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A Microcontroller Operated LASER based Railway Gate and Signal Controlling System with Efficient Accident Prevention Strategy via IP-Webcam related Video-Surveillancing

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Abstract: ***The objective of our proposed work is to provide an automatic railway gate at a level crossing replacing the gates operated by the gatekeeper. 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. By the presently existing system once the train leaves the station, the stationmaster informs the gatekeeper about the arrival of the train manually. 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. By employing the automatic railway gate control at the level crossing the arrival of the train is detected by the laser light module placed near to the gate and people can aware the position of the train by cctv feature using Arducam mini camera. Hence, the time for which it is closed is less compared to the manually operated gates and also reduces the human labour. Since, the operation is automatic; error due to manual operation is prevented In our project if a person suddenly comes in front of a running train, train detects the presence of the person by using passive infrared sensor (PIR sensor) sensor operated by Arduino-UNO (R3) microcontroller and it reduces its motion and finally stops .Thus we can prevent accidents.***

Keywords: Laser light module, Arduino-UNO (R3) microcontroller, Passive infrared sensor (PIR sensor), Arducam mini camera.

I. INTRODUCTION

This paper deals with a topic which is more unique and economical method for improving the safety of railway gate crossing. Road accidents at railway gate is a leading cause of death and injury worldwide. There is a Survey which is conducted by Indian Railway and they found that about 17% of total railway accidents in India is occurred for passive railway crossings and unawareness of railway gate keeper. Now a days the operation of railway gates at level crossings is not so reliable and not so effective. Primarily the road users have to wait a very long time before the arrival of train and even after the train is left and even they don't know that is there two train comming at the both side or not. And secondly most of accidents that usually made by the carelessness driving of the road users or the time errors which is not maintain by the gatekeepers and the gatekeeper know the message via telephonic system so if the telephone is disconnected or busy anyreason then chances of the accident is more. Now here comes the importance of automatic railway gate control system. In this project we detect the arrival of train and warn the road users about the arrival of train by timer in the LCD screen. In this system, at the level crossing the arrival of the train is detected by the laser light module placed near to the gate. Hence, the time for which it is closed is less compared to the manually operated gates and also reduces the human labour and chances of accidents is also reduced. Each and everyday accident occurs in various ways in various places. This project is mainly done to save life and prevent accident. Prevention of an accident can be solved in such a way that when the train detects the presence of people the speed of the train gradually decreases and ultimately stops. Recently Two Indian Railways passenger trains crashed to a crowd of people in the eastern outskirts of Amritsar, Punjab, on 19 October, 2018 and they gathered there to watch celebration of the Hindu festival of Dussehra and they were standing on the tracks and they couldn't listen the sound of the train because of fire crackers. The accident occurred in the early evening and 59 people were died on the spot and approximately 100 people were injured. Normally a train driver can not see if any human try to attempt suicide at the midnight or fell down or come across on the railway track but PIR sensor can detect the motion of a human being. So if any human being come infront of the running train then PIR sensor will detect it and the speed of the train will decrease gradually and finally the train will stop. So this project is only for accident prevention purpose and improve the safety at level crossing.

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II. OUR PROPOSED WORK

In our proposed work we use laser light module (transmitter and receiver) for the arrival of train is a new concept for our project and count down process and message printing on a lcd screen make our project more fruitful to common people. Another feature of our project is live telecasting of the arrival of the train on a screen as a sender and receiver processing using Arducam mini camera.So people can see the actual position of the train from the railway gate. This feature can aware people and prevent accidents and the timer on the lcd screen will prevent the sudden fall down of the railway gate on the veichle or car or human beings.Prevention of an accident can be solved in such a way that when the train detects the presence of people in front of the train using PIR sensor the speed of the train gradually decreases and the speed controller will help to reduce the speed and finally the train will stop.

