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Abstract	Every day around the world, a humongous amount of people die from road accident and the subsequent injuries. There are many problems which are largely prevalent in the everyday life of a driver around the globe. Some of the techniques that are available in the market are too expensive to implement on a common vehicle. If we take a look around the common household in an Indian society, most of the people are using average cost vehicles and they are not able to afford the existing techniques which can detect the obstacle to prevent from the road accident. The survey has been conducted on the problems which are being faced by the driver at the time of driving and we have proposed a suitable and less expensive ways to implement the solutions of, not all the problems, but few of them to detect the causes of road accident by using some sensors like ultrasonic sensor, ldr sensor, ir sensor and prevention from collision. As smart-driver assistance system, invisibility problem is our main focus in this project. The concept is that it assists the driver with information and actions. In our proposed work, the smart-driver assistant system will provide the information after analyzing results of various sensors existing in the system and then if the driver is unable with actions necessary to ensure the driver's safety. Invisibility in fog is one of the major reasons of road accidents, various approaches have been made to counter this problem. We have found that ultrasonic sensor can be used to counter this problem. The sensed information is provided to the driver who takes appropriate action depending on the information. However, there are cases where the driver is incapacitated or unable or there are cases where the driver actually needs to drive faster for some urgency. In such cases, the smart-driver assistant system comes in play and slows down the vehicle for the drive, which changes their direction. If unable, the system slows the vehicle itself and if still not stopped, it stops the vehicle at 20 cm away from the obstacle. The proposed work has been tested with four parameters and found to be a better solution.

Keywords (separated by '-')	Smart-driver assistance system - LDR - IR - Ultrasonic sensor

Smart Sensing for Vehicular Approach

Mukesh Chandra Sah, Chandan Kumar Sah, Shuhaib Akhter Ansari, Anjit Subedi, A. C. Ramachandra and P. Ushashree

Abstract Every day around the world, a humongous amount of people die from road accident and the subsequent injuries. There are many problems which are largely prevalent in the everyday life of a driver around the globe. Some of the techniques that are available in the market are too expensive to implement on a common vehicle. If we take a look around the common household in an Indian society, most of the people are using average cost vehicles and they are not able to afford the existing techniques which can detect the obstacle to prevent from the road accident. The survey has been conducted on the problems which are being faced by the driver at the time of driving and we have proposed a suitable and less expensive ways to implement the solutions of, not all the problems, but few of them to detect the causes of road accident by using some sensors like ultrasonic sensor, ldr sensor, ir sensor and prevention from collision. As smart-driver assistance system, invisibility problem is our main focus in this project. The concept is that it assists the driver with information and actions. In our proposed work, the smart-driver assistant system will provide the information after analyzing results of various sensors existing in the system and then if the driver is unable with actions necessary to ensure the driver's safety. Invisibility in fog is one of the major reasons of road accidents, various approaches have been made to counter this problem. We have found that ultrasonic sensor can be used to counter this problem. The sensed information is provided to the driver who takes appropriate action depending on the information. However, there are cases where the driver is incapacitated or unable or there are cases where the driver actually needs to drive faster for some urgency. In such cases, the smart-driver assistant system comes in play and slows down the vehicle for the drive, which changes their direction. If unable, the system slows the vehicle itself and if still not stopped, it stops the vehicle at 20 cm away from the obstacle. The proposed work has been tested with four parameters and found to be a better solution.

AQ1

Keywords Smart-driver assistance system · LDR · IR · Ultrasonic sensor

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1 Introduction

Transportation has a key influence in the improvement of our civilization. Transportation intends to move individuals, creatures, or merchandise starting with one place then onto the next. Furthermore, it can be accomplished by different means of land (street and rail), water, air, pipeline, link, or space. Be that as it may, the most well-known and the most utilized as a part of our everyday life are street transports like transport, auto, cruiser, and so on. Road accidents are an essential stress for the both made and making the world. Diminishing these setbacks and completing directing factors for the security of drivers and individuals by walking is of most extraordinary hugeness as the decrease and flow examinations exhibit that most of the road mishaps happen in light of roadwork or obstacles or clashing speed. The essential point is that roads mishaps are dangerous and furthermore hurting to both individual lives and properties. These should be avoided. There have been various progresses to control the development prosperity and the starting late impelled driver help structures are to some degree unmistakable. There are various such unique structures to control the speed of the vehicles normally and avoid horrendous repercussions. One such system to control the vehicles speed is cruise control (CC). It keeps up the speed of the vehicle at customer reset capacity. The adaptable excursion control (AEC), which adds to CC the capacity of keeping a shielded division from the principal vehicle. A drawback of these structures is that they are not unreservedly fit for perceiving straight and twisted parts of the road; where the speed must be conveyed down to avoid setbacks [1].

