

# Speed Control of Electric Motor using Ultrasonic Sensor and Image Processing Technique with Raspberry Pi 3

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**Abstract:-** India has the second largest roadway network in this world. India's economy relies mainly on road transport. Nowadays road accidents, injury and even death have been considered as common in our country. People don't follow traffic rules and road safety measures and these are the main reason of such accidents. Government of India has made variety of road traffic and road safety rules for everyone using road for their safety and decreasing the number of daily road accidents. In order to reduce the accidents, speed limit should be maintained. The speed of the motor can be reduced using Ultrasonic Sensor and image processing technique with the help of Raspberry pi. When speed limit sign board is detected, the speed of the motor is controlled within the specified limit using Image processing limit. Ultrasonic sensor is used to detect objects within the specific range and the speed of motor is reduced when an object is sensed.

**Keywords:** Object Detection, Video-Image Processing, Ultrasonic Sensor, BLDC motor, Raspberry Pi

## 1. INTRODUCTION

Road accidents have become very common because of vehicle crashes and not educating of proper road safety measures. The number of mortality is increasing due to the motor vehicle crashes by the people ignoring road safety rules. All the roads have been engaged for full day where vehicle are rushing in their high-speed. People in the recent world are being used to of their personal transportation so there is more traffic on the roads than ever before. In such circumstance, the traffic norms and safety measures need to be followed by people for safe driving. As a result the road accidents can be diminished. It is now becoming very unsafe to drive on the road day by day about the penalty. If the owner fails to pay the fine, it might result in nullification of the driving license, doubling the fine and it could end up in arrest.

Wireless PDAs are used by the police to recognize a vehicle's or driver's history. 85 percent speed is affiliated for safe speed limit at zone. 98th is for highway geometric sketch. 15 percent speed is morsel speed on major highways. It is apparent that person driving at the average speed has less possibilities of getting into an accident than a motorist who is driving beyond the speed limit. One who travels at average speed has proper control on the vehicle as one that is moving at a high speed or beyond the speed limit mark. Driving beyond the speed limit could help us buy some time but is it really worth it. Violating speed limit is a main factor in about 2 to 5 percent of fatalities. Speed discrepancy, which is the act of thrusting over the limit makes it hard to ascertain the speed of other drivers and it can create accidents while switching lanes or overtaking other vehicles because at the same time the other driver could also be increasing his speed, at the same time as you are switching between lanes and this could end up in accidents.

Not only destruction of life but also speed can cost money and some other problems. The fuel consumption is amplified by traveling in vehicles at elevated speeds and environment gets polluted due to this. Apart from consumption of more fuel, the driver has to spend more money since over speeding drains up the fuel fast. Driving the vehicle fast will increase the wear and tear of that vehicle and the forecasted reliability could decline and substitution of the automobile will be faster than the foreseen period because the vehicle won't last longer as it was supposed to be.

## 2. COMPONENTS OF THE SYSTEM

Even though the highway police have begun to use automated instruments, the speed-limit restriction in India is almost non-existent. Those equipments are used to appropriate speed and mail the car owner

### 2.1 RASPBERRY PI

Raspberry Pi is a portable size and low cost computer board which has a powerful processor with high performance. Raspbian OS is used as the main core language and it can develop program using Python and C language. The Raspberry Pi 3 has

Broadcom BCM2837 ARM cortex – A53 1.2GHz memory, 1GB LPDDR2 (900MHz) RAM , micro SD, 802.11n Wifi module , Bluetooth is 4.1 Classic low energy, 40 pin GPIO , Display Serial Interface (DSI), Camera Serial Interface (CSI).



Fig- 1: Raspberry Pi 3

## 2.2 ULTRASONIC SENSOR

The distance from an object can be measured using this instrument. Objects that are within a range of 20mm – 4500mm (.78” – 14’ 9”) can be disclosed. The distance found is intimated by the two digital pins in the device. The function of Ultrasonic Range Detection Sensor includes transmission of ultrasonic pulse at 40 KHz range, holding and listening for the echo pulse, and estimation of the time taken. A pulse can be triggered as fast as 20 times a second and it is possible to detect objects as near as 30mm and upto 300cm away. A 5V power supply is required to run the sensor. For triggering input and to initiate the ranging, 10uS is required. An 8 cycle burst of ultrasound is transmitted by the module at 40 kHz and echo is enhanced. The pulse width and the range will be in relation to trace the echo of distant objects. Then range is estimated through the time interval between receiving echo signal and transmitting trigger signal. It is highly recommended to utilize above 60ms configuration cycle, so that trigger signal to echo signal can be prohibited. Gnd, +5v, echo and trigger are the four main connections.