A. Components Required For Proposed Work

1) *Servo Motor:* A servo motor is an electrical device. It can push or rotate an object with great precision. If you want to rotate and object at some specific angles or distance, then you can use servo motor. Servo motor is just made up of simple motor which can run through servo mechanism. If the motor which is used, is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor. We can get a very high torque servo motor in a small and light weight packages and it is easy to use. Due to these features they are being used in many applications like toy car, RC helicopters and planes, Robotics, Machine etc.The position of a servo motor is decided by the electrical pulse and its circuitry is placed beside the motor.



Fig.1Servomotor SG50

2) *LCD:* LCD (liquid crystal display) is the technology used for displaying. Like light-emitting diode (LED) and gas-plasma technologies, LCDs allow to display to be much thinner than cathode ray tube (CRT) technology. LCDs consume much less power than LED and gas-display for displaying because they work on the principle of blocking light rather than emitting it.

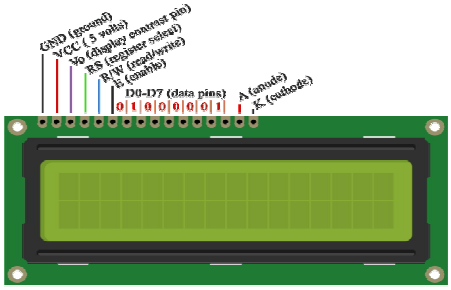


Fig. 2 Liquid Crystal Display

3) *Buzzer:* A buzzer is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric. It is also known as beeper. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.



Fig. 3 Buzzer

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4) *LED:* A light-emitting diode (LED) is a semiconductor light source which emits light when current flows through it. Electrons present in the semiconductor recombine with electron holes, releasing energy in the form of photons.



Fig. 4 led

5) *Laser Module:* The laser head of laser module is composed of a light-emitting tube, condenser lens and adjustable copper sleeve and it is assembled when delivered. The focal length of the lens of laser module is adjusted glued by strong glue stick, which can work directly after connecting to a 5V DC power supply.

6) *Transmitter Module*

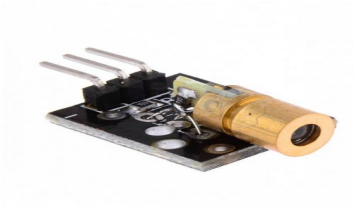


Fig. 5 transmitter module

7) *Receiver Module*



Fig. 6 receiver module

A photoresistor is a light-controlled variable resistor and the resistance of a photoresistor decreases with increasing incident light intensity; in other words, we can say that it exhibits photoconductivity. A photoresistor can be applied in light-sensitive detector circuits, light-activated and dark-activated switching circuits and it is very easy to use.

8) *Microcontroller Board (ATMega328P- Arduino UNO-R3):* Arduino is an open-source hardware and software company.The Arduino Uno is a microcontroller board which is based on the ATmega328. It has 20 digital input/output pins of which 6 can be used as PWM outputs and 6 can be used as analog inputs, a 16 MHz resonator, a power jack, a USB connection, an in-circuit system programming (ICSP) header, and a reset button. It contains everything which is needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

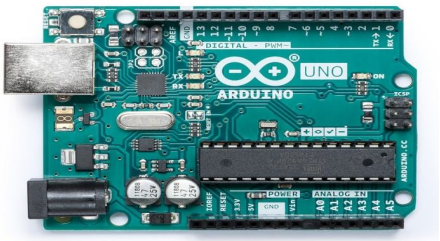


Fig. 7 Arduino UNO-R3

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9) *ArduCAM Mini Camera:* The ArduCAM Mini Camera Module Shield w/ 2 MP OV2640 for Arduino can be used in many platforms like Arduino, Raspberry Pi, Maple, Chipkit, Beaglebone black etc. It is optimized version of ArduCAM shield Rev.C. It is also a high definition SPI camera, which reduce the complexity of the camera control interface.



Fig. 8 ArduCAM Mini Camera

10) *Jumper Wire:* A jump wire is also known as jumper wire, or jumper. It is an electrical wire, or group of them in a cable, with a connector or pin at each end which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other .Jumper wires are typically used with breadboards and other prototyping tools so that it easy to change a circuit when it is needed.