2 Related Work

Smart vehicles are a thing of today, a rave among the vehicles. Regular vehicles while helpful and responsive to human info, while vital does not give the wellbeing and security of the smart vehicles which are involved numerous highlights that require no human information and help when the driver cannot and along these lines maintaining a strategic distance from the workload. Earlier investigations and examines have indicated numerous enhancements in the ideas and outline of such vehicles with keen highlights. In 1983, an entire creation four-wheel electronic hostile to slide control was presented on the Toyota Crown. In 1987, Mercedes-Benz, BMW, and Toyota delivered their first footing control frameworks. In 1990, Mitsubishi discharged the Diamante (Sigma) in Japan which highlighted another electronically controlled active trace and traction control system (the first mix of these two frameworks on the planet) that was created by Mitsubishi. It was basically named TCL in 1990. In any case, now the framework has advanced into Mitsubishi's cutting-edge Active Skid and Traction Control (ASTC) framework [2].

There were numerous early cautioning frameworks that have been endeavored as ahead of schedule as the late 1950s. For instance, Cadillac, which built up a proto-

type vehicle named the Cadillac Cyclone and utilized the new innovation of radar to distinguish protests in the front of the auto with the radar sensors, which was mounted inside the "nose cones". It was resolved too expensive and the model was thusly dropped. In 1995, the primary current show, for really useful forward collision avoidance, was performed by a group of researchers and architects at Hughes Research Laboratories in Malibu, California. It was financed by Delco Electronics and was going by HRL physicist Ross D. Olney. This innovation was named for promoting purposes as "Admonish". The framework [3] was radar-based—an innovation that was promptly accessible at Hughes Electronics, however, not economically somewhere else. A little custom-manufactured radar-head was created particularly for this car application at 77 GHz.

So also there have been numerous different endeavors on numerous different parts of smart vehicles like utilizing ultrasonic sensors, and cruise control for advanced driver framework. Here in this venture, we have adjusted numerous methodologies endeavored before and have attempted to make a brilliant vehicle that is smart in the sense it is simple, however, does its work without quite a bit of client input. At the beginning of autos, paces of vehicles were low and there were generally a couple of vehicles out and about. The expansion in the number of vehicles and their speed has just outpaced the enhancements on streets and the other activity offices, bringing about hazardous street travel. The principal part of night driving is the headlight which gives better vision. On the other, the hand vision of the driver is influenced by the headlights of approaching vehicles. In addition, the action moves at a speedier rate during the evening, this prompts head-on impacts. Night driving is a wonder administered by various components. So to give ideal enlightenment at all separations when vehicles are in the region, a controller is planned to such an extent that speed, separation of a vehicle from another vehicle, [4] driver activity, climate condition, kind of street (terrain, bend, highway) while driving are considered to create the compelling yield power free of glare. Since the data sources are fluffy in nature, a fuzzy controller is outlined.

Obstacle detection framework is an exceptionally reasonable framework that can be utilized as a part of moving or stationary frameworks. It can even be utilized to help outwardly weakened individuals. It is additionally relevant to anything that moves, incorporating robot controllers alongside kept an eye on or unmanned vehicles for arriving, ocean, air, and space. Obstacle detection and risk recognition—these are synonymous terms with comparable results, however, are once in a while connected in various areas; for instance, obstacle detection is normally connected to ground vehicle route, through hazard detection is regularly connected to flying machine or rocket during the time spent arriving, as in "landing hazard detection." It is a framework issue that comprises of sensors that [5] investigate the world around, world models that speak to the sensor information in a pertinent shape, numerical models of the association between objects around and the vehicle, and algorithms to process the majority of this to induce obstruction avoidance feature to the vehicle.

