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Advanced Driver Assistance System

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Abstract: ***The prime motive of the automobile industry is to improve safety in driving machines and avoid accidents. Traffic rules and regulations drafted by the law aren't followed by many citizens. This is another reason for an accident. Accidents sometimes are unintentional. Some serious acts like drunk and drive, ignoring the signboards, and over speeding might result in severe causalities. To prevent situations like these we seek the Advanced Driver Assistance System (ADAS). ADAS has the potential to increase safety and provide comfort driving. Driving situations are electronically controlled and decisions are simplified for the driver. Old people may also receive plenty of benefits from this technology. ADAS is designed with a human-machine interface which tends to improve road safety marginally. Accidents caused by human error can also be minimized. ADAS helps the driver to automate, adapt and enhance the vehicle system for safe driving. Passive safety technologies like wearing seatbelts and airbags cannot prevent road fatalities. Modern technology like ADAS is different from traditional and passive technology and minimizes the fatalities consistently. ADAS also alert the driver of potential problems and helps in maintaining the stability of the vehicle under critical circumstances. Safety features are implemented to take control of the vehicle during collisions. ADAS relies on inputs from multiple sources like the brake assistant, pressure control system, lane departure warning system, road sign identification, etc. Additional features can also be customized based on the needs of the driver. In this paper methods to prevent over speeding, vehicle collisions, and driver alertness systems are discussed. RFID readers are used for sensing the speed limit in the signboards. The speed of the vehicle is managed based on the reading obtained from the tags. Sensors like ultrasonic, alcohol detector, gas sensor, temperature sensor are used to measure other parameters to enhance the safety measure while driving.***

Keywords: Driving behavior, RFID Reader module, Sensors, Speed control, Variable speed limit.

I. INTRODUCTION

In the developed world road facilities is a major concern. Most of the accidents are associated with excessive road transportation and inappropriate speed. The Driver Assistance system will assist the driver in the driving process and it will increase the car safety and more generally road safety. In some dangerous situations, these systems warn and actively support the driver and if necessary it automatically takes the necessary actions to avoid vehicle collision.

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In this system, various sensors are embedded to increase safety during the driving process. Some of the sensors include an ultrasonic sensor, gas sensor, temperature sensor, alcohol sensor, and some other sensors that are embedded to increase safety.
If the sensor detects any obstacle it will alert the driver through the buzzer after that if any actions are not taken by the driver, the system will automatically reduce the speed or in some dangerous situations stop the car when the vehicle is too close to the other vehicle. When the vehicles enter into the RF region, it will automatically slow down the car speed as detected in the signboards using RFID technology.
In the existing roadways, the signboards which are used to avoid accidents are not noticed by many drivers, so it is not an efficient method to avoid accidents. Some vehicle to vehicle accidents have occurred near the traffic area as well as highway roads are due to the laziness of drivers. To avoid these problems we proposed a system, it will assist the driver with a high degree of comfort and provide alertness in some dangerous situations. Here RFID tags and readers are used for this speed controlling actions. Whenever the vehicle fitted with RFID reader comes into the region where the RFID tag is present the data which is nothing but an identification number is send to the Arduino to take particular actions to control the speed and this is how the speed is controlled in the vehicle in some regions like school zones.

II. LITERATURE REVIEW

Chaudhari Priyanka Ramnath proposed several methods to provide safety while driving like collision avoidance using IR sensors, fuel detection systems, lane change assistance, and adaptive light control system [1]. The primary downside is that the IR sensors used to determine the presence of other vehicles, pedestrians, and some other objects to avoid crashes and accidents. In case of reliability ultrasonic sensors are better than IR sensors and the maximum range of an ultrasonic sensor is about 20 meters while for the IR sensor it is only between 1-5 meters and also depends on the type of IR sensor which is used the operating range will also vary. Nayana.H.C, Basavaraj Neelgar, Ragul High ware proposed methods to detect objects like vehicles and pedestrians by using the Pi camera module which is useful for collision avoidance among vehicles and with some other objects [2]. But in smoky and dust conditions the Pi camera will not be suitable for capturing images due to poor visibility it will result in blur images which is not sufficient for object detection while driving and makes the driving tougher. Ashok Kumar.R, Kavitha.V, Jegan.R, Satish.S proposed speed limit recognition using Beacon technology [3]. This beacon work along with Bluetooth enabled in mobile phones to provide notification of speed limits whenever the vehicle comes into the region where beacon tags are placed.

The only disadvantage is that the Beacons can be used along with smart phones with Bluetooth enabled if there is no connection or due to poor connection with mobile phones there may be a lack in the transformation of information to the drivers. And the other disadvantage is the cost, it is not cost-effective and battery friendly.
Having a mobile with an enabled Bluetooth connection isn't battery friendly and very few customers will comply to keep their Bluetooth activated to attach with beacons. The remaining section of this paper has organized as follows.

III. PROPOSED METHODOLOGY

The proposed system supports the drivers by strengthening their sensing ability, warning in case of error and reducing the controlling efforts of drivers. This system has an RFID tag placed in the road signboards and RFID readers are placed in the vehicle. When the vehicle comes into the region where the tag is placed, then signals emerging from the reader will energize the tag and the identification number which is stored in the tag is read through the reader fitted in the vehicles. The speed limit is fixed for each identification number (e.g. 6005B28A1B4 id is assigned to a speed limit of 30km/h). Once the limit is read it will be displayed as a notification to the driver, if the driver ignores the notification, then required action will be taken to control the speed of the vehicle automatically by processing through the Arduino and by using pulse width modulation technique. And some sensors are also embedded within the car system to make the driving more safely like ultrasonic sensor to find the distance between the vehicles and prevent the vehicle to a vehicle collision and pedestrian collisions and other sensors are also interfaced to provide safety.