Fig. 9 Jumper wire

11) *Dc Motor:* A DC motor is one of the class of rotary electrical machines which converts direct current electrical energy into mechanical energy. The most common types rely on the forces is produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, in order to change the direction of current periodically flow in part of the motor.



Fig. 10 DC motor 5V

12) *L298N Motor Driver Module:* The Motor Driver is used to control **motors** so that you can control the working speed and direction of two motors simultaneously. This Motor Driver is developed and designed based on L298 IC. L298 is a 16 Pin Motor Driver IC. This motor driver is designed to provide bidirectional drive currents at voltages from 5 V to 36 V and it is very easy to use.

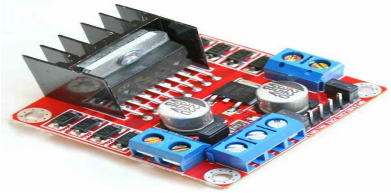


Fig. 11 L298N motor driver module

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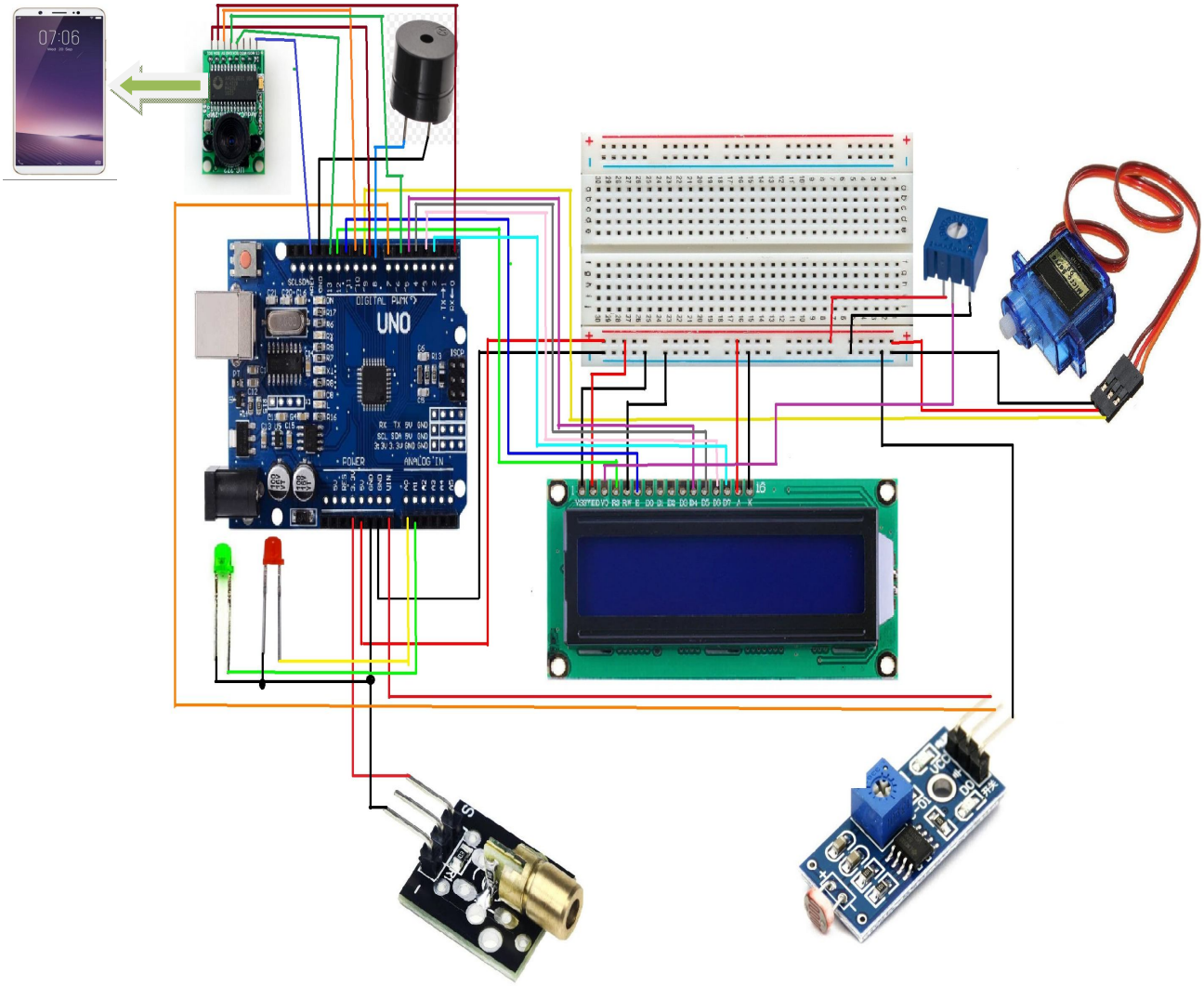
13) *PIR Sensor:* A passive infrared sensor (PIR sensor) is an electronic sensor. It measures infrared (IR) light radiating from objects in its field of view.PIR sensors allow you to sense motion, almost it is always used to detect whether a human has moved in or out of the sensors range. They are most often used in PIR-based motion detectors. It works on 5V DC current supply and gives TTL output which can be directly given to microcontroller or to relay through a transistor. This sensor consists of pyroelectric sensor and fresnel lens which detects motion by measuring change in the infrared levels emitted by the objects. It detects motion up to 20ft. This module is very sensitive in order to change in infrared levels subjected by human movement.