What it truly does is, utilize sensors both at the front and back of the vehicle guards and afterward send radar and sonar signals outward. These outward moving signals when striking against an impediment, they return back to the vehicle guards, or all the

more exactly to their source. This path traveled by the waves is then estimated and the separation between the vehicles and the obstacle is considered. Once the separation between the vehicle and the object is resolved, the suitable move is then made to keep up the security of the vehicle. As a rule, the vehicles, if the question is inside the range, convey an alert to the driver who at that point acts likewise. In any case, there are [6] additionally some advanced variants of this framework where the vehicle quickly applies a brake to stop the auto before crash. Light-dependent resistors (LDRs) or photoresistors are most of the time used as a piece of circuits where it is imperative to distinguish the proximity or the level of light. They can be depicted by a grouping of names from the light-dependent resistor (LDR), photoresistor, or even photocell, photocell, or photoconductor. But unique contraptions, for instance, photo diodes or photo transistor can in similarly be used, LDRs or photoresistors are a particularly beneficial equipment fragment to use. They give considerable change in security from changes in light level.

In perspective of their minimal effort, the simplicity of fabricating, and convenience LDRs have been utilized as a part of a wide range of uses. At one time, LDRs were utilized as a part of photographic light meters, and even now they are as yet utilized as a part of an assortment of uses where it is important to recognize light levels. LDRs are extremely helpful parts that can be utilized for an assortment of light-detecting applications [7]. As the LDR resistance ranges over such a wide range, they are especially valuable, and there are numerous LDR circuits accessible past any appeared here. With a specific end goal to use these parts, it is important to know something of how an LDR functions.

2.1 Automobile Manufacturers

i. **Volvo**:

2006: Volvo's "Impact Warning with Auto Brake", created in collaboration with Mobileye, was presented on the 2007 S80. This framework is fueled by a radar/camera sensor combination and gives a notice through a head up show that outwardly looks like brake lights. On the off chance that the driver does not respond, the framework pre-charges the brakes and expands the brake help affectability to boost driver braking execution. Later forms will naturally apply the brakes to limit person on foot impacts. In a few models of Volvos, the programmed stopping mechanism can be physically killed. The V40 likewise incorporated the primary walker airbag, when it was presented in 2012.

2013: Volvo presented the primary cyclist identification framework. All Volvo vehicles now come standard with a lidar laser sensor that screens the front of the roadway, and if a potential impact is recognized, the seat straps will withdraw to decrease overabundance slack. Volvo now incorporates this security gadget as a discretionary in FH arrangement trucks.

2015: “Intelli Safe” with auto brake at crossing point. The Volvo XC90 highlights programmed braking if the driver hands over front of an approaching auto. This is a typical situation at occupied city intersections and additionally on roadways, where as far as possible are higher. [src: wikipedia]

ii. **Audi:**

2010: “Pre sense” self-governing crisis slowing mechanism utilizes twin radar and monocular camera sensors and was presented in 2010 on the 2011 Audi A8. “Pre sense in addition to” works in four stages. The framework initially gives cautioning of an approaching mischance, initiating danger cautioning lights, shutting windows and sunroof, and pretensioning front safety belts. The notice is trailed by light braking to stand out enough to be noticed. The third stage starts self-governing incomplete braking at a rate of 3 m/s^2 (9.8 ft/s^2). The fourth stage builds braking to 5 m/s^2 (16.4 ft/s^2) trailed via programmed full braking power, generally a large portion of a moment before anticipated effect. “Pre sense raise”, is intended to diminish the results of backside crashes. The sunroof and windows are shut and safety belts are set up for affect. The seats are advanced to secure the auto’s inhabitants. 2015 presented the “shirking partner” framework that mediates in the guiding to enable the driver to maintain a strategic distance from a snag. On the off chance that a mischance happens the “turning collaborator” screens contradicting movement when turning left at low speeds. In basic circumstance, it brakes the auto. “Multicollision brake help” utilizes controlled braking moves amid the mischance to help the driver. The two frameworks were presented on the Second era Q7. [src: wikipedia]

iii. **Ford**:

