International Journal of Scientific Engineering and Technology Research

ISSN 2319-8885
Vol.05,Issue.08,
April-2016,
Pages:1513-1516

www.ijsetr.com

Automatic Railway Gate Control System with Intruder Sensation and High Speed Alert System

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Abstract: The objective of this research work is to provide an efficient alternative to many conventional techniques used by the railways in order to decrease accidents occurrence incorporating manual operations i.e. aims at the design, development and testing of working model entitled Automatic Railway Gate Control system with intruder sensation and high speed alerting system. Railway track and road related accidents are more dangerous than other transportation accidents in terms of severity and death rate etc. This model deals with two things. Firstly it deals with the reduction of time for which the gate is being kept closed and secondly, to provide safety to the road users by reducing the accidents. By employing the automatic railway gate control at the level crossing the arrival of the train is detected by the sensors placed in the side of the tracks. Hence, the time for which it is closed is less compared to the manually operated gates. The operation is automatic therefore error due to manual operation is prevented. In situations where the train is late due to some reason, the gates remain closed for long durations causing dense traffic jam near the gates. This too can be prevented by automation. The proposed system uses IR sensors to detect the arrival and departure of trains at the railway level crossing and ATMEGA 16 Microcontroller to control the opening/closing of gates.

Keywords: Microcontroller, Automatic Railway Gate Control System, Signaling Lights, Buzzer, Stepper Motor, ULN2003 (Darlington pair), Seven Segment, LCD (16x2).

I. INTRODUCTION

The aim of this project is to control the unmanned railway gate automatically using the embedded platform. Today we see in newspapers very often about the railway accidents happening at unattended railway gates. Present project is designed to avoid such accidents if implemented in spirit. This project is developed in order to help the railways in making its present daily routine working system a better one, by eliminating some of the loopholes existing in it. Based on the responses and reports obtained as a result of the significant development in the working system of railways, this project can be further extended to meet the demands according to the situation. This can be further implemented to have control room to regulate the working of the system. Using simple electronics components we have tried to automate the control of railway gates. As a train approaches the railway crossing from either side, the sensors that are placed at a certain distance from the gate detects the approaching train and accordingly controls the operation of the gate. Also indicator light has been provided to alert the motorists about the approaching train. This device is to manage the control system of railway gate using the microcontroller. In this research work ATMEGA16 Microcontroller plays the main role. The program for this project is embedded in this Micro controller and interfaced to all the peripherals. The timer program inside the Microcontroller IC performs all the functions as per the scheduled time. ATMEL STUDIO is used for the making of code and hex file. In general, level crossing gates are operated manually by a gate keeper. The gate keeper receives the information about the train arrival from a near station. When the train starts to leave the station, the station in-charge delivers this information to the closest gatekeeper to get ready. The proposed system uses IR sensors to detect the arrival and departure of trains at the railway level crossing and ATMEGA16 to control the opening/closing of gates. The project is simple to implement and subject to further improvement.

II. HARDWARE DESCRIPTION

This picture given below shows the Automatic Railway Gate Control by using ATMEGA16 microcontroller. Automatic railway gate control system is accomplished to use various electronic components. This system can be simply divided into three main categories: the input, the processing and the output units. The detail circuit diagram of the railway gate control system is shown in Fig.1. For the gate control state, the gate will be closed when the motor rotates at particular angle (i.e. 90 degree) until the train has crossed the gate otherwise the gate remains opened. The main control unit

of this system is ATMEGA16 microcontroller and it can manage the control processes of all input and output units. IR sensor circuit is applied to sense the train on the railway track.

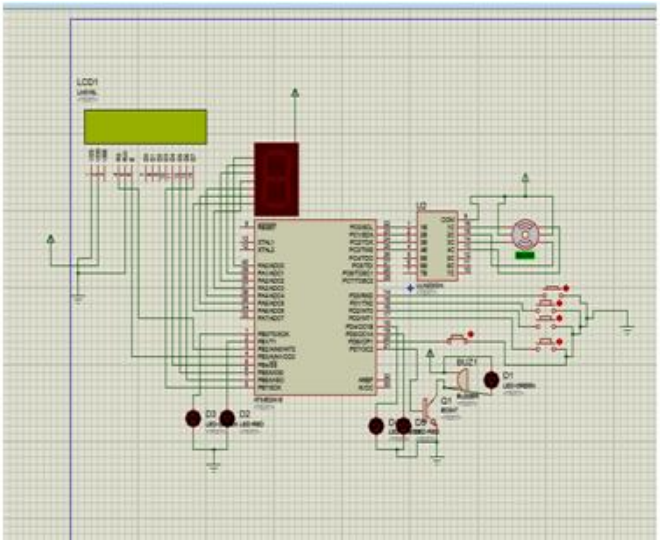

Fig.1. Circuit diagram.