Fig. 12 PIR Sensor

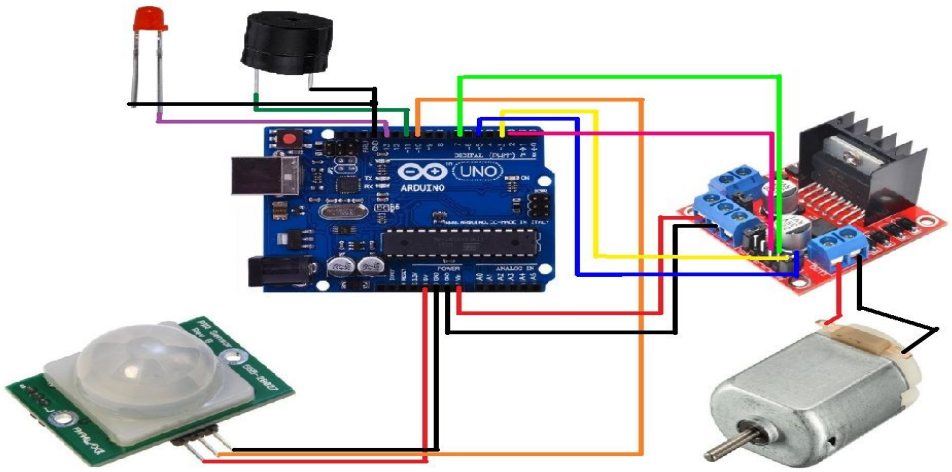
B. Proposed Circuit Diagram

1) Circuit Diagram For Automatic Railway Gate System-Part-1



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2) Circuit Diagram For Automatic Railway Speed Controlling System After Detecting Living Object -Part-Ii



C. Proposed Algorithm For Our Proposed System (Combining Ii.B.1 And Ii.B.2)

Start

Step 1: At first the signal of train is red and after some time the train starts its journey and at that moment the railway gate lifts up.

Step 2:When the train cuts the laser light module the buzzer sounds on and the signal of the train becomes green from red.

Step 3: After that count down starts on lcd (LIQUID CRYSTAL DISPLAY) screen and the position of the train from the gate is displayed on screen using arducam mini camera.

Step 4: After finishing of the count down a message “the train is coming” is printed on the lcd (LIQUID CRYSTAL DISPLAY) screen and if any human being comes in front of the train then go to step 5 otherwise go to step 6.

Step 5: The speed of the train decreases gradually and the buzzer sounds on and red led light becomes on and train stops.

Step 6: Next the railway gate pulls down and a message is printed on the lcd screen “the train has passed”.