Starting on the 2012 Ford Focus, Active City Stop was offered on the range topping Titanium show, under the discretionary Sports Executive Pack. The framework utilized windscreen mounted cameras, radars, and lidars to screen the street ahead. The framework doesn’t give a notice, rather, it can keep a crash happening at speeds in the vicinity of 3.6 and 30 kph. This speed was later raised to 50kph, and was accessible on all models, the Trend, Sport, Titanium, ST, and RS (Limited Edition as it were.) [src: wikipedia]

iv. **Honda**:

2003: Honda presented a self-sufficient braking (Collision Mitigation Brake System CMBS, initially CMS) front impact evasion framework on the Inspire and later in Acura, utilizing a radar-based framework to screen the circumstance ahead and give brake help if the driver responds with deficient power on the brake pedal after a notice in the instrument bunch and a fixing of the seat belts. The Honda framework was the primary creation framework to give programmed braking. The 2003 Honda framework additionally joined an “E-Pretensioner”, which worked in conjunction with the CMBS framework with electric engines on the safety belts. Whenever initiated, the CMBS has three cautioning stages. The principal cautioning stage incorporates capable of being heard and visual notices to brake. In the event that disregarded, the second stage would incorporate the E-Pretensioner’s pulling on the shoulder bit of

the safety belt a few times as an extra material cautioning to the driver to make a move. The third stage, in which the CMBS predicts that an impact is unavoidable, incorporates full safety belt slack takeup by the E-Pretensioner for more powerful safety belt insurance and programmed use of the brakes to reduce the seriousness of the anticipated crash. The E-Pretensioner would likewise work to diminish safety belt slack at whatever point the brakes are connected and the brake help framework is actuated.) [src: wikipedia]

3 Algorithms

INPUT: List of sensor implemented in the vehicle sense the information/data from the environment and transmits to the microcontroller.
OUTPUT: The microcontroller gives the perfect commands to the motor driver for actuation.

1: Initialize the PIN of Arduino UNO board for the list of sensors and D.C motor.
2: Command is given by a smartphone via Bluetooth to control the vehicle in the Forward, backward Left and Right directions.
3: if command equal to “F” and obstacle detected in the way then,
Target distance between the vehicle and obstacle will be calculated as given bellow:
   a. Ping-Time = Ping-Time/1,000,000*3600;
   b. Target-distance = speed of sound * Ping-Time;
   c. Target-distance = Target-distance/2;
   d. Target-distance = Target-distance * 63,360*2.54//Target-distance is converted into cm.
4: if Target-distance >40 cm then,
Vehicle starts moving smoothly and message will display in the LCD display as “No obstacle in the Way”.
5: if Target-distance will be >20 cm and<=40 cm then,
6: Speed of the vehicle reduced slowly and message will display in the LCD display as “obstacle detected in the way (e.g. 33 cm) ahead from the vehicle, Drive slowly”.
7: if Target-distance will be equal to 20 cm.
8: Vehicle stops automatically with warning sound and message will display in the LCD display as “obstacle is obstacle is too nearer to the vehicle”.
9: if any objects with high Intensity detected with in/equal to 40 cm form the vehicle then,
10: Intensity of a Vehicle Headlight becomes dim and becomes in the original state after crossing the objects. (Object may be static or dynamic).
11: if command equals to “R” then,
12: Vehicle starts moving in the reverse direction.
13: if command equals to “TL” then,

14: Vehicle turns in the left direction.
14: if command equals to “N” then,
15: Vehicle STOP.
16: if LDR status equals to ON then, Head Light TURN ON,
17: Else, Head Light TURN OFF.

4 Proposed Implementation

4.1 Block Diagram

- The power supply is a rechargeable battery source which supplies power to the DC motor and different components of the vehicles like the microcontroller and sensors.
- The motor driver is an IC which receives power from the battery and signal from the Arduino, microcontroller, to move the four wheels of the vehicle.
- Arduino is a microcontroller device which along with its own processor and ROM supports various peripherals like the sensors, buzzers, and Bluetooth.
- Sensors represent the three different sensors used in this project. LDR sensor, IR sensor, and ultrasonic sensor for performing variously proposed functionalities of the system.
- Bluetooth module is a master/slave configured device used for controlling the vehicle with a remote handheld controlling device.
- LED is a small light which reflects the action taken by the IR sensor and LDR sensor.
- A buzzer is a sound device which gives a warning sound when certain criteria are met by the vehicle.
- LCD is a displaying device that shows the information provided by the various vehicular components (Fig. 1).

