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AUTOMATIC RAILWAY CROSSING SYSTEM

AKRITI & UPENDRA PRASAD

BIT, Sindri, Dhanbad, Jharkhand, India

ABSTRACT

The aim of this paper is to design an automatic railway gate controller using microcontroller. This mainly aims at preventing accidents at unmanned level crossings where many accidents take place every day. 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 chances of accidents at unmanned level crossings and provide immense safety. This report deals with the designing and operation of this automatic railway gate controller.

KEYWORDS: Railway Gate, Level Crossing

INTRODUCTION

In this work, I concerned with providing an automatic railway gate control at unmanned level crossings replacing the gates operated by gate keepers and also the semiautomatically operated gates. It 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 that usually occur due to carelessness of road users and at times errors made by the gatekeepers. By employing the automatic railway gate control at the level crossing 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. Subsequently, buzzer indication and light signals on either side are provided to the road users indicating the closure of gates. Once, no vehicle is sensed in between the gate the motor is activated and the gates are closed. 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. Thus, the time for which the gate is closed is less compared to the manually operated gates since the gate is closed depending upon the telephone call from the previous station. Also reliability is high as it is not subjected to manual errors.

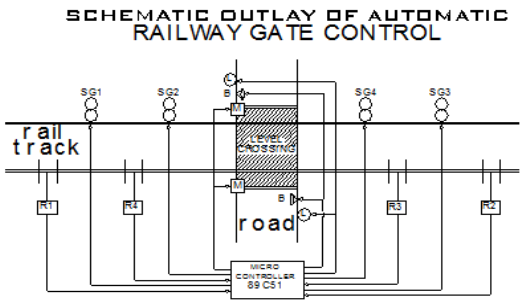

Figure 1: Outlay of Automatic Railway Gate Control

R1 & R2: Sensors on the track, placed at about 5 km from the gate to detect the train arrival on either directions.

R3 & R4: Sensors on the track, placed at about 1 km from the gate to detect the train departure on either directions.

SG1, SG2, SG3 & SG4: Signals placed by the side of the track to indicate the train driver about the closing of the gate.

B: Buzzer, an audio signal to warn the road user about the approach of train.

M: Motor for gate operation.

L: Light signal to warn the road user.

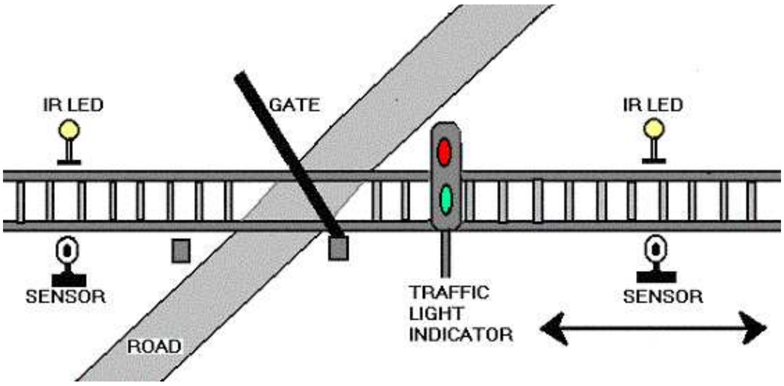

Figure 2

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 go to 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 step7 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 to next STEP. Otherwise repeat STEP 9.

Step 10: Open the gate.

Step 11: Go to STEP 3.

Step 12: Stop.

