AUTOMATIC OBSTACLE DETECTION IN RAILWAY NETWORK USING EMBEDDED SYSTEM

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Abstract- In railway department now days many accidents are occurring. The railway network is highly prone to accidents compared to other means of transport. This work presented here is the automatic obstacle detection in railway network using microcontroller on the level crossing and also on the rails. This paper sever the train signaling. This work deals with the two modules. The first one is obstacle detection within level crossings and the second is obstacle detection on the whole network of rails. Comparing to the existing work it is a simple concept with low consumption of power using a microcontroller. The obstacle sensor is used to sense the obstacle and microcontroller is used to take the decision and transmission and reception of the signals. This system is designed to use in all the level crossing and the whole network.

Keyword- Obstacle Detector, Vibration Sensor.

I. INTRODUCTION

Now a day’s a railway accidents are dangerous one in the transportation. There are many projects in automatic control of gate and projects in prevention accidents in railways, but their ideas were very complex and fail to calculate the speed of the arriving train. London automatic signaling provides only the solution for signaling propose only, but the concept failed to say about the presence of obstacle on the rail track. A Radio Based Intelligent Railway Grade Crossing System to Avoid Collision, Automated unmanned railway level crossing system, they have explained the discipline way road ways on level crossings. They have failed to imagine if the motorist is not obeying the rules or a car or a truck is stuck inside a gate or if there is any traffic jam. This work satisfies all the problems that are mentioned above. This work gives a better idea to the simplicity of the system and cost effective and speed of the arriving train. In this paper the design consists, the vibration sensor to sense arriving train and the signal is transmitted to activate the system in both the cases to take decisions. In first case, the obstacle is detected in the rail gates. In second case the obstacle is detect in path of trains and also in the level crossings. In the first case the obstacle detector is used to sense the obstacle on the rails within the gates and the signal is passed to the microcontroller to take the decision and put the auto brake. In the second case the rails are divided into several blocks and 10 blocks and further sets. Each block consists of laser sensors and microcontroller. The arrival of train can be detected by the vibration sensor. When a train is arriving inside a one block, that block will deactivate and the next block will activate. This system sends the signal to the train weather there is any obstacle or a train, if there is any train or an obstacle; it transmits a signal to the arriving train to stop. This work is done by low consumption electronic components and a simple system which is fats and cost effective.

II. HARDWARE DETAILS

Mirocontroller:

PIC 16F877A: An embedded system is a special-purpose computer system, which is completely encapsulated by the device it controls, so there are some specific requirements for each system, such as functions, reliability, cost, size, and power consumption, etc. Based on the computer technology, an embedded system is designed for specific application with hardware and software that could be tailored to adapt the system requirements. The core device of an embedded system, the embedded microprocessor can be an 8-bit, 16-bit or 32-bit microprocessor. Because of the limitation from the poor performance such as low running speed, low addressing capability and high power consumption, etc., the 8 bit or 16 bit microprocessors cannot meet the requirements of some complex embedded applications.

In the field of the 8 bit embedded system application, PIC (Programmable Interface Controller) gains tremendous success. PIC controller smaller size, lower power consumption, lowers cost, and relatively higher performance, etc. For instance, with a plenty of register and high instruction executing speed, most of data operations are completed in registers.

The PIC has advantages in addressing flexibility, facility and higher execution efficiency as well as fixed lengths of instructions, and so on.

AT89C52: The AT89C52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, three 16-bit timer/counters, six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89C52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The...
Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power down Mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next hardware reset.

Sensor:
Laser Sensor: This sensor is used to detect the obstacle on the rails.
Vibration Sensor: This sensor used to detect the arrival of the train.

