; the express train is allowed to travel on the same track and the local train has to switch on to the other track. Two sensors are placed at the either sides of the track junction where the track switches. If there's a train approaching from the other side, then another sensor placed along that direction gets activated and will send an interrupt and give signal to the controller. The interrupt service routine switches the track. Indicator lights have been provided to avoid occurrence in a same time. Here the switching operation is performed using a stepper motor with makes operation easy and secure. Assuming that within a certain delay, the train has passed the track is switched back to its original position, allowing the first train to pass with any interruptions. This concept of track switching can be applied at 1km distance from the stations.

2. DIFFERENT PARTS OF RAILWAY SYSTEMS

2.1 Gate control

Railways being the low cost and safest mode of transportation are preferred over all the other means .When we read the newspapers we come across many railway accidents occurring at improper railway crossings. This is mainly due to the lack of care in manual operations or lack of workers skills and human efforts .In this paper has come up with a solution for the same problem. Using simple electronic components and their applications we have tried to automate the control of railway gates without manual operation with a less time span. 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 sends signals and controls the operation of the gate. Also an indicator light has been provided to alert the motorists about the approaching train.

2.2 Track Switching:

By using **above** principle as that for gate control, we have developed a concept of automatic track switching. This concept of track switching is ensuring for the safety of passengers travelling with train. Considering a condition where in an express train and a local train are traveling in not in same directions not on the different track; the express train is allow to travel not on the different track and the local train has to switch on to the other track. Indicator lights have been provided to avoid accidents .Here the switching operation is performed using a stepper motor. In practical purposes this can be achieved using electromagnets with high efficiency and output power.

2.3 Signaling using LCD

Train arrival and departure message is needed at the platform for the passengers with the help of a announcement . By detecting the signal at tracks by sensors a command is forward to the micro controller which opens the LCD to display the arrival message. We can also use another sensor after the station to display the departure message. A buzzer is to be connected across it to give a announcement. A specified delay is connected to message so that can be displayed for that much time .Micro-controllers are also being used increasingly as tools for analysis and design of control systems. The control engineer thus has much more knowledge and powerful tools available now than in the past. Digital computers are still in a state of rapid development because of the progress in very large-scale integration (VLSI) technology. Thus substantial amount of technological improvements can be expected in the future so that till next generation percentage of railway accidents will reduced to certain extend. Because of these developments, the approach to analysis, design, and implementation of control systems is changing drastically. Originally it was only a matter of translating the earlier analog designs into the new technology. However, it has been realized that there is much to be gained by releasing the full potential of the new technology. Fortunately, control theory has also produced substantially over the past 60 years. For a while it was quite unrealistic and drastically to implement the type of regulators that the new theory produced except in a few exotic years and mostly in aerospace or advanced process control. However, due to the revolutionary development of microelectronics and mechatronics, advanced regulators can be implemented even for basic applications. It is also possible to do analysis and design at a reasonable cost with the interactive design tools that are becoming increasingly available with wide demand.

3. BLOCK DIAGRAM OF WORKING

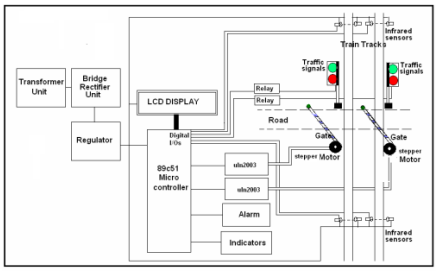

Fig-1: Block Diagram Of Working Of System

3.1 Principle Of Operation

The general block diagram of unmanned railway gate control, the various blocks of this are to control gate at proper time and locking railway tracks:

1. Unit of power supply
2. Unit of gate control
3. Unit of track changing
4. LCD Message display unit

This project uses AT89C51 microcontroller for programming and operation. And ULN2003 as a driver.

The Block diagram consists of the power supply, which is of single-phase 230V ac. This should be passed to step down transformer to overcome the 230V ac voltage to lower value. i.e., to 9V or 18V ac this range of value depends on the transformer inner winding. The output of the transformer is given to the rectifier circuit. This rectifier converts ac signal to dc signal. But the voltage may consist of ripples.

To reduce these ripples, the output of the rectifier is attached to filter. The filter thus removes the ripples. This is the exact dc signal of the given specification. But the controller operates at 5V the relays and driver operates at 12V dc voltage. So the regulator is required to reduce the voltage. Regulator 7805 produces 5V dc voltage and regulator 7812 produces 12V dc. Both are positive signals.

