

GUARD

Preventing Blind Spot Accident using Arduino

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ABSTRACT: The title **GUARD** is an acronym for **GuidingyoUAnd Reporting Disturbance**. The total number of blind spot accidents has seen a drastic increase within the past few decades. Though several attempts had been made to assist the bike riders, the success rates are minimum. This paper focuses on the cause and statistic reports on blind spot accidents. It also deals with the fabrication of a module to prevent blind spot accidents with experimental results. The project helps to improve the environmental visibility of a bike rider. It depicts the presence of an object or vehicle in the blind spot zone of the rider and aids for a safe ride during the course of travel. A TFT colour LCD display gives graphical output of the presence of vehicle in the blind spot zone.

KEYWORDS: Blind Spot accidents, Arduino, Advanced Driving Assistance System (ADAS) and accident prevention.

I. INTRODUCTION

Accident is a common word in the modern era. Almost every individual has met with a road accident. Though invention of automobile is a boon to the mankind, the number of accidents has increased after that. Fatalities in major accidents are usual. But it is important to know that even minor bike accidents lead to termination of human life. Such peculiarity of the two wheeled vehicle accidents have attracted the authors towards this project. In a developing country like India with a majority of motorcycle riders, frequency of accidents are more. In order to reduce accidents, identification of cause is essential.

There are several reasons for bike accidents. Some of them are carelessness, drunken driving, use of mobile phones while driving, blind spots, etc. Some of these accidents can be minimised with a little modification in the existing technology. One such area, is the accidents caused due to blind spots. More detailed explanation of blind spots is given in Section II of this paper.

Arduino is open source hardware cum software. The microcontrollers of Arduino can be programmed for a wide range of applications by interfacing corresponding sensors with it. In this paper Ultrasound sensors HC-SR04 have been used. The output is displayed with a 1.8" TFT colour LCD Display. Further detailed descriptions on these are given in Section IV of this paper.

This paper is divided into six sections: Introduction, Blind spot, Statistics and Literature Review, Proposed Methodology, Experimental Results, Conclusion and Future work. Section II and section III elaborates about the problem statement and the need to eliminate the same. In section IV a suitable theory that could clear this challenge is suggested. It also explains the codes used for the module's functioning. Section V depicts the results of the implemented project work. Finally Section VI adds in a set of suggestions which can be incorporated into the proposed system in order to improve the functionality, at the cost of increased price.

II. BLIND SPOT

Most of the accidents are due to blind spot. It is a region around a vehicle which is not visible to the rider's vision. Obstacles in these regions are in incognito to the rider [5] [6] [11]. They are neither visible in the peripheral visibility zone nor when seen through the rear view mirror. Fig.1 shows the Peripheral visibility Zone, Rear view Mirror Zone, And the Blind spot Zone.

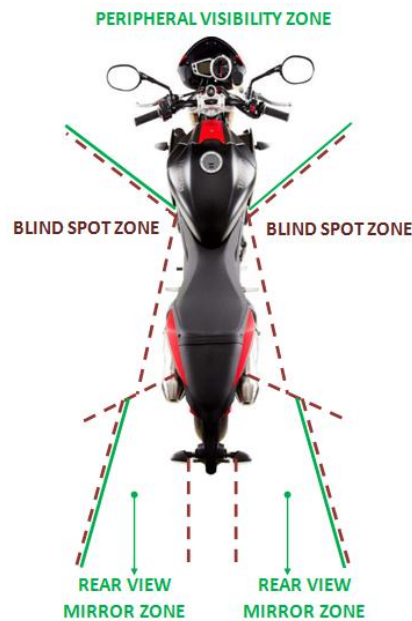


Fig. 1. Blind spot zones in two wheelers

The visibility span of human being is usually around 170- 185 degrees. But the span is narrowed to around 140 degrees when a helmet is worn. This further increases the blind spot zone around the motor bike. Such blind spots could prove to be of great danger while taking sudden turns [9]. There have been several blind spot accidents in the past two decades alone. Detailed descriptions of the accidents have been made in the next section of this paper.

III. STATISTICS AND LITERATURE REVIEW

A survey conducted by National Highway Traffic Safety Administration states that, nearly 840,000 accidents occur in United States of America each and every year which results in 300 fatalities [19].