The LCD display is used to show the arrival and departure messages of the train. DARLINGTON PAIR is used for controlling the stepper motor for gate open and close control. Alarm unit is utilized for warning the road users. The gate control system consists of four infrared sensors. The sensors are fixed at the certain distance on both sides of the gate, i.e. sense train before arrival and sense the train departure. When the sensor 1 and sensor 2 senses the train, IR sensors goes in "on" state. At the same time, the light signal of the road traffic is changed from Green color to Red color and the train traffic signal is changed from Red to Green color. A buzzer gets activated when the train is crossing the gate and the railway gate is closed, and train arriving on track message will displayed on LCD display. When the train passes through the IR sensor3 and sensor 4, the road traffic is changed from Red color to Green color and the train traffic is changed from Green to Red color. At the same time, the railway gate gets open. In this time, IR sensors are seem to be in off state. The timing condition for the railway gate control system must be set base on the speed and length of the train into the background algorithm for microcontroller. Timing condition for the railway gate control system must be set based on the speed and length of the train into the background algorithm for microcontroller.

III. SYSTEM OVERVIEW

Algorithm:

STEP 1: (Start)
STEP 2: (Set the input sensors for sensing train.)
STEP 3: (Check for the arrival of the train by the sensors. If the train is sensed go to step 4 and step 5 otherwise step3.)
STEP 4: (Make the warning signal for the road users.)
STEP 5: (Close the gate.)
STEP 6: (Check for the train departure by the sensors. If the train sensed go to next step. Otherwise repeat STEP 6.)
STEP 7: (Open the gate)
STEP 8: (Go to STEP 1)

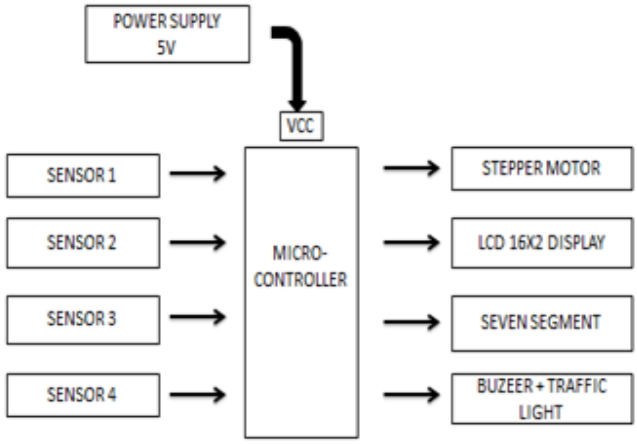

Fig.2. Block diagram.

Flow Chart:

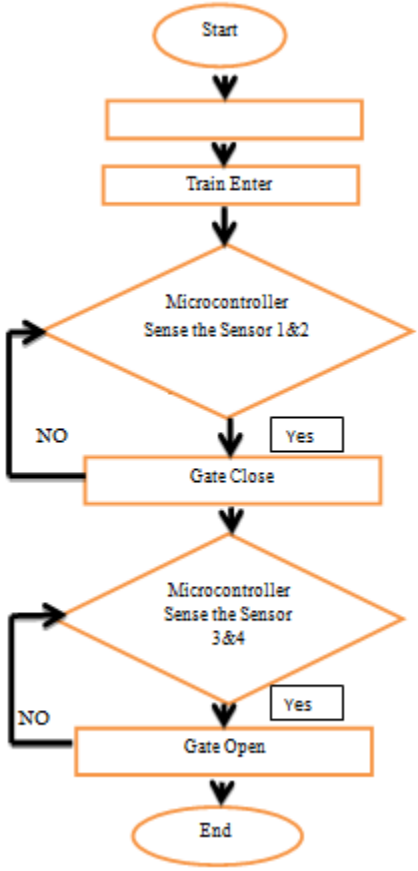

Fig.3. Flow Chart.