4.2 Adaptive Headlight

The central part of night driving is the headlight which gives better vision. On the other, the hand vision of the driver is influenced by the headlights of approaching vehicles. Also, the activity moves at a quicker rate around evening time, this prompts head-on impacts. Night driving is a marvel administered by various variables. So to give ideal light at all separations when vehicles are in the region, a controller is planned with the end goal that speed, separation of a vehicle [8] from another vehicle, driver activity, climate condition, kind of street (landscape, bend, highway) while driving are considered to create the successful yield force free of glare. Since the sources of info are fluffy in nature, a fluffy controller is composed.

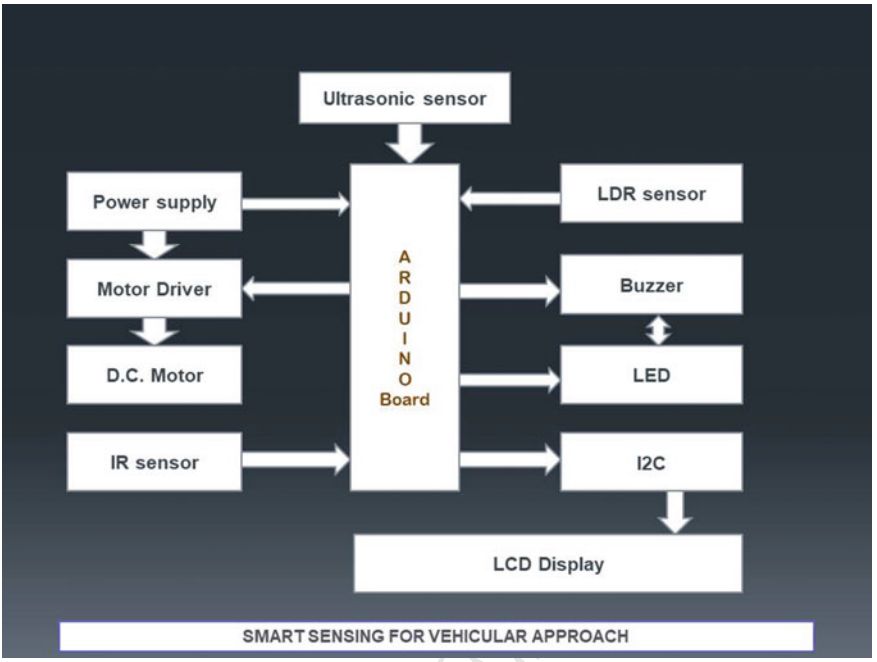

Fig. 1 Block diagram of the proposed work

Application:

When driving on twisting streets during the evening, amid dusk, or in other low-light conditions, adaptive headlights are very helpful. Or maybe they can be necessities on occasion. They can be utilized as a part of the accompanying circumstances and situations.

- A stray creature amidst the street, during the evening.
- Sudden passageway of a vehicle in your path while turning.
- Hill peaking on a restricted and bowed street, we can not affirm if a vehicle is coming or not.
- The headlights may turn the approaching rider bling amid turning.

4.3 Electronic Stability

Accessible in numerous new autos, this innovation enables drivers to keep up control of their vehicle amid extraordinary controlling moves by keeping the vehicle headed in the driver's planned course, notwithstanding when the vehicle nears or surpasses the breaking points of street footing.

Electronic stability control (ESC) causes drivers to keep away from crashes by diminishing the threat of slipping or losing control because of overdirecting. ESC ends up dynamic when a driver loses control of their auto [9]. It utilizes PC-controlled innovation to apply singular brakes and helps bring the auto securely back on track, without the threat of fish-following.

