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An Effective Approach of Prevention of Collision in Railway network

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Abstract: Railways being the being the largest transport network in India, it is of utmost importance to ensure the safety of this network. Major railway accidents occur due to collision of trains running on same track. This can be prevented by using a technology known as ACD (Anti collision Device). ACD is a fully integrated Electronic Control System which can be used to minimize collisions and increase safety on Railway system. It is a non signaling system that can provide additional cover of safety in train operations to prevent dangerous train collisions caused due to human errors or limitations and equipment failure. The purpose of our paper is to design an anti-collision system which will detect trains running on the same track and avoid accidents by providing an alarm to concern units. Such system will be able to report the problems to main control room, nearby station as well as grid control stations and avoid the disaster.

Keywords: 8051 Microcontroller, Motor Driver, IR LED, Photo Diode**.**

I. INTRODUCTION

There has been a lot of railway accidents recently in the past, yet railways have not implemented any such system in their railway network. To prevent rail accidents and to provide safety to the millions of passengers who suffer daily from trains we came up with the idea of anti-collision system for railways, it not only warns the driver of the collision situation but also automatically stop the train to prevent such accidents.

II. TECHNOLOGY

Here we have used the IR LED, Photo Diode along with the internal comparator circuit [1] of the microcontroller for the detection of obstruction in railway track. It is observed that the Photo Diode is very much sensitive towards the light and is affected by the surrounding light sources. The sensitivity is controlled by the variable resistance up to certain limits.

III. TECHNICAL DETAILS OF ANTI-COLLISION SYSTEM

An obstruction sensor embedded in front of a toy train detects an obstruction in the line of sight. The obstruction sensor is designed by the combination of IR Tx LED-(IR333) and a photodiode (Pd 15-22c). The IR LED continuously transmits the infrared rays and the photodiode placed beside the IR Tx LED is connected in the reverse bias mode. When obstruction is present in front of the train ,the IR rays get reflected back, meanwhile the photodiode on receiving the light rays starts conducting resulting in low voltage drop to the input pin of the internal comparator fabricated inside the microcontroller (AT89C2051) [2][3]. The reference voltage of the comparator is connected to a potentiometer to maintain the sensitivity of photodiode, the high pulse obtained at the output pin of the comparator indicates the presence of obstruction in the line of sight The microcontroller [3] which is connected to the obstruction sensor scans continuously for any high pulse to the input of the obstruction sensor. An LED is connected to the microcontroller indicates the presence of obstruction. In other words the LED indicates the high pulse generated by the comparator. However a minimum safe distance should be kept so that a model train should properly work in accordance with an obstruction sensor. Figure 1 below shows the block diagram of the system.

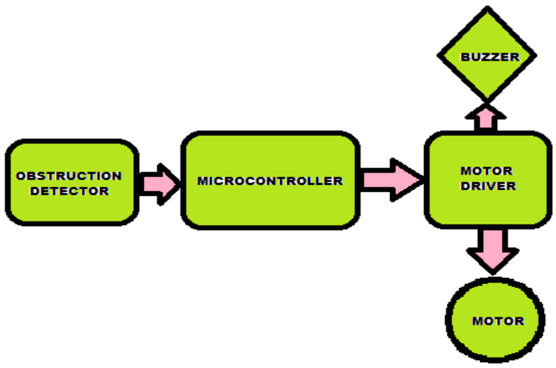

Fig.1: Simplified Block Diagram of the System

IV. CIRCUIT DIAGRAM

In this model we have used 8051 microcontroller as mentioned earlier [4] [5] which consists of an internal analog comparator having Vin (pin 12) and Vref (pin 13).

The obstruction detector used here is the combination of IR LED transmitter which is connected to the power supply. The IR is received on getting reflected by the obstruction to the photo diode which is connected in the reverse biased mode in the Vin of the analog comparator circuit.

The Photo Diode on receiving light source gets activated and allows large amount of current to pass though it, resulting in the zero potential in the Vin, which decides the detection of the obstruction in the line of sight.

The Microcontroller then processes the input data and decides the output to be fed to the motor driver connected in the port 1. The motor driver used has 2 input and 2 output port which is interfaced by 1 motor and 1 buzzer [6][7].