Circuit Description: This bidirectional train detection circuit is designed to control the accident that occurs due to unmanned barrier and in order to reduce the time for which barrier is close by using four IR SENSOR in which two of them are used before barrier which detect the arrival of train as soon as these sensors detect the train, a message will be displayed on the LCD and signal light changes to red for road

traffic and green for train traffic which was initially set to green for road and red for train, the barrier then is made to fall down using stepper motor and DARLINGTON PAIR, and the countdown is initiated.(which is already calculated as the time taken by the train to reach the third sensor). Now if the train crosses the first two sensors and happen to stop at the barrier or before the barrier without reaching the third sensor, then the circuit will automatically the train to be on track and the barrier remains closed i.e. the countdown would stop since we cannot be sure of the time for which the train will remain stopped before it actually reaches the fourth sensor. Now as soon as train reaches the third sensor and then fourth sensor the circuit will consider this as the "train leaving condition" resulting in a message displayed on the LCD, countdown starts again , stepper comes to its original state, signal light changes , buzzer gets off. Now after a fixed time set in the counter the circuit will again check whether the train has left the track or not, if not then barrier will stays down. All the conditions will remain same as before and the barrier will only open when the train leaves the track. In this way we can save time and reduce the dependence of man on barrier control**.**

Explaining Different Parts: The components used are as follows

ATMEGA16:

- Totally 40-pin DIP package
- Manufactures with CMOS Technology.

IR Sensor: Use IR rays transmitter and black led Receiver to detect obstacle.
Led: Use for signaling of road side and train side traffic.
Stepper Motor: This is used to open and close the gates automatically when it is rotated clock wise or anticlockwise direction. Stepper motor requires 500mA current so use the ULN2003 or ULN2803 driver to drive the stepper motor.
Buzzer: Use to generate a beep sound for signaling the arrival of train.
LCD(16x2): An alphanumeric LCD (16x2) is used to display the message related to arrival and departure of train.
Seven Segment Display: It is used to count the time taken by train to reach from sensor 1&2 to 3&4.

IV. CONCLUSION

The present existing system is manually and human controlled system, once the train leaves the station, the stationmaster informs the gatekeeper about the arrival of the train through the telephone. Once the gatekeeper receives the information, he closes the gate depending on the timing at which the train arrives. Hence, if the train is late due to certain reasons, then gate remain closed for a long time causing traffic near the gates. No centralized system is available, presently signals are control by mean of interlocking and warning signs and signal device, which is totally semiautomatic system. By employing the automatic railway gate control at the level crossing, the time for which it is closed is less compared to the manually operated gates and also reduces the human labour. 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. And implementing the work railway system can be centralized which can control the train collision accidents.

Features of Proposed System:

- The system will consist of 4 IR trans-receiver pairs in order to increase accuracy.
- Micro controller based circuit design.
- Automatic train sensing & gate controlling.
- The gate will be closed till the whole train passes out.
- The opening of gate will be sensor based not delay based.

Discussion: The point mainly discussed in this research paper are:
Existing System:

- Manual/Physical gate closing & opening.
- Manual switch based gate closing & opening.

Limitations of exiting system:-

- Chances of human error.
- Time consuming.
- A lot of human resource is required.

Advantages:

- Reduces chances of human error.
- Less time consuming.
- No human resource is required.
- Safety and quality of services
- Accident avoidance

Scope of The Project:

- This project is developed in order to help the RAILWAYS in making its present working system a better one, by eliminating some of the loopholes existing in it.
- Based on the responses and reports obtained as a result of the significant development in the working system of RAILWAYS, this project can be further extended to meet the demands according to situation.
- This can be further implemented to have control room to regulate the working of the system. Thus becomes the user friendliness.
- This circuit can be expanded and used in a station with any number of platforms as per the usage.
- Additional modules can be added without affecting the remaining modules. This allows the flexibility and easy maintenance of the developed system.

V. ACKNOWLEDGMENT

We owe a debt of gratitude to our project investigator Dr. Nisha Jha(Assistant Professor, Department of Electronics) and Ms. Anju Rustagi (Associate Professor, Department of

Electronics) for providing us with an opportunity to start this paper .though their time advice, constructive criticism and supervision, they were a real source of inspiration for us and excellent advisers during the preparation of this paper.

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