Telegraph, a magazine company states that, the blind spot accidents had increased by 50% between 2009-2011. In majority of the cases the driver takes a turn unaware that there is a car in the blind spot [18].

According to the survey conducted in the year 2008, 1.3 million people die on roads every year. 20-50 million people are subjected to severe non fatality injuries. Road accidents are the reasons for death of youngsters among the age of 15-29 which contributes to about 1-3% GDP cost of the country. It is predicted that the death of people will raise up to 1.9 million by the year of 2020. Especially in India, road traffic accidents ranks sixth in taking away the lives of young and middle aged people.

Statistical reports by the Open Government Data by Government of India shows that there were 23,529 motorbike accidents in India (year 2014) which contributes to about 21.93% of total road accidents [17].

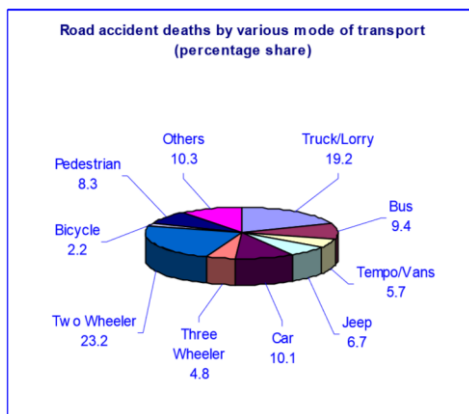


Fig. 1. Accidents by various modes of transport in India in 2012. [15] [17]

The above pie chart explains that in the year 2012, majority of road accidents have been for two wheelers [15]. Major fraction of the two wheeler accidents are fatal, hence there is a need to reduce it. There have been many attempts to minimize the blind spot accidents. Most common methods employed in heavy automobiles are the use of blind spot mirrors [21]. Blind spot mirrors have huge potential areas of improvements. Pitchipoo.P et.al. had done a research work on design optimization of rear view mirrors [2]. Cameras and computer vision systems had been installed in some vehicles [1] [5] [6] [7]. Vicente Milanes et.al. had used V2I wireless communication system for co-operative driving within the vehicles in an environment [3]. The results of camera feedback were fed to vibratory sensors installed in seats and steering wheels by Jaemin Chun et.al. [4]. Rajendra Prasad Mahapatra et.al. had developed an advanced panoramic image sensor for wider field of view of the image. With such sensors entire blind spot zone around the vehicle can be eliminated [20].

IV. PROPOSED METHODOLOGY

The above said problems can be overcome by a simple obstacle detection module using Arduino. This includes the use of Arduino ATMEGA 328P-PU microcontroller, HC-SR04 ultrasonic sensors, and 1.8 inch TFT colour LCD display. The figure 2 shows the block diagram for the working of proposed module.

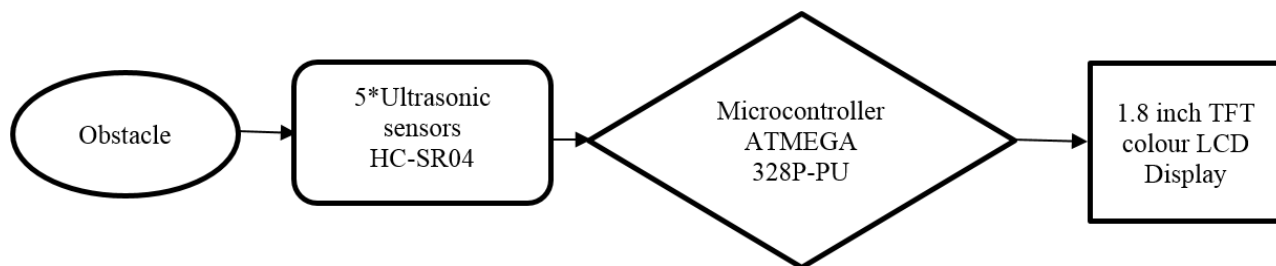


Fig. 2. Block diagram for proposed module

As per the block diagram (Fig.2), after sensing the obstacle the data is transferred to the microcontroller, which interprets the distance in metric scale. The value of the distance measured is converted into corresponding LCD scale. This converted data is transferred to the LCD screen which is fixed next to the odometer.