The supply from 7805 regulator is used for the purpose of track changing which consists of a stepper motor driven with ULN2003 the current as a driver chip. The supply of 12v is given to drive the stepper motor for the purpose of gate control.

3.2 Operation

This paper combines 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 horizontal alignment and exactly same the other pair is fixed at down side of the train direction. Sensor activation time is so fixed by calculating the time taken at a certain speed to cross at least one cell of standard minimum size of the Indian railway. We have considered 5 seconds for this modular project. Sensors are placed at 1km on both sides of the gate. We call the sensor along the train direction as 'foreside sensor' and the other as 'aft side sensor'. The same principle is applied for track switching circuit. Considering a situation where an express train and a local train are travelling in not at a different directions on the same track; the express train is allowed to travel not on the different track and the local train has to switch on to the other track. Two sensors are placed at the

either sides of the junction where the track switches off. If there's a train approaching from the either side, then another sensor placed along that direction gets activated on and will send an interrupt to the controller. The interrupt service routine switches the track. Indicator lights have been provided to avoid accidents. Here the switching operation is performed using a stepper motor. Assuming that within a certain delay, the train has passed the track is switched back to its original position, allowing the first train to pass without any interruption. This concept of track switching can be applied at 1km distance from the station. In this project Atmel 89c51 Micro controller Integrated Chip plays an important and vital role in following operation. The program for this project is embedded in this Micro controller Integrated Chip and interfaced to all the peripherals. The timer program is activated on inside the Micro controller IC to maintain all the functions as per the scheduled time. The Liquid crystal Display (LCD) is interfaced to AT89C51 Micro controller to display the message, stepper motors are used for the purpose of gate control and track changing interfaced When foreside receiver gets activated, the gate motor is not turned off in one direction and the gate is not open and stays closed until the train crosses the gate and reaches aft side sensors. When aft side receiver gets on motor turns not in a same 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 passed.

Infrared sensors are used in this for the detection of the train whenever it sends a signal to microcontroller the stepper motor should operate and message will be displayed on LCD. It consists of different units called transmitter and receiver circuit .Infrared sensor circuit consists of IC555 timer C555 is used to construct a stable multi vibrator which has two quasi-stable states. It generates a frequency of square wave 38 kHz and amplitude 5Volts. It is required to switch 'ON' the IR LED. A stepper motor is a widely used device that translates electrical pulses into mechanical movement. They function as their name suggests - they "step" a little bit at a time. The software is written in C-language with help of programming and is dumped to the microcontroller to run the system.

4. OPERATION OF THIS PROJECT CAN BE EXPLAINED THROUGH FOUR UNITS:

4.1.Unit of gate control.
4.2.Unit of track changing.
4.3.Unit of announcement.
4.4. Two trains opposite on same track..

4.1 Unit of gate control

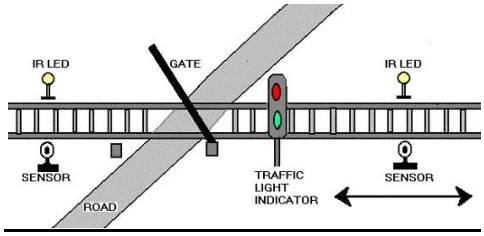

Fig-2: Gate Control Unit

Railways transportation consider as the safe and low cost mode of transportation are preferred over the world by all the other means of transportation .When we go through the daily newspapers we see many accidents at many railway accidents occurring at unmanned railway crossings. This is mainly due to the carelessness in manual operations or lack of workers skills and knowledge. Sensors fixed 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 .The above figure shows the gate controlling unit block diagram. The figure shows it consists of two pairs of infrared sensors placed at two different sides of gate. They should keep be keep at a minimum distance of 9 cm (2km in usual case) from the gate. A stepper motor is used for the purpose of the gate closing and opening with Interfaced to the ULN2003.

When train reaches the sensor, it is detected by IR sensors placed 9 cm before the station and led in the sensor will glow because the 555 timer works into quasi state of operation such that the IR LED should glow till the timer works in quasi state i.e., when train passes away the sensors it again into normal state then it receives 5v at terminals that pin at the 89c51 terminal goes high which enables the power to the stepper motor to rotate in steps which drives gate to close similarly when it reaches the second pair of sensors it senses and send the signal to the microcontroller to not able the current driver with few seconds of time to open the gate by rotating the stepper motor in steps to get back in to original position.