Australian research demonstrates that ESC decreases the danger of:

- Single auto collisions by 25%
- Single 4WD crashes by 51%
- Single auto collisions in which the driver was harmed by 28%
- Single 4WD crashes in which the driver was harmed by 66%*

4.4 Obstacle Detection

Obstacle detection framework is an exceptionally common sense framework that can be utilized as a part of moving or stationary frameworks. It can even be utilized to help outwardly disabled individuals. It is additionally material to anything that moves, incorporating robot controllers alongside kept an eye on or unmanned vehicles for arrive, ocean, air, and space. Hindrance recognition and peril discovery—these are synonymous terms with comparable results, however, are at times connected in various regions; for instance, impediment identification is generally connected to ground vehicle route, while danger location is regularly connected to flying machine or shuttle during the time spent arriving, as in "landing risk identification." It is a framework issue that comprises of sensors that examine the world around, world models that speak to the sensor information in an applicable shape, scientific models of the cooperation between objects around and the vehicle, and calculations to process the greater part of this to gather deterrent evasion highlight to the vehicle.

What it truly does is, utilize sensors both at the front and back of the vehicle guards and afterward send radar and sonar flags outward. These outward moving signs when strike against a deterrent, they return back to the vehicle guards, or all the more accurately to their source. This way went by the waves is then estimated and the separation between the vehicles and the question is resolved. Once the separation is resolved, suitable move is then made to keep up the security of the vehicle. Much of the time, the vehicles, if the protest is inside the range, convey an alert to the driver who at that point demonstrations in like manner. In any case, there are likewise some propelled variants of this framework where the vehicle promptly applies brake to stop the auto before crash.

4.4.1 Forward Collision Avoidance

Forward collision avoidance frameworks are a dynamic security include that cautions drivers in case of an unavoidable frontal crash. At the point when the FCW framework

prepared vehicle comes excessively near another vehicle before it, a visual, capable of being heard, or potentially material flag jumps out at alarm the driver to the circumstance.

FCW frameworks are likewise alluded to as “Pre-safe Braking,” “Collision Warning with Auto-Brake,” “Pre-Crash Warning Systems,” “Collision Mitigation Braking System,” “Predictive Forward Collision Warning,” and different names. The capacity and limits of these frameworks can fluctuate incredibly, notwithstanding a typical general objective to keep a forward impact. To discover the name of the particular framework in your vehicle, counsel your proprietor’s manual or the dealership [9].

How it can help you avoid a crash

FCAT can be successful by:

- Warning the driver of a potential crash danger while going along an expressway or in rush hour. On the off chance that the driver does not react to the notices, the framework can lessen the vehicle’s speed.
- Emergency halting if a walker strolls before it
- Preventing a stationary vehicle from driving forward into the back of another stationary vehicle.

Different innovations have been created for FCAT frameworks, varying in:

- Detection go
- Responsiveness.

4.5 Light-Dependent Resistor

Light-dependent resistors (LDRs) or photoresistors are frequently utilized as a part of circuits where it is important to distinguish the nearness or the level of light. They can be portrayed by an assortment of names from lightward resistor, LDR, photoresistor, or even photograph cell, photocell, or photoconductor. Albeit different gadgets, for example, photodiodes or photograph transistor can likewise be utilized, LDRs or photoresistors are an especially advantageous hardware segment to utilize. They give substantial change in protection from changes in light level. In perspective of their minimal effort, simplicity of make, and usability LDRs have been utilized as a part of a wide range of uses. At one time, LDRs were utilized as a part of photographic light meters, and even now they are as yet utilized as a part of an assortment of uses where it is important to distinguish light levels. LDRs are extremely helpful segments that can be utilized for an assortment of light-detecting applications [10]. As the LDR protection fluctuates over such a wide range, they are especially valuable, and there are numerous LDR circuits accessible past any appeared here. Keeping in mind the end goal to use these parts, it is important to know something of how a LDR functions.

Table 1 Reading of ultrasonic sensor

Distance	Actions
0–20	Vehicle will stop automatically
20–40	Speed will reduced by 40 rpm
>=40	No obstacle in the way

Table 2 Reading of LDR sensor

LDR status	LED status	Distance (cm)
300	ON	0–10
500–800	ON	25–35
>=800	ON	>35

Table 3 Reading of IR sensor

Distance (cm)	LED status
Less than 40	Light intensity becomes LOW
Greater than 40	Light intensity becomes HIGH

5 Results

The vehicle is successfully able to move in all the directions, and the integration of various components is quite successful too. We successfully connect the LCD display to the microcontroller to display the warning messages. And as a driver, we are able to control the vehicle with smart phone via Bluetooth. Along with the driver assistant, we have implemented smart sensing through sensors to provide smart features.

5.1 Test Cases

Description

- Table 1 explains the working of the ultrasonic sensor in which it determines the action with respect to the distance calculated or given. When the vehicle is between 0 and 20 cm then the vehicle will stop, between 20 and 40 cm the speed gets slowed down and greater than 40 cm the vehicle will be running normally.
- Table 2 explains the working of LDR sensor that determines the LDR status along with the LED status with respect to the distance of the light from the LDR. On 0–10 cm, the resistance is between 300Ω and the LED is ON, between 25 and 35 cm with nearly 500–800Ω the LED will glow, similarly for the distance greater than 35. On minimum distance between 0 and 10, the LED will be OFF.
- Table 3 determines the LED by the IR sensor. Obstacle on less than 40 cm, the LED will glow with less intensity but distance over 40 cm the LED will glow with high intensity depending on day and night.

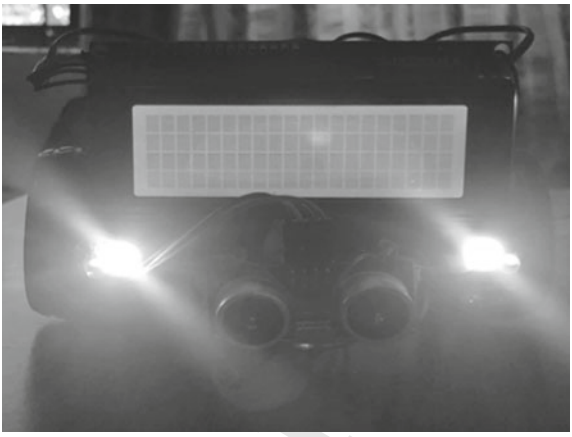

Fig. 2 Detecting obstacle in fog (low visibility)

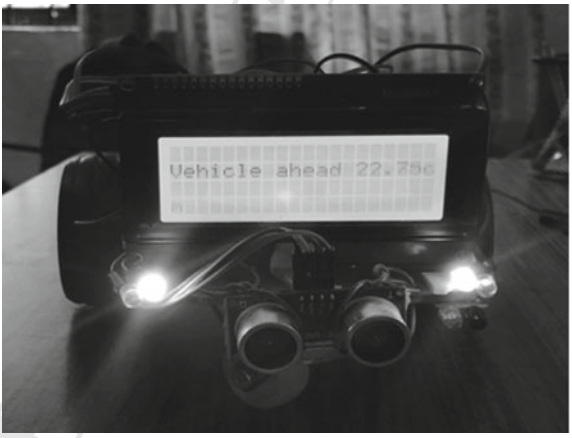

Fig. 3 Obstacle detected by the vehicle 22.75 cm ahead

5.2 Snap Shot

See Figs. 2 and 3.

6 Conclusion

Road accidents and crashes are now facing an all-time high number in modern India, and there are various reasons for this—both natural and situational. And to counter this increasing toll of lost lives, we have tried to present a smart-sensing vehicle with Arduino as its microcontroller and DC motor for actuation of the vehicle. We have considered some major reasons for road accidents like weather conditions, night driving, or vehicle's loss of control over its wheels. The project focuses on adaptive

headlights which can alter the level of the brightness of the headlights as per timing of the day and light by sensing the amount of light it is receiving. The obstacle detection feature is probably the most helpful as it measures the distance between the obstacle and the vehicle and helps to take proper action.

The advancement in road transportation and its decreasing cost is enabling people to take upon the automobiles and thus the increased traffic is a major reason for the number of people dying on the roads for vehicle accidents. Thus, with this project, we have called upon engineers to take up action to save those lives. While this project gives a rudimentary prototype of where the vehicles have reached in regard to the safety of vehicles, further methods can be developed to help with this aim.

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AQ5

Author Queries

Chapter 35

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