III. ARCHITECTURE

The system is constructed with the two sensors and two microcontrollers. The system is divided into two divisions. The first one is in the level crossings and the second one is in the railway track. In the first system shown in the fig 1, a vibration sensor is used to sense the train. This vibration sensor is connected with the microcontroller AT89C52. The next a laser sensor is connected with the microcontroller PIC 16F877A. In the PIC 16F877A, the obstacle detection is calculated and either true or false condition is transmitted by this MC. In the second system shown in fig 1, the arrival of train is detected by the vibration sensor and transmits the signal to the blocks and cabins. This processing is done by the microcontroller AT89C52. The laser sensor is used to process the obstacle detection and to sending the signal to the train, either to stop or continue to run. Concept might be same in both systems the construction is different in both systems. We will see the elaboration of this system in the further explanations. An embedded C is used to program

IV. PROPOSED METHODOLOGY

The aim of the work is to provide the full safety in railway department. The two systems are designed in the paper. One is a system in a level crossing on roadways and on the other hand a system in a full track. In the first system the devices are designed to sense the obstacle, the laser detectors are kept on the gates in such way that it can detect in all possible directions. When the arriving of train is detected by a vibration sensor and the signal is transmitted to the gate by a MC AT89C52. After the signal is send the system is activated in level crossing. We are using a microcontroller PIC 16F877A. If there is an obstacle means the system will send a signal to the microcontroller. In MC an analog signal is converted to the digital signal then the decisions are taken. The signal arrived from the range of rails will alone have a true condition otherwise a false condition. True condition sends the signal to the train to activate the autobrakes if there is a false condition the message will sent to the train as the track is clear and keeps the auto brake in release condition. Then again the loop will start from the first step. If the obstacle is moved the microcontroller sends a signal to release the auto brakes. Next, the system that is designed in rails used to detect the obstacle on the path of the track and to clear the way. In this concept the track of the railway will be divided into cabins. The 10 cabins are jointly built into each block and the range of cabin depends upon the electric post on the sides of the track approximately at hundred feet. As like the system a laser sensor is kept on the electric post. If the train arrives the vibration sensor detector detects the arrival of the train. After the detection of train the first block is deactivated and the second block from the vibration sensor which is activated. The same microcontroller AT89C52 is used to the vibration sensor to pass the signal to the blocks to activate. When the blocks are activated the laser sensor kept in electric post will send the multi beam laser light to detect the obstacle on the track. It sends the laser in 180 radians so that it can cover the whole area of the cabin. The laser sensors are connected with MC PIC 16F877A. The signal digitalized. The range is determined according to the graph (Time vs Voltage) shown in fig 2. The decisions are taken according to the range. That is the microcontroller gives a true conditions only to the output signals from the laser signal within that range. If there is no obstacle means signal is sent to the train that the track is clear. If it finds any obstacle within the range it sends a signal to the train to put the auto brakes. It also fulfills the purpose that if there are two trains on the same track the trains are automatically stopped.
We will sample the outputs from the sensor for efficient ADC. To ignore a moving obstacle we use delay circuit shown in fig 3.

![](image)

**Fig 3: Delay Circuit**

Delay time will be equal to the time period of each scanning of laser sensors on the electric post. Thus the restricted obstacle on the rails is detected automatically. Hope that, this will reduce the railway accidents up to 90%.

V. FLOWCHART

System 1:

![Flowchart of System 1](image)

**Fig 4: Flowchart of System 1**

System 2:

![Flowchart of System 2](image)

**Fig 5: Flowchart of System 2**

In this flowchart fig 4&5, we can clearly understand the sequential steps of this system. These sequential steps are automatically processed. The loop design in the is flowchart makes the system more reliable. This concept makes the system simpler than other.

VI. ADVANTAGES

1) Very simple circuit.
2) Very easy and fast to design.
3) Easy to understand.
4) Easy to replace.
5) PIC 16F877A’s EEPROM has a retention > 40 years.
6) Low-power, high-speed Flash /EEPROM technology.
7) Fully static design.
8) Wide operating voltage range (2.0V to 5.5V)
9) Commercial and Industrial temperature ranges.
10) Low-power consumption.
11) Avoided a motion sensor by using a simple delay circuit.

CONCLUSION

The obstacle detection in railway network using embedded system designed in this paper is a real-time and general-purpose capability. Moreover its small size and low power consumption. This gives simple solution to the problem for railway accidents ever found. In the future we can additionally design with a GPS and surveying camera with a display in trains. We can develop the control arithmetic and improvement of functions, on which further study should be conducted.

REFERENCE:


