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# Prevention of Accidents using Automated Railway Crossing System

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***Abstract*: *Railways is the most prominent mode of transport across the country, which reaches every corner of the country. Accidents have been a major headache to the Indian Railway. Accidents that have been occurring at the railway crossing is increasing marginally at a higher rate. Therefore, new technology needs to be considered that is reliable, effective and functional for automatic railway gate closure. This Automatic railway gate crossing is an IR sensors based system. This system is implemented using IoT technology. Whenever the train base is sensed by the IR sensor (placed at around 1.5 km distance away from the railway gates) the microcontroller (Arduino Nano) activates the closure of gates that are connected to the driver circuit operated by DC motors. This system also detects obstacles(vehicles) using IR sensors (placed at the railway gates) that are preventing the closure of railway gates and alerts the train accordingly, then the train is mechanically slowed down or stopped if necessary. This system is developed to be a fail-proof system to avoid accidents at the railway crossing.***

***Keywords: Internet of Things, Automated Railway Gates, Transportation, Microcontroller, Arduino Nano, Sensors, Driver circuit, DC motors***

## I. INTRODUCTION

The Railway is the most favoured means of transport over the country which connects every city. On a daily basis, we read a several number of accidents that take place across the railway tracks. These sorts of accidents are sometimes deadly where there can be heavy losses. So, with more precautions, we need to enhance the railway transportation. Sometimes these railway mishaps are more destructive than any other accidents that take place in other modes of transport. To sort out these kinds of accidents across the railway crossing we propose this prototype. The IoT technology is a network of gadgets, cars, buildings and various things that are linked simultaneously with software, programming, sensors that allow these objects to gather and exchange information.

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The Internet of things (IoT) will control the objects that are connected to the internet remotely. IoT makes everything smarter virtually with the data collection, AI algorithms and networking. Major component of IoT is a sensor device which is used to collect data from the surroundings/environment. An IoT connected device will have the capability of alerting us in different ways like SMS, phone calls and through app notifications by which we can control the devices remotely.
The proposed system uses a controller to automate the railway crossings and to avoid accidents near the railway gates. This system can be developed as a fail proof system with continuous maintenance. It is a cost efficient way of automating the railway crossings. Hence, this system can make human life at railway crossing more safe and secure. The working of this project involves an electric framework connected to a mechanical framework.

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## II. LITERATURE SURVEY

In the existing system, the gate operator receives a call from the nearby railway station at the time of departure of the train. The gate operator then closes the gate at the railway crossing. [4] But in some situations, the gate is closed even if the train is late. Previously this prototype has been tried by various methodologies that had various limitations, which have been overcome. One such methodology was using ZigBee where data transfer between was slow and high maintenance was required, [2] [10] [11] the other was "Distributed real-time control of railway crossing using multi-agent" where the components were highly interdependent and required human intervention at regular intervals. Most of these approaches can be eliminated or minimized to some level by using an intelligent railroad crossing system that uses sensors close to the railway gates that sense rail arrival and close the gates. [3] The automated railway crossing takes less time compared to manual crossing and reduces the required human intervention.
The same idea can be implemented at unmanned railway crossings that reduces error rate during the operation of gates. Hence, an automatic railway gate control with a very limited budget can be implemented at each and every railway crossing to save the lives of the people. [5]
The main aim of automating the railway gate system is to reduce the operational period of gates and to avoid accidents at the railway crossings. Sushant Gajbhiye proposed a self-regulating railway gate system using radio frequency tags and microcontrollers. In this paper errors are restricted because of automated operation using microcontroller and also it overcomes the major drawbacks of IR sensor.