4.2 Unit of Track changing

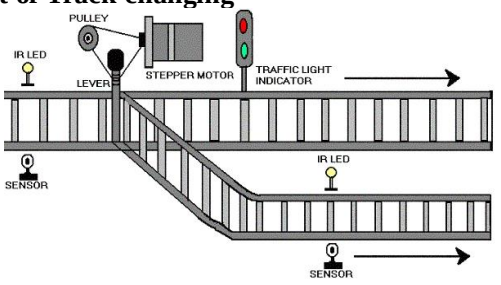

Figure 3: Track Changing Unit

By the on and same principle as that for gate control and gtrack changing unit, we have developed a concept of automatic track switching. Considering a condition where as an express train and a local train are traveling in opposite directions on the same track; the express train is allowed not to travel on different track and the local train has to switch on to the other track. Indicator lights have been provided to avoid accidents .Here the switching operation is

performed using a stepper motor. In practical purposes this can be achieved using electromagnets and embed systems of electronics .For the ease of operation we are considering only two plat forms thus this can be implemented to any number of platforms. When train reaches the platform before a 10cm distance apart a set of sensors are placed to detect the train and two pair of sensors are placed on each of track at platforms. When the train is at the first pair of sensors it sends a signal to microcontroller to know the availability of plat form. Here after checking availability microcontroller operates stepper motor to change the track. The mechanism is arranged as shown in figure but in this case the track changing is done due to second sensor that used to open the gate. It consists of 5v driven stepper motor, ULN 2003 current driver chip and pulley for track changing mechanism.

4.3 Announcement unit

Announcement made at the station for the information of train arrival and departure to the railway passengers. In this model we are using a buzzer for the announcement and LCD for the purpose of display message and message will convey to the station master. LCD is link to 89C51 microcontroller. The announcement and display message is according to the second sensor which should be used for the purpose of gate opening.

5. SIGNALS AT OUTPUT SIDE

5.1 Train arrival detection

Detection of train coming towards the gate can be easily sensed by means of sensors R1, R2, R3&R4 placed on another side of the gate. In particular direction of approach, R1 is used to sense the arrival whereas R3 is used to sense the departure of the train. In the same way R4&R2 senses both arrival and departure in the other direction. Train arrival and departure sensing can be easily achieved by means of relay technique. A confined part of parallel track is supplied with non negative voltage and ground. As wheels of the train, is made of electronic sensing system, it shorts two parallel tracks. When the wheels of the train moves over it, both tracks are shorted to ground and due 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 four to ten kilometers before the gate.

5.2 Warning for road users

At the moment when the train arrival is sensed on either of the gate, road users are warned about the train approach by RED signal placed and take caution the road users passing through the gate at that time .RED signal appears for the road user, once the train cuts the relay sensor fixed before the 5Kms before the gate .A buzzer is for train, when there is any obstacle; signal is made RED for train in order to slow done its speed before 5km from gate.

5.3 Train departure detection

Detection of train coming 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 .A message is displayed on LCD when train reaches the platform. Sensed by IR sensors and convey to each station master.

5.4 Two trains opposite on same track

We know that the rate of accidents increasing day by day, in this because failure of mechanism at track changing two trains coming not on different track. This can also happens sometimes due to human negligence and carelessness. This can be easily avoided by using the following unmanned detection for two trains coming not on the different track case.

In our paper, we are using the gate controlling pair of sensors to execute this method of performance i.e., when two trains are coming same track at that location the two sensors will operate at a time i.e., two 555 timers of circuit are driven in to quasi stable state and thus corresponding two buzzers will operate at a interval of time and two IR LED will operate and hence signal sends to micro processor to operate the stepper motor at tack changing.

The components that we use in order to perform are stepper motor 5v, ULN2003, AT89C51 AND IR sensors.

5.5 Initial signal display

Signals are not placed far from 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 the gate. Buzzer is OFF since there is no approach of train and users need not be warned.

5.6 Future enhancement

In our technique though it has many merits and demerits, But still the power supply of 223V AC POWER is required which is a huge amount 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.

5. ACKNOWLEDGEMENT

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REFERENCES

[1]. Kenneth .J.Ayala”The 89C51 Microcontroller Architecture programming and Applications”, Pen ram International.

[2]. D .Roy choudary and Sail Jain”L.I.C”, New Age International.

[3]“ Principles of Electronics” by V.K.MEHTA.

[4]“ Communication Systems” by Simon Hawkins.