As discussed earlier, any vehicle or obstacle that is present within the blind spot region cannot be seen by the one who rides the bike. Hence the sensors are placed in the bike as shown in figure 3. The regions that the sensors cover were sufficient to detect active obstacles in the blind spot zone. If the obstacle was at a distance greater than 0.5m, no warning will be given to the rider. When the obstacle approaches closer (less than 0.5m), the LCD monitor displays a line corresponding to the position of the obstacle with respect to the bike.

The ultrasonic sensor works by sending high frequency ultrasonic waves towards the obstacle, capture the reflected wave and calculate the time taken for it. Speed of sound is 340m/s and it takes approximately 1.47ms to cover a distance of 0.5m [13].Hence,it would take double the time to detect an obstacle at that distance. This proves that the working of HC-SR04 is quick and detectsobstacles even at dynamic condition.The list of components used and the corresponding prices are mentioned in table 2.

Sl.No.	Components Used	Rate (Indian rupees)	Quantity	Amount
1	Arduino ATMEGA 328P	800	1	800
2	Ultrasonic Sensor HC-SR04	120	3	360
3	1.8" TFT SPI colour LCD Display	700	1	700
4	Other accessories	150	-	150
Sum				2010
Allowance(10%)				201
Total				2211

Table 2. Product Structure

In Table. 2 the cost of each component in this module has been tabulated. The overall cost with the addition of allowance, sums up to 2211 Indian rupees.Compared to other blind spot detection modules, the functioning of this module is better at a lower price.

In addition to the nature of sensors and microcontrollers used, the positions of these sensors play a vital role. Fig 3 shows how these sensors are placed in the two wheeler. The lateral sensors (S1 and S2) are symmetric about the bike's median. They cover the blind spot zones on both sides. The sensor S3 gives feedback of the vehicle approaching from behind, which is also very useful while coming to a halt. In order to prevent the intervention of riders'legs with the sensors, the sensors have been placed belowboth the foot rest. S1, S2 and S3 are left, right and rear ultrasonic sensors respectively.S3is mounted just below the number plate at the back. The regions within blue lines are covered by the sensors. Obstacles in these regions are detected and the closest point is displayed in the LCD in the form of a line.

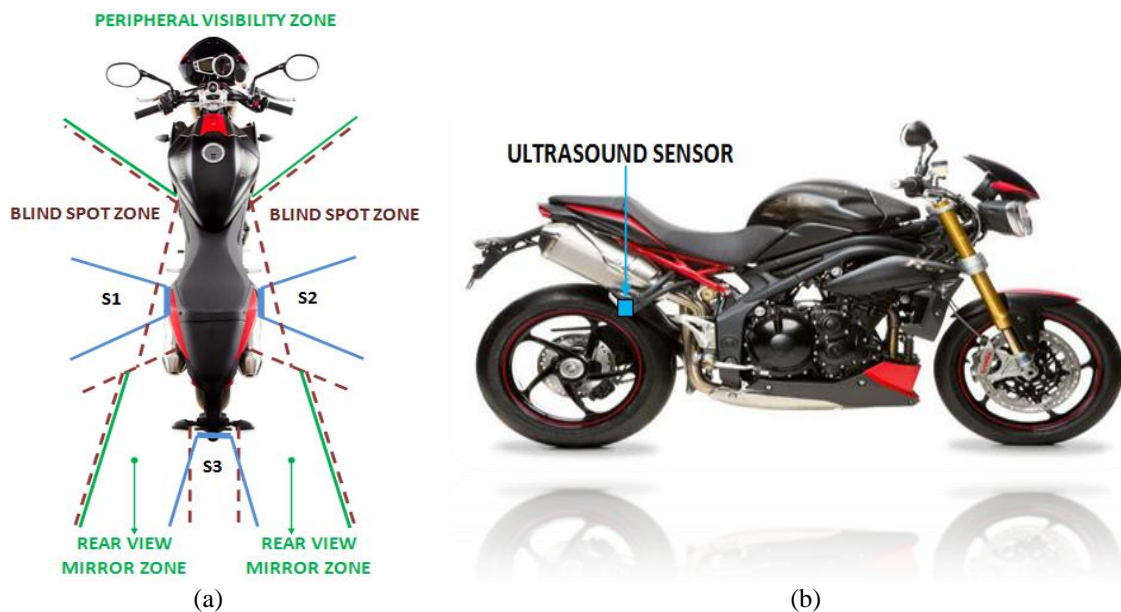


Fig. 3. Sensor positioning for the proposed module. (a) Top view (b) side view.