[6] Shobhit Gakkhar in his paper action prevention methods at railway crossing proposed a system for object detection at railway crossing in order to prevent railway accidents. This system recognises train horn in real time in a noisy environment by using speech recognition and hidden markov model. [7]
Shubham Malik proposed a GSM based system to track the location of trains and automate the railway crossing system based on the location. The train driver will be notified if there is any possibility of collision or an accident. [8]
Pushpa Y proposed a system for accident prevention due to collision as well as fire using flex sensors, fire sensors and a microcontroller unit to operate on. [9]

## III. PROPOSED SYSTEM

The proposed system detects the train by using IR sensors. The DC motor is driven by using a L293d (motor driver) and an Arduino Nano with Atmega328P microcontroller is used to control the device. The arrival of the train is detected by an IR sensor which is placed 1.5km away from the railway gate, then the microcontroller will issue a command to close the gate with an alarm/siren. Upon receiving the information about the arrival of the train the system checks for obstacles that are preventing the closure of gates, then the micro-controller will issue a command to the railway signal which alerts the train and the speed of the train is mechanically decreased or if the gap is implausibly less the train is stopped. So we prefer to suggest an automated system to sense the train by using two IR sensors and operate railway gates appropriately.

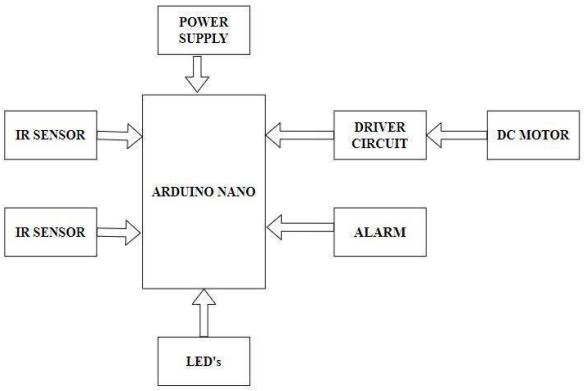


**Fig 1: Architecture of Proposed System**

For opening and closing of the gates, a L293D motor driver is used to run the gate motor in both forward and backward direction. All the systems are regulated by Arduino. The code written to run hardware in this proposed system using embedded C is dumped into Atmega328P microcontroller. In the Fig.1 the components used are explained below:

### A.Microcontroller

In this framework, we are using an Arduino Nano with an ATmega328P microcontroller.
In this proposed system the functionalities of the micro controller is listed as below
1)To identify the arrival as well as the departure of the train.
2)A L293D motor driver and DC motor are used to operate the railway gates.
3)Alert the vehicles near the railway gate about the arrival of the train using an alarm.
4)To control the Red, Green, Yellow signal lights at railway crossing.

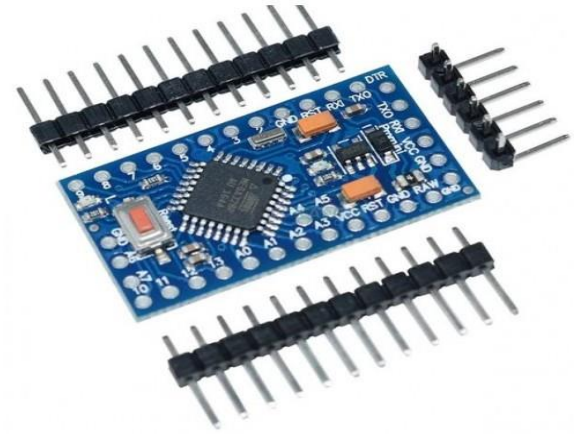

**Fig 2: Arduino Nano which consists Atmega328P microcontroller**

### B. Sensors (IR Sensor)

The sensors act as an input unit placed at a quite a distance from the ends of railway gates. These sensors are responsible for the detection of arrival and departure of trains. These sensors act as input units for the framework. The IR sensors work based on the principle of transmitting and detecting IR radiations.


**Fig 3: IR Sensor**

### C. DC motor

The DC motors are used to operate the gates forward and backward. The principle of working of a motor is that the electrical energy is converted to mechanical energy.

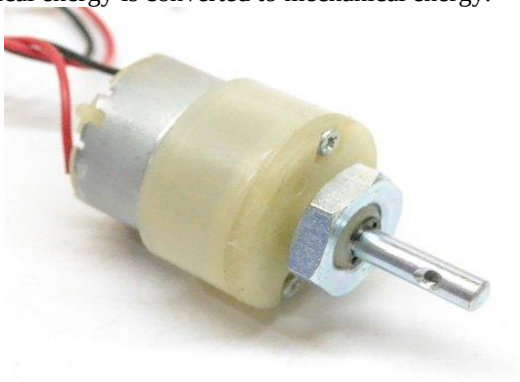

**Fig 4: DC Motor**

**D. Driver circuit(L293D)**

It is an IC motor driver which can drive 2 DC motors at a time. This motor driver can drive the motor in either direction (forward and backward).

