

# Arduino Based Hill Collision Alert System: An Approach

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**Abstract:** One returns into human forms, after having wandered through other life forms. The importance of human life cannot be overemphasized as it drives overall economic growth. This research focuses on problems associated to accidents of vehicles in hilly areas. Through this paper, I provide an approach to a more secured and enhanced system to avoid accidents in hilly areas and minimize human injury and deaths. In this system, the vehicle is warned on detection of rocks and cliffs. The system uses infra-red sensors paired with arduino controller. Arduino sends the warning to the driver in the absence of an object (rocks). A Wi-Fi camera module is also installed in the vehicle which sends real time images. The module is made to use Artificial Intelligence's subset Machine learning to enhance the security of vehicle. The module is designed to secure accidents. The system contacts the Arduino using its serial communication protocol (Universal Asynchronous Receiver/Transmitter) for efficient use of system and to minimize the rate of collision.

**Keywords -** Arduino, camera module, infra-red sensor, machine learning, raspberry pi zero, vehicle safety.

## INTRODUCTION

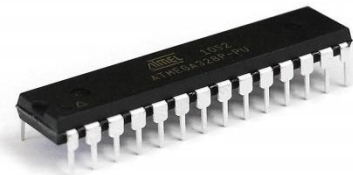
Software testing is an important activity which plays a The defective roads of hilly districts are the second major cause of accidents, accounting for 13.6%. In 2017, road accidents claimed the lives of 1.3 million people worldwide.[7] So, it is often necessary to take precautionary steps against them. Therefore, the development of an enhanced system to avoid accidents of vehicle has been emerged. With the development of modern science and technology, the modern researches are focusing on autonomous robots. Autonomous robots are widely used in the fields of automobile, electronics, machinery, transportation and so on. Implementation of arduino in these cases can minimize the rates of failure. This study mainly realizes the intelligent mode of arduino accident avoidance car. This car can analyze the path in real time with the help of infra-red sensors and the camera module which can capture images at a very fast rate.

### ARDUINO UNO

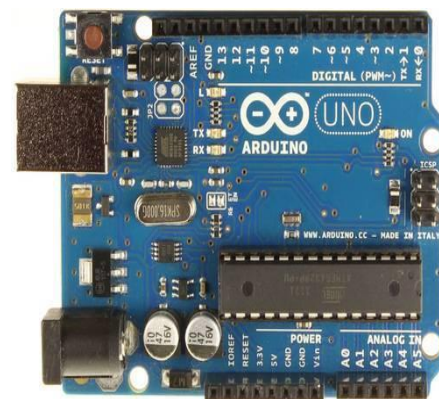
The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller. The board is equipped with sets of digital and analog input/output (I/O) pins, programmable with the Arduino IDE via a type B USB cable. It can be powered by the USB cable.

- Operating voltage – 5volts
- Analog input pins – 6
- Digital pins – 14 (of which 6 provide PWM output)
- Input voltage (recommended) – 7 to 12volts

- Input voltage (limits) – 6 to 20volt



(A) ATmega328P



(B) Arduino Uno

**RASPBERRY PI CAMERA MODULE v1.3:**

The 5MP Raspberry Pi Camera Module Rev 1.3 equips flexible cable for attaching with Raspberry Pi zero. The high-definition 5MP camera delivers outstanding photos, ideal for projects. The Raspberry Pi camera module can be used to take high-definition still photographs. It attaches via a 15cm ribbon cable to Raspberry Pi by way of one of the two small sockets on the board upper surface. This interface uses the dedicated CSI (Camera Serial Interface) interface, which was designed especially for interfacing to cameras. The CSI bus is capable of extremely high data rates, and it exclusively carries pixel data.

- Resolution – 5MP
- Image size – 2592x1944
- Sensors – Omnivision 5647 fixed focus
- Aperture – 2.9
- Focal length – 3.29



**(A) Raspberry Pi Camera Module v1.3**

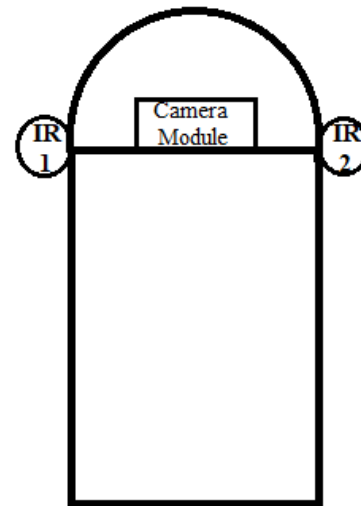


**(B) Raspberry Pi zero**

**DESIGN:**

Fig. 1 shows the layout for the various component placement on the vehicle. The two infra-red sensors are placed on both the sides i.e. left and right side of the vehicle

named as IR 1 and IR2 respectively. The Raspberry Pi Camera Module Rev 1.3 named as camera module is placed above the vehicle inclined at an angle of 30 degrees with the line between the rectangle and the semi-circle taken as reference. [1],[4]



**Fig. 1**

**WORKING:**

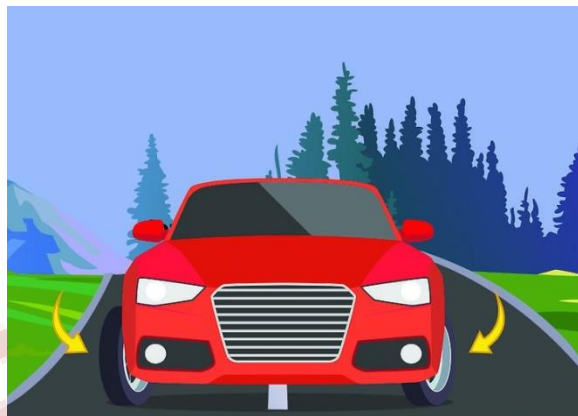
The connections between the components are shown in the block diagram. The main controller of the project is arduino uno which controls the 2 infra-red sensors and gives warning to the system on the absence of rocks. The two infra-red sensors are placed on front doors of the vehicle on both the sides. The IR sensor is programmed in such a way that it triggers an impulse signal whenever there is absence of rocks (exact opposite for what an IR sensor is used for). The left IR sensor is tuned in such a way that it senses the thermal radiations upto a distance of 0.7 m - 1.0 m, when the vehicle is climbing uphill. In the similar manner, the ir sensor placed on the right side of the vehicle can sense the radiations in the range of 3.4m to 3.6 m when the vehicle is climbing down. So both the IR sensor provides the warning to the arduino. Now, the second step would be to control the movement of vehicle, here we use the PWM approach of arduino to control the speed of vehicle. Using the delay function the motor, the car can walk smoothly, use PWM to control the speed of the car, and use the controller to steer the the vehicle with the help of IR sensors. To enhance more secured and efficient system a Raspberry Pi Camera Module Rev 1.3 is tuned with a raspberry pi 3 which captures real time images at every certain interval. The camera modules uses machine learning algorithm to process every image and

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it takes decision on the detection of cliff. The ML output is fed as an input to Pyserial library of python 2.7, and then through UART (serial communication protocol) of arduino controls the movement of vehicle.



**Stage 1**



**Stage 2**

**RESULTS**

This study uses Arduino IDE 1.8.9 and writes C program to complete the movement and control of the arduino based hill collision alert system. As shown in the above pictures, the stage 1 detects the problem for which the system is designed. In stage 2 the arduino controls the accident, with the help of sensors and camera module. This system works for maximum efficiency, the rate of failure of this system is barely minimum.



System avoided this situation

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