

## DEVELOPMENT OF A SAFE OVERTAKING SYSTEM ACCORDING TO BANGLADESH HIGHWAY ROAD

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**Abstract:** *Overtaking is common scenery in the high way roads. Sometimes, road accident occurs due to overtaking. It is happening all over world. Because, the drivers are not so careful about road accident during driving. Also the roads which are not divided in to several lines, there is a possibility of accident during overtaking. But overtaking is necessary for various purposes. So a safe overtaking system is required for us for safety during driving the vehicles. It is seen that, when a car or small vehicle wants to overtake another vehicles or truck or lorry, then road accident can occur. So I would like to propose a system that will help someone to know the existence and distance of a vehicle when he is at the back of a big vehicle or truck. It will help to overtake safely without any road accident. It can work within the range 10 cm distance. During practical application, it needs to be increased. If the distance between the front vehicle and truck is more than 10 cm distance, green light will on. It means that overtake is safe. If the distance between the front vehicle and truck is less than 10 cm distances, it means that overtake is not safe.*

**Key words:** Overtaking, Road Accident, Driving, Vehicle, Truck, Safety.

### 1. INTRODUCTION

Overtaking or passing is the act of one vehicle going past another slower moving vehicle, travelling in the same direction, on a road. The lane used for overtaking another vehicle is almost always a passing lane further from the road shoulder which is to the left in places that drive on the right and to the right in places that drive on the left.<sup>[1]</sup> Development of a “Safe Overtaking System of Vehicle” means to develop a system that will help to overtake safely in the high way roads without facing any problem. It is a microcontroller circuit based system. It is a new concept. Generally a sonar sensor is used. Sonar sensor detects the distance and existence of vehicle. After that, the signal is converted in to visual through different color LED light by a microcontroller circuit. We are in the age of development of science & technology. Science & technology are developed day by day. Unfortunately our country is not so developed in science & technology. But we are trying to develop it. As much as we can develop science & technology in our country, we can live a better life. An economic safe overtaking system can play a great role in this sector of Bangladesh.

### 2. LITERATURE REVIEW

In 2013 university of Porto in Portugal developed a technology known as “See Through System”. The idea was a lightweight heads-up display which was used to look through a truck which is at the ahead. The idea is to support a driver who is stuck behind a large, slow moving vehicle on the high way and has no way to check if it is safe or not to pass. According to a new scientist report on the system, the image has a delay of 200 milliseconds, and it shows an oncoming car to be ten meters further away than it actually is, if both it and the driver’s car is moving at 90 kilometers per hour. Michel Ferreira and his colleagues at the University of Portugal developed the see through system. Ferreira is also popular founder of a technology based company specialized in “Optimization of vehicular mobility,” called Geo link. Ferreira has started that he is not only interested in “Intelligent Transportation System” but in what he terms “Cooperative ITS,” where inter vehicle communication plays an important role. In a scenario involving the see through system, large vehicles drive with a forward facing webcam on the on their windshield. Cars have a transparent LCD screen built

in to their windshield. The driver is able to see what the road in front of the blocking vehicle looks like, in the position that the vehicle occupies on the road [2]. In 2014 Volvo has developed a technology known as “All Around Visibility”. For safety while driving, visibility is crucial. All round visibility helps the driver to see the corners of the cars body as well as possible. This helps driver during parking and driving. It helps to avoid confliction with another vehicle during [3]. In May 2014, GOOGLE presented a new concept for their driverless car where safe overtaking system. 22 June 2015 a “transparent safety truck” project is set for testing in Argentina. They use a giant display behind truck. Samsung is working on this technology to let people see through giant trucks on the road. The safety truck prototype mounts a wireless camera on the front of the vehicle and live streams the view onto a giant wall of four video screens on the back. It is first attempt on this system in CUET, though some projects are slightly similar to it. They are not directly related to the safe overtaking system. There are some works which are so close to it.

### 3. METHODOLOGY

The main goal of project can be sub divided into two main step. Objectives is to to build a safe overtaking system of vehicle and to reduce rate of death due to road accident. To design a vehicle detecting system for safe overtaking system, we used ultrasonic sensor. It is better than IR sensor because ultrasonic sensor can detect more distance than IR sensor.

#### 3.1 Project Working Procedure:

Firstly, we selected a toy car on which total circuit would be installed. Secondly, a circuit a board was made which is the main portion of safe overtaking system. Then a small drive program was made which is loaded in the microcontroller. The program is written in PIC basic-pro language. Then, Sensors were used to detect the vehicles and lights were used to give signal about distance. Then, Sensors were used at the front face of toy car. Finally, the lights were used at the back of the toy car.