Step 7: After passing of train to the railway gate, the gate lifts up and buzzer sounds off.

Step 8: The signal of the train becomes red from green.

End

III.EXPERIMENT AND RESULTS

In our project we are going to create such system which can be able to avoid several accident in railway track.We have to use latest technology that is automatic railway gate control to avoid maximum number of accident on railway crossing Therefore, system is more reliable, accurate and less time consume. People can aware the position of the train by cctv features using Arducam mini camera and the timer in the lcd screen will help them to get the minimum time to cross the railway gate.In our project if any human being come infront of the running train then PIR sensor will detect it and the speed of the train will decrease gradually and finally the train will stop.Now if the train has stopped suddenly then the train will not control its speed and the coaches of the train will be derailed from the track.So here we use speed controller to control the speed of the train.

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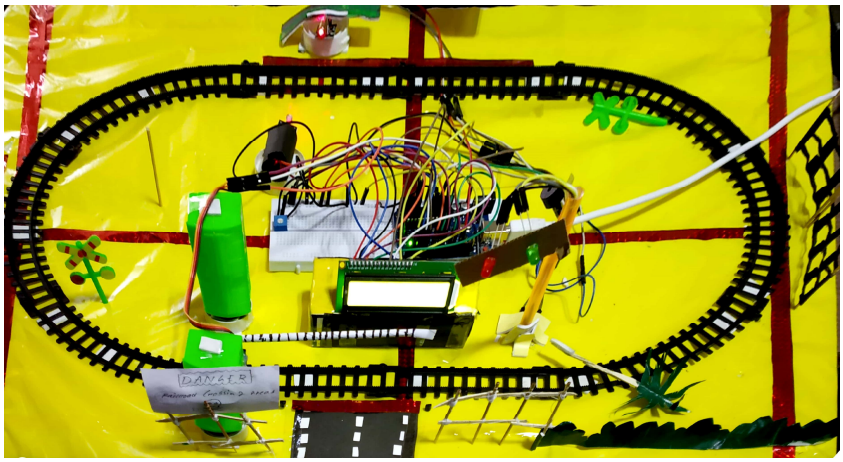


Fig. 13 Circuit of automatic railway gate controlling system.

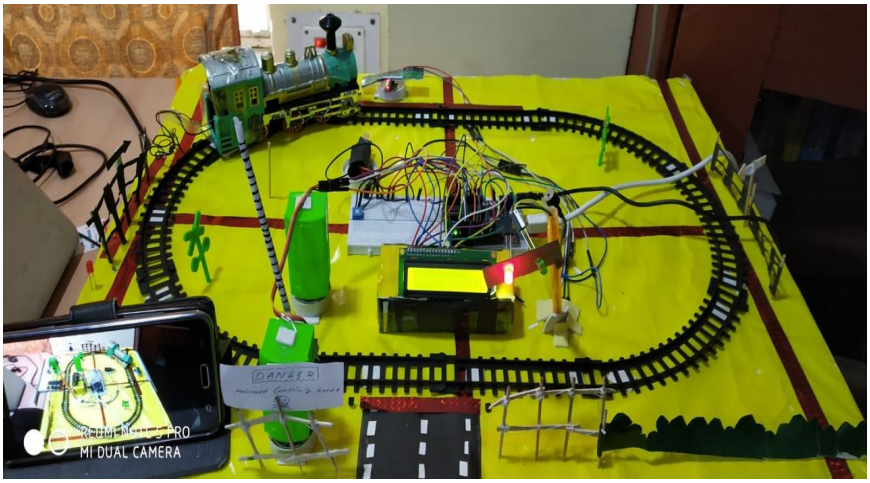


Fig. 14 Live telecast of the actual position of train on a screen with the help of Arducam mini camera.