FLOW CHART

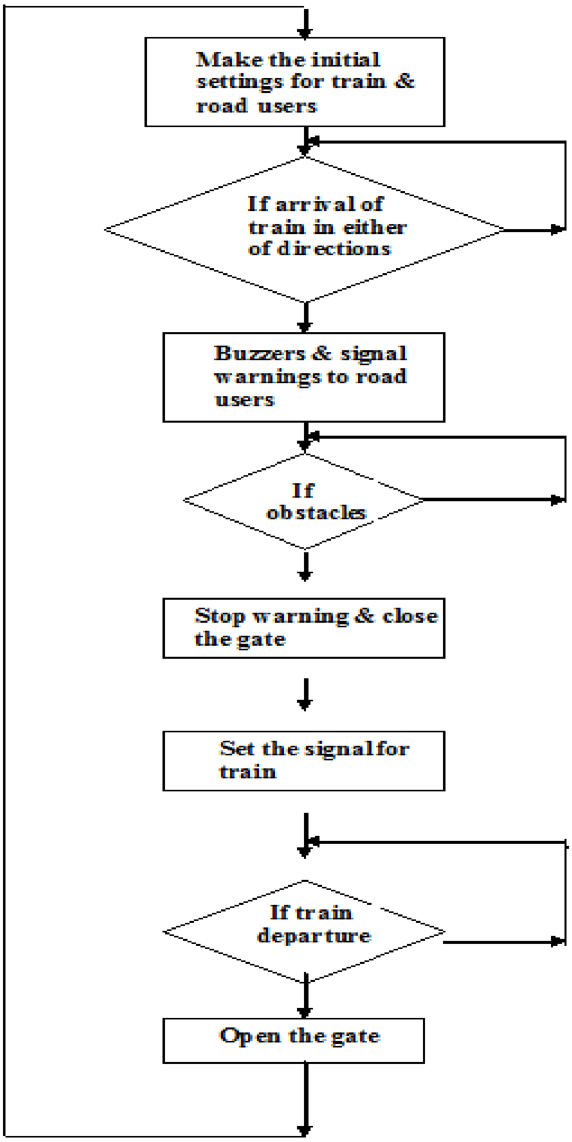

Figure 3

HARDWARE DESCRIPTION

The project consists of four main parts:

- 8051 microcontroller
- IR Transmitter
- IR Receiver
- Stepper Motor Circuit

8051 Microcontroller

The I/O ports of the 8051 are expanded by connecting it to an 8255 chip. The 8255 is programmed as a simple I/O port for connection with devices such as LEDs, stepper motors and sensors. More details of the 8255 are given later.

The following block diagram shows the various devices connected to the different ports of an 8255. The ports are each 8-bit and are named A, B and C. The individual ports of the 8255 can be programmed to be input or output, and can be changed dynamically. The control register is programmed in simple I/O mode with port A, port B and port C (upper) as output ports and port C (lower) as an input port.

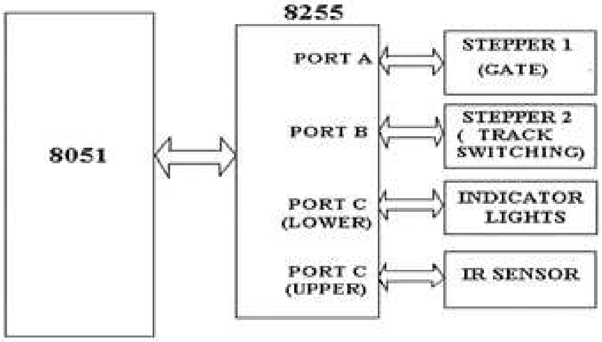

Figure 4: Block Diagram of 8051 Microcontroller

IR Circuits

This circuit has two stages: *a transmitter unit and a receiver unit*. The transmitter unit consists of an infrared LED and its associated circuitry.

IR Transmitter

The transmitter circuit consists of the following components:

- IC 555
- Resistors
- Capacitors
- IR LED

The IR LED emitting infrared light is put on in the transmitting unit. To generate IR signal, 555 IC based as table multivibrator is used. Infrared LED is driven through transistor BC 548.

IC 555 is used to construct an a stable multivibrator which has two quasi-stable states. It generates a square wave of frequency 38 kHz and amplitude 5Volts. It is required to switch ‘ON’ the IR LED.