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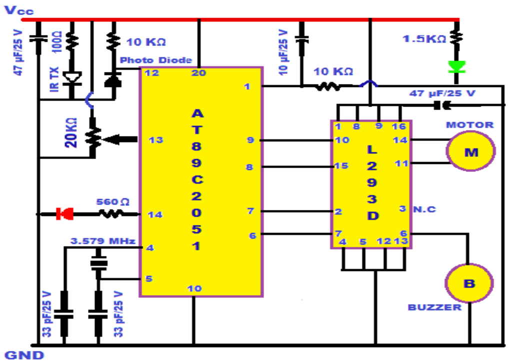

Fig 2: The Circuit Diagram

V. PROGRAM CODE

```
ORG 100
START: CALL BUZZER
AGAIN:          SETB P1.0
                SETB P1.1
                SETB P3.6
                JNB P3.6, LED_1
LED_0: CLR  P1.2
MOV A, #000010000B
MOV P3, A
CALL DELAY1
MOV A, #000000000B
MOV P3, A
CALL DELAY1
JMP AGAIN
LED_1: SETB P1.2
CALL BUZZER
MOV A, #000000000B
MOV P3, A
CALL DELAY
JMP AGAIN
BUZZER:         SETB P3.2
                CALL DELAY
                CLR  P3.2
RET
DELAY:          MOV  A,  #0FFH

MOV  R7, A
L2:     MOV  A, #0D5H
                MOV  R6, A
L1:     DJNZ R6, L1
                DJNZ R7, L2
                RET
DELAY1:         MOV  A,  #00FH

MOV  R7, A
J2:     MOV  A,  #007H
                MOV  R6, A
J1:     DJNZ R6, J1
                DJNZ R7, J2
                RET
END
```

V. SIMULATION

The simulation [8] of the hardware is done from Proteus Simulation Software as shown in fig 3. Various test conditions based on data acquired during literature survey were fed as input. Result of the simulation was observed to be positive and coincided with the proper system of operation. The circuits after successful simulation are designed and fabricated [9][10][11] as depicted in fig 4.

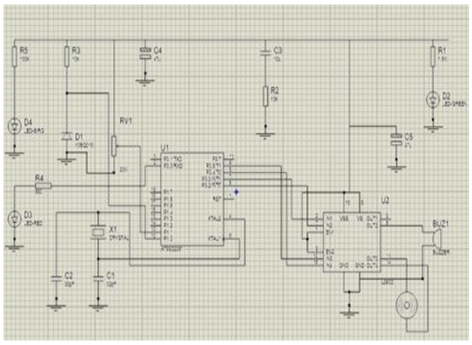
Fig 3: Simulation of the circuit on Proteus

VI. TEST AND RESULT

The clock pulse is supplied to the microcontroller from the crystal oscillator (3.579MHz) connected along with the ceramic capacitor (33pF) .The motor driver (L293D) is interfaced in port 3 of the microcontroller. The motor driver consists of two input and two output ports respectively. On detecting an obstruction, the microcontroller feeds the motor driver which in turn stops the motor and rings the buzzer alarm as an indication. Hence the two trains on the same track will never collide in such condition[12][13][14].

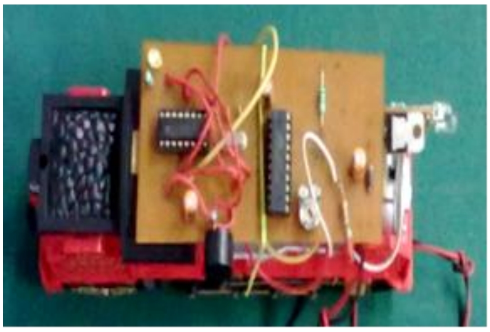
Fig 4: Hardware Implementation of the System

VII. CONCLUSION

The system discussed above does not interfere with normal working of train operations. Being the non-signaling and inter locking system it does not replace any existing signaling and interlocking system and does not alter any procedures of train operations. All ACDs along the ACD route can effectively be used to communicate with each other through radio communication when they are within a radial range of at least 3 kms. On board computers use inputs from Global Positioning System (GPS) for determination of train location, speed, course of travel and time. It can provide warnings and regulate speed control in dangerous hillside locations. The process is still in developing stage .We hope if the system is applied properly, we can expect a definite safe and reliable train journey in future.

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