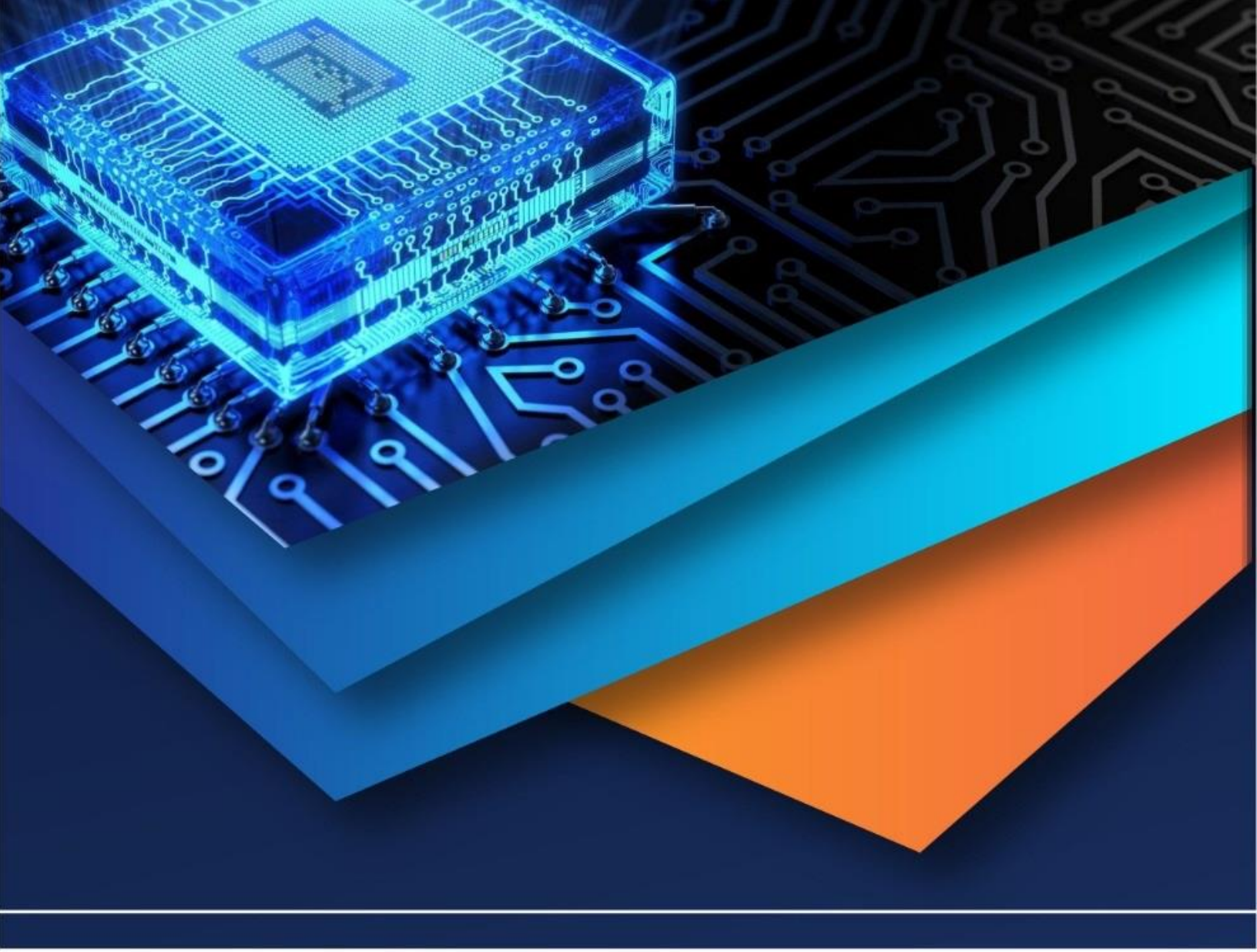
IV. CONCLUSION

The circuit of our project was designed and set up in a breadboard. It is found to be very reliable and stable and useful. The circuit was able to control the railway gate precisely. The circuit was tested in both direction and worked perfectly. By using laser module we were able to achieve a fast response. Our project is a necessary tool for today's railway crossings due to the increased number of accidents and also due to the problems occurring to the road passenger's while waiting a longer time during the passage of train unnecessarily. By using our project the run over cases of train can be reduced.

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