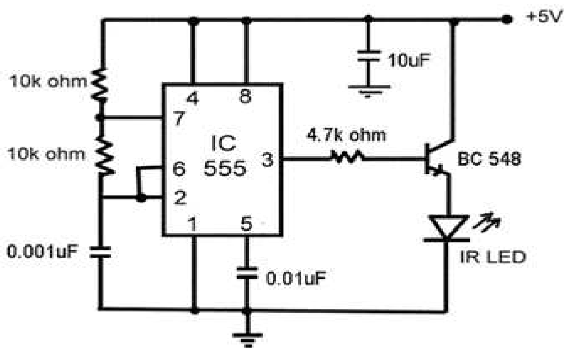

Figure 5: IR Transmitter

IR Receiver

The receiver circuit consists of the following components:

- TSOP1738 (sensor)
- IC 555
- Resistors
- Capacitors

The receiver unit consists of a sensor and its associated circuitry. In receiver section, the first part is a sensor, which detects IR pulses transmitted by IR-LED. Whenever a train crosses the sensor, the output of IR sensor momentarily transits through a low state. As a result the monostable is triggered and a short pulse is applied to the port pin of the 8051 microcontroller. On receiving a pulse from the sensor circuit, the controller activates the circuitry required for closing and opening of the gates and for track switching.

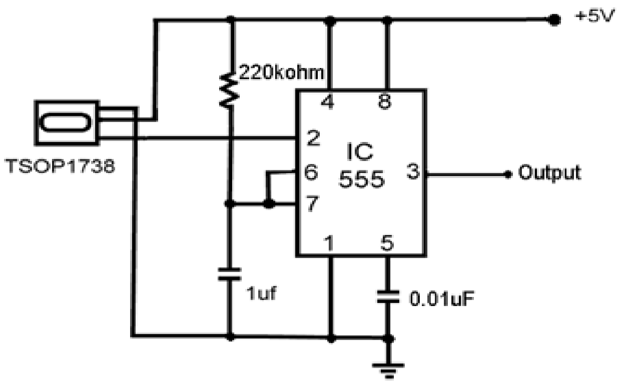

Figure 6: IR Receiver Circuit

THE WHOLE SET UP IS

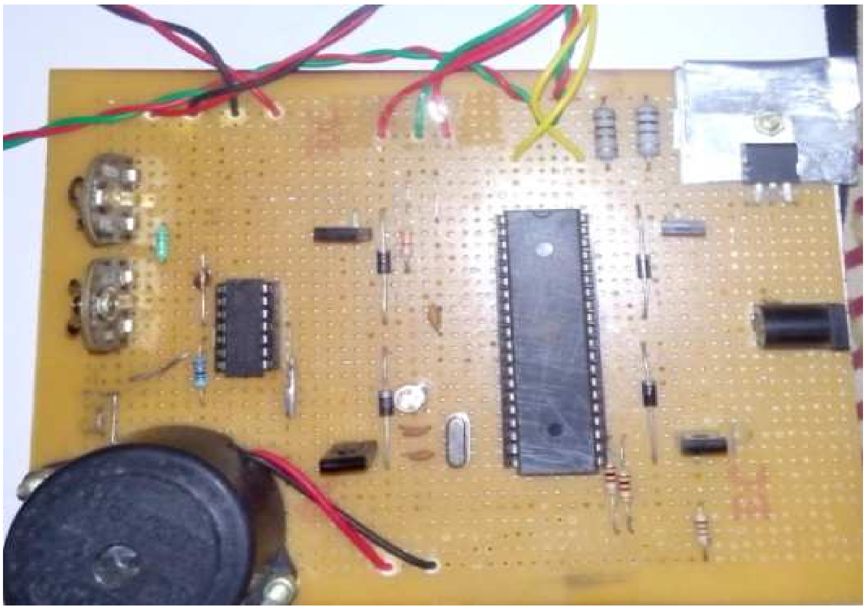

Figure 7: Whole Setup as Hardware Model

CONCLUSIONS

Using automatic railway crossing system, we improve the rail road transportation facility by reducing the chances of occurrence an accidents at unmanned level crossings and providing immense safety. Also this technique has fast operation than older system, it saves a 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. Since the design is completely automated it can be used in remote villages where no station master or line man is present. Thus this design finds its applications in many cases.

ADVANTAGES

- Avoid accidents in level crossings
- No manual work is needed.
- Low cost
- automated operation
- Low Power consumption

FUTURE ENHANCEMENT

This paper has satisfactorily fulfilled the basic things such as prevention of accidents inside the gate and the unnecessity of a gatekeeper. But 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.

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