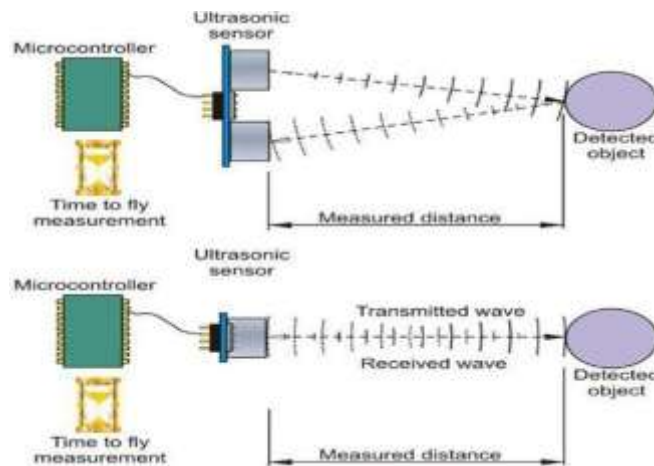


Fig- 2: Ultrasonic Sensor

### 2.3 BLOCK DIAGRAM

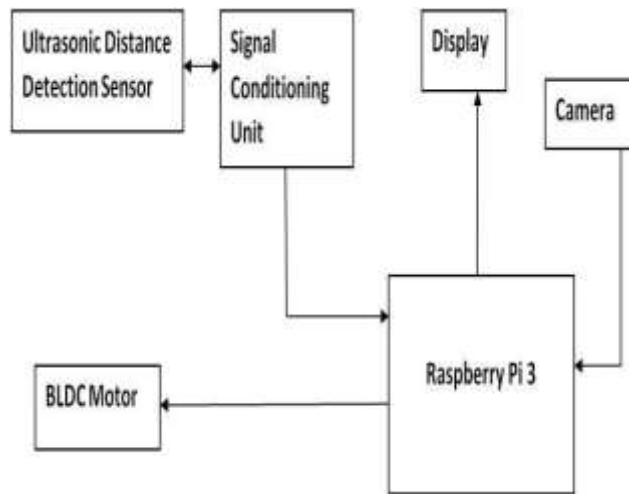


Fig- 3: Block Diagram

## 3. METHODOLOGY

### 3.1 GENERAL PROCEDURE

Speed of the electric motor is automated giving the control to the Raspberry Pi so that the safety level of the rider can be increased. The main features of the proposed system are:

1. Ultrasonic sensor will be able to reduce the speed of the motor on sudden detection of any object within the range.
2. The speed limit sign boards are also detected so that the motor speed can be controlled using image processing technique.
3. The system is operated in the battery of vehicle, therefore it can provide control over the speed of motor throughout the running of vehicle.
4. Raspberry Pi runs 14 hours per day.

The speed sign boards are continuously monitored and detected using a dedicated camera for speed control by image processing. It helps to ensure the safety of the rider. The speed of the vehicle is continuously monitored by the raspberry pi.

Vehicles are essential in our day-to-day life for transport. For safer travel, the speed has to be controlled and it is done with the help of proposed system.