Even though there are other blind spot preventing solutions, this method is the easiest and comparatively low cost method.

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- Cheapest alternative for blind spot accident prevention is the use of blind spot mirrors, but that requires a skilled rider to understand the vehicle's position. Moreover, most of the motorcyclists remove their rear view mirror for cosmetic reasons.
- Use of cameras or radar sensors can be more effective but they are high priced.

The use of ultrasound sensors and their positioning makes this method more efficient and cheap.

V. EXPERIMENTAL RESULTS

The following results were obtained from the above proposed module. The results when the obstacles were placed within the range of .5m are shown in the fig 5. The obstacles are at different distances from the vehicle. With the presence of backlight, the readability of the LCD display is good even during day time.

While performing the experiment, all the obstacles near the stationary bike were removed and the display output was recorded. Obstacles were placed at various distances around the bike. For each case the display output was recorded and the results were documented.

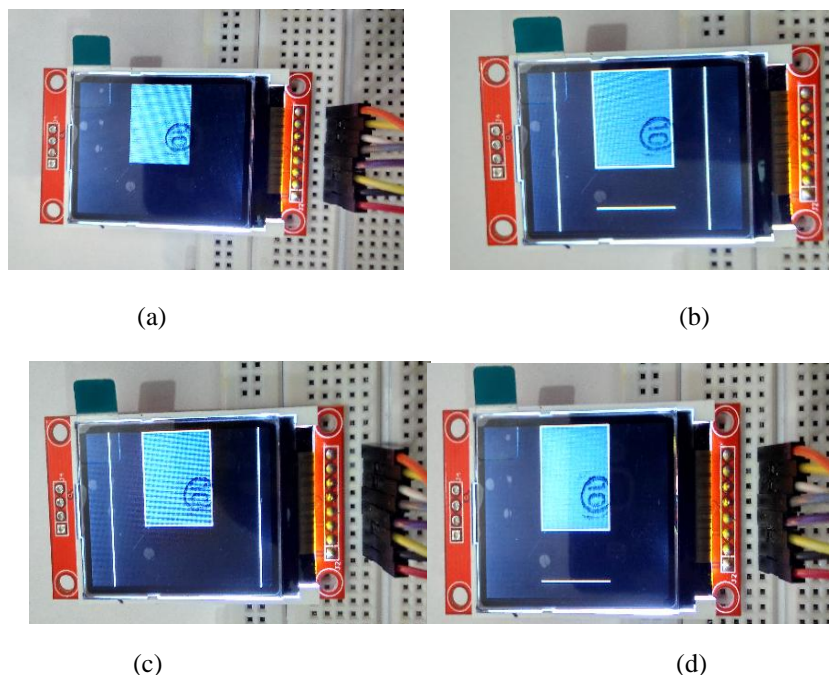


Fig. 5 Results in TFT colour LCD display. (a) There are no obstacles within the half a meter radius. (b) When obstacles are approaching from all the 3 sides of the vehicle. (c) When there are obstacles at left and right side. (d) When an obstacle approaches from the rear.

According to the code written, every time an obstacle is detected and its position is displayed on the LCD screen, the whole screen is erased. Due to this the screen appears as if it flickers frequently. It was one of the constraints of this module. There are possibilities of cross talk when using multiple ultrasonic sensors. The ultrasonic sensors may read the signal from other sensor hence producing a wrong output [20].

VI. CONCLUSION AND FUTURE WORK

An accident prevention module was successfully fabricated that would assist the bike riders to prevent blind spot accidents. Moreover, cost of the module was greatly reduced in addition to providing a graphical live feedback to the rider. Possible areas of improvement include

- Sensors of longer range can be used to improve riding assistance at higher speed.
- Motion blur can be included in the display to help rider know whether the obstacle is approaching or leaving.

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- Flickering of the LCD due to the clear screen command could be avoided by the use of high processing speed micro controllers.
- Cost of production could be reduced if the modules were manufactured for commercial purpose in large scale.

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