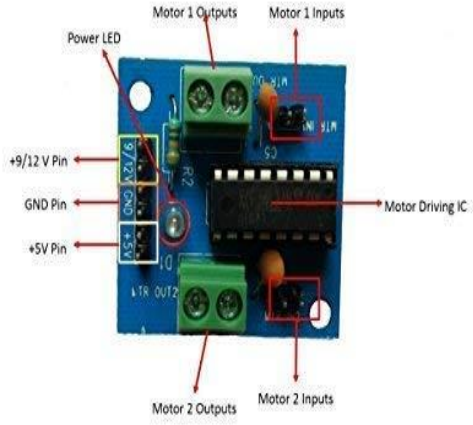


**Fig 5: L293D Driver Circuit**

**E. Arduino Integrated Development Environment.**

It is a cross-platform for implementing the coding part can be done by using the Arduino ide. These are the components that are primarily used for the prototype. The "Arduino language" is simply C++.All the standard library functions are written C/C++ and the IDE uses the GCC/G++ compiler. Using this components, the previously tried prototypes related to solving the problem is more efficiently solved and has better experience. It is developed to write and dump codes into arduino compatible boards and chips. as like other software arduino ide also has a supporting window to edit text followed by a main menu which consists of buttons to verify, upload, open, new, save and many more.

## IV. DATA FLOW DIAGRAM

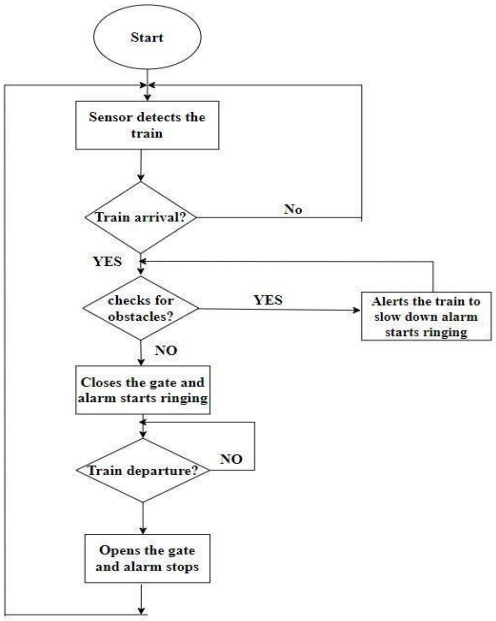


**Fig 6: Flow chart depicting dataflow**

In the above Fig 2 the dataflow of the prototype which is an automated railway crossing system, before the start of the driver circuit, the system is programmed to trigger IR sensor every time after certain delay. Once the train is detected the command passes to the microcontroller. The system checks for obstacles when the IR sensor detects the train. If obstacles are found, then the train is slowed down and the alarm starts ringing. If no obstacle is detected, then the gates are closed. After the departure of the train, the gates are opened.

## V. RESULTS AND DISCUSSION

The results that the prototype display are as follows:
1)Detects the train arrival and departure.
2)To open and close the railway gate automatically by using the DC motor.
3)Alarm and light signal for warning the people regarding the train departure and arrival.
4)Checks for the obstacles before any train passes from the crossing.
The advantages are accident avoidance, less human intervention, safety and quality of services, accurate gate open/close. The prototype is accordingly made to avoid the accidents at the unmanned crossing after its effective use at the unmanned crossing we can propose this project/prototype at the manned crossing which could reduce the accidents that take place near the crossings. To make it completely automated we need equip a never ending source of energy that could operate the gates and the appropriate solution is the solar energy that can be obtained through the solar panels.

## VI. CONCLUSION

By implementing this system, we can achieve reduction in the number of accidents taking place across the railway crossing across the nation. This can turn out to be a simple, cost-effective and reliable solution to decrease operational error rate at railway crossings. In future we can enhance this system by connecting a solar panel replacing the traditional electric supply and make this a fully automated and self-regulating system.

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