### 3.2 ALGORITHM

Controlling the speed of motor using Image processing technique

**Step 1:** Video frames are captured by the camera.

**Step 2:** Edge detection process is carried out.

**Step 3:** Motion analysis is performed.

**Step 4:** Definition of the detection zone.

**Step 5:** Captured video frames are classified and processed.

**Step 6:** As a result, speed of the motor is controlled as per processed sign board image.

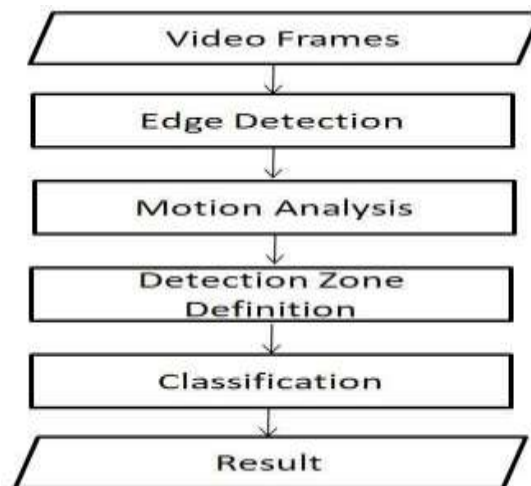


Fig- 4: Image Processing Flowchart

Reducing the speed of motor using Ultrasonic sensor

**Step 1:** Transmitter sends ultrasonic waves for a certain range of distance.

**Step 2:** Obstacle is detected by the sensor.

**Step 3:** Wave is reflected back by the object.

**Step 4:** Ultrasonic receiver receives the wave.

**Step 5:** Braking circuit gets input from the receiver.

**Step 6:** Brake of the vehicle is applied.

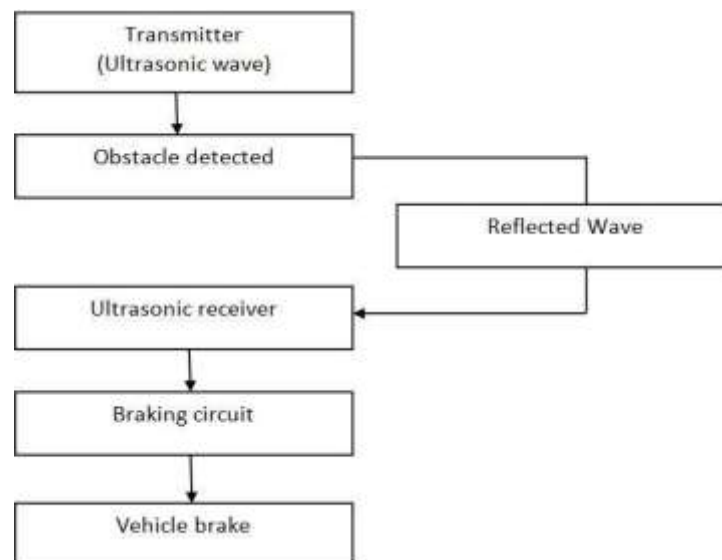


Fig- 5: Ultrasonic Sensor Flowchart

#### 4. RESULT ANALYSIS

##### 4.1 IMAGE PROCESSING

The webcam is used to capture the road signs and the video frames are processed such that it compares the processed image with the images fed before. Based on the speed limit, the speed of the electric motor is controlled.

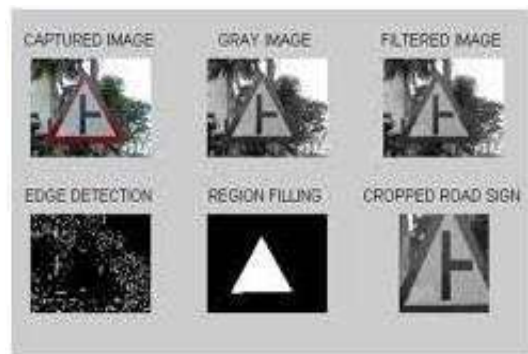


Fig- 6: Image Processed by camera

## 4.2 ULTRASONIC SENSOR

The ultrasonic sensor transmits wave and detects for the presence of any object within the range. Incase of presence of any object within the range, the receiver will sense the wave echoed by that object. The speed of the electric motor will be reduced so that collision with the object can be prevented.

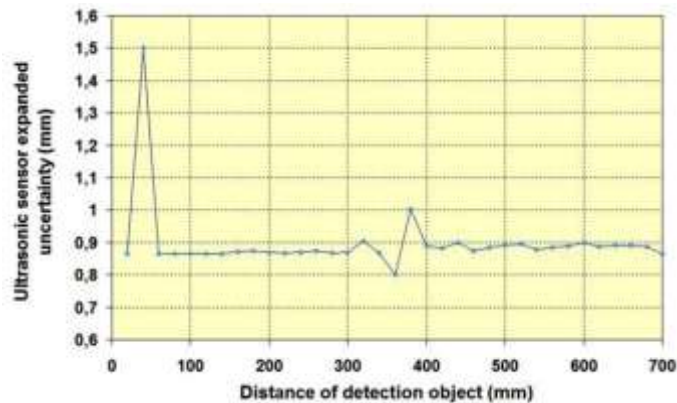


Chart- 1: Object detection using Ultrasonic sensor

## 5. CONCLUSION

The automated speed control of electric motor can be implemented in bikes thereby reducing the accident rate in our country. This speed control system helps to improve the control and stability of the vehicle. Raspberry pi 3 is an important part of system which handles the processing and working. In this proposed system we used Ultrasonic sensor for detecting the objects within the specified range and controlling the speed of electric motor. The speed limit sign board image captured by the camera will be processed so that the speed can be controlled within the mentioned speed.

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