#### 3.2 Required Hardware Components:

Name of the main components that will be used in this system are: 1) Arduino UNO, 2) 9 volt battery 3)

Sonar sensor, 4) Toy car, 5) Green and yellow LED light, 6) Bread board, 7) Male to female jumper, 8) Female to female jumper, 9) Normal connecting wire, 10) Vero board, 11) Resistor and 12) IC 7805.

#### 3.2.1 SONAR SENSOR:

An Ultrasonic sensor or sonar sensor is a sensor which is used to detect an object or to measure the distance from sensor by using ultrasonic sound as shown in figure 1.

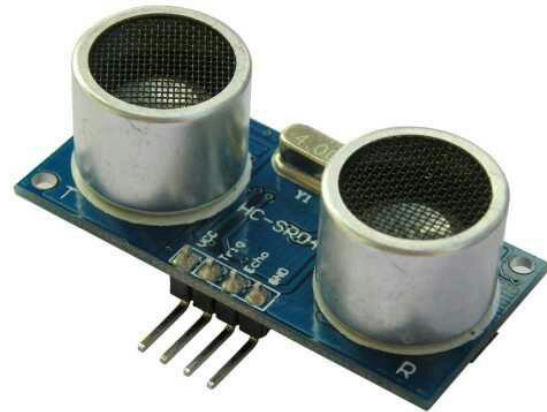


Fig 1: Sonar sensor [4]

In my project, I used two model of Ultrasonic sensor. They are HC-SR04 and SRF05 model. Ultrasonic sensor module HC-SR04 model provides 2cm-400cm non-contact measuring function. The ranging accuracy can reach to 3mm.the modules includes ultrasonic transmitters, receiver and control circuit.

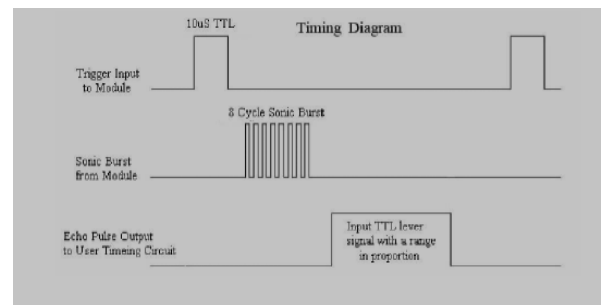


Fig 2: Timing diagram of HC-SR04 Sonar sensor [4]

The timing diagram of HC-SR04 Sonar sensor is only needed to supply a short 10us pulse to the trigger input to start the ranging, and then module will send our an 8cycle burst of ultrasound at 40KHz and raise its echo. The echo is a distance object that is pulse

width and the range in proportion. It is possible to calculate the range through the time interval between sending trigger signal and receiving echo signal.

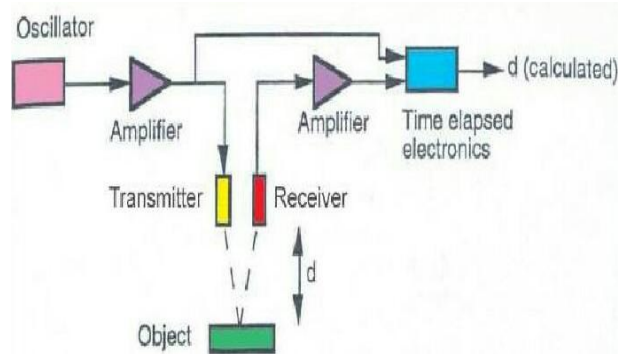


Fig 3: Components of Ultrasonic sensor <sup>[4]</sup>

### 3.3 Working Principle of Ultrasonic Sensor:

In the ultrasonic sound based system mainly two system work to measure distance. They are transmitter system and receiver system. Transmitter system sends the ultrasonic sound to find existence and distance of an obstacle. When ultrasonic sound reflects from the body of the object, it is received by the receiver system. Then the difference of time of sending and receiving signal is calculated in time elapsed electronics. From this calculation sensor measures the distance. <sup>[4]</sup>

#### 3.3.1 Environmental Effect on Sonar Sensor:

Environment has little effect on the ultrasonic sensor. They are air pressure, air temperature and protective measures. Air pressure: Normal atmospheric pressure changes have little effect on measurement accuracy. However, ultrasonic sensors are not intended for use in high or low air pressure environments as pressure extremes or the sensor face. Air temperature: the velocity of sound in air is temperature dependent. An increase in temperature causes a slowing of the speed of the sound. As a result, the sensing distance increases. Protective measures: In wet application, the sensor should not be mounted in such a way that standing water or other fluids can rest on sensing face. In general, to maintain operating efficiency, care must be taken to prevent solid or liquid deposits from forming on the sensor face. The sensor can also be vulnerable to aggressive acid or alkaline atmospheres. <sup>[4]</sup>

### 3.4 Required Software Components:

There are some software needed to fulfill the project. They are C programming for language, Arduino IDE as a compiler and Using Arduino IDE to write and modify the program.

### 3.5 CONSTRUCTION OF SAFE OVERTAKING SYSTEM:

Arduino has some slots which are used for required purposes. During construction or connecting wires, GND was connected to the bread board by a female to male wire. Then GND slot of Arduino UNO was connected to the GND of sonar by a male to male wire through the bread board. Again, VCC pin sonar sensor was connected to the bread board. Then a male to male connected wire was used to connect the GND of sonar with the GND of Arduino UNO circuit. Then the Echo pin of sonar sensor was connected to the 13 no slot of the Arduino UNO by using a female to male connecting wire.

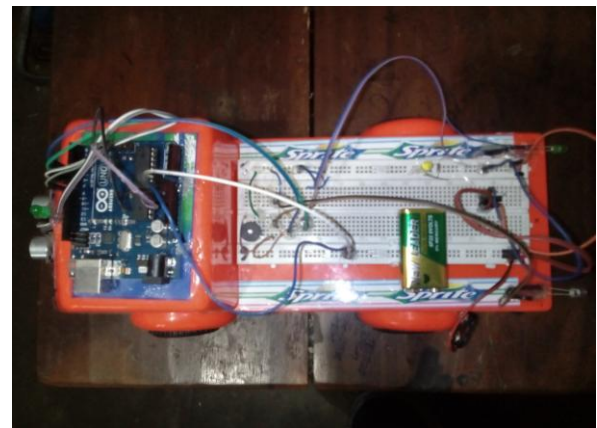


Fig 4: Circuit diagram of safe overtaking system

The trigger pin of sonar sensor was connected to the 12 no slot of the Arduino UNO by using a female to male wire. There were more two connections were taken from the Arduino UNO to the bread board from the slots 11 and 10 by using male to male connection wire. Two LED light were placed to join with the two connections. They are used to give signal.

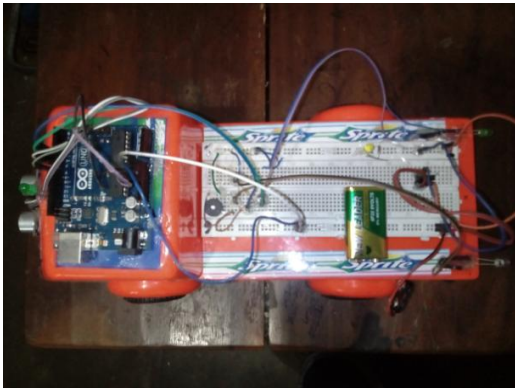


Fig 5: Prototype vehicle with corresponding circuit

Two resistances were also used with the LED for the safety of the LED light. Thus the connection of the hard wires was completed. Then the developed program was installed at the Arduino UNO. After completing this works, the system was placed on a toy car. Thus the total system was completed. This system can detect any obstacle at 10 cm distance.

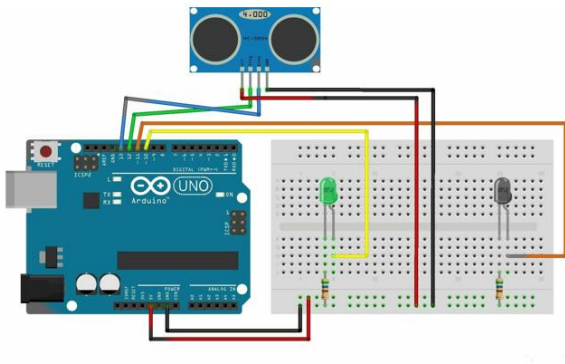


Fig 6: Circuit diagram of safe overtaking system

### 3.6 Working Procedure of Safe Overtaking System:

In this safe overtaking system, an ultrasonic sensor is attached at the front of a vehicle. This sensor produces ultrasonic sound to the front of the vehicle. There are two systems which work simultaneously. One produce sound and through it .another system is used to receive reflect sound wave. There will make a system that converts this ultrasonic sound in to electrical signal. Here the variation of this electrical signal depends on the input data of sensor. The input data of sensor depends on the distance between the sensor and the obstacle. The input of this system is

processed by a microcontroller circuit. Two types of color LED light will be used. When the distance between car and another vehicle is not so suitable for overtaking, the red light will turn on. When the distance is suitable enough for overtaking, the green light will turn on. As a result, a man who wants to overtake the car in front of him, he can overtake safely. Presently the detection technique of laser, radar, infrared ray and ultrasonic sensor has been widely used as the aspects of safety technique to avoid car collision incidence and distance measurement. These sensors help to get information about a suitable distance. At the aspect of distance measurement, the technique of ultrasonic sensor is applied to measure the distance range when the car changes drive way, to overtake, even parking of car. Because of the expensive price, the distance measuring system of car with the technique of laser and radar is set on the minority of slap-cars, so the research of the distance measurement system of backing up with high ratio capability and price for the medium cars and the low-end cars is an important task of automobile industry. An obstacle detecting device for detecting an obstacle includes a transmitting and receiving element for a transmitting and receiving an ultrasonic wave and a gain controller for the gain of the amplifier. Transmitting and receiving element transmits the ultrasonic wave at different multiple transmission distances. The rising time depends on the transmission distances of the ultrasonic wave. The rising time in case of a short transmission distance is faster than that in case of a long transmission distances. Amplifier amplifies a received signal.

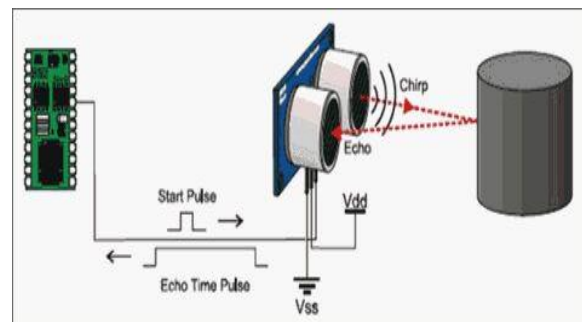


Fig 7: Detecting obstacle

### 3.7 Minimum Distance Calculation for Safe Overtaking:

Generally, according to road condition of Bangladesh, BRTC and BRTA the maximum speed of vehicle is 30 to 60  $\text{ms}^{-1}$  in single road such as Chittagong to Cox's bazaar road. After doing some practical observation and solving some basic laws of physics, we found out that for this type of road, the minimum distance for safe overtaking needs to be 50 m.

### 3.8 Architecture Design of Safe Vehicle Overtaking System:

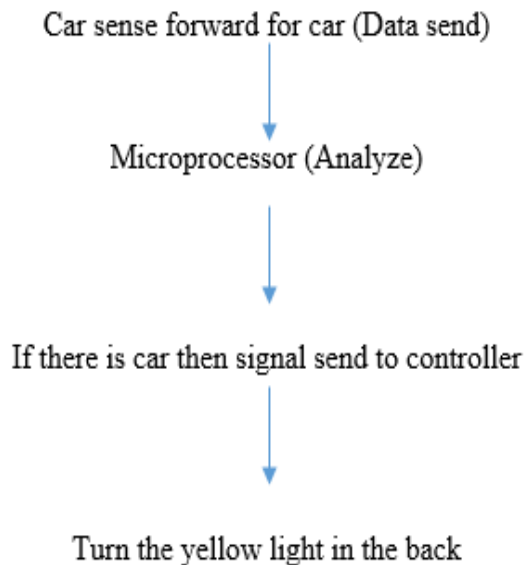


Fig 9: Flow chart of a safe overtaking system of vehicle

## 4. CONCLUSION

Overtaking is one of the main reasons of road accident all over the world. It happens for various reasons. Most of the time, drivers are not so careful when they overtake a vehicle in front of him. Sometimes they try to overtake without knowing the existence and distance of another vehicle. As a result, the development of a technology with a view to overtaking safely is too much important now. So we should involve in such technological field to ensure safety. Because, one of the main reason of development of a country, also depends on the safe transportation. Most often the overtaking driver fails to observe an operating indicator on the vehicle ahead, or misinterprets the indication given or often involves attempting to pass Lorries. Overtaking more than one vehicle ahead and hitting a vehicle that turns right out of the cohort ahead, having previously been obscured by the rearmost vehicles in that cohort. It was revealed that inexperienced drivers involved in overtaking accidents were significantly more likely than other drivers to have their errors concentrated in two main areas.

## 5. REFERENCES

- [1] <https://en.wikipedia.org/wiki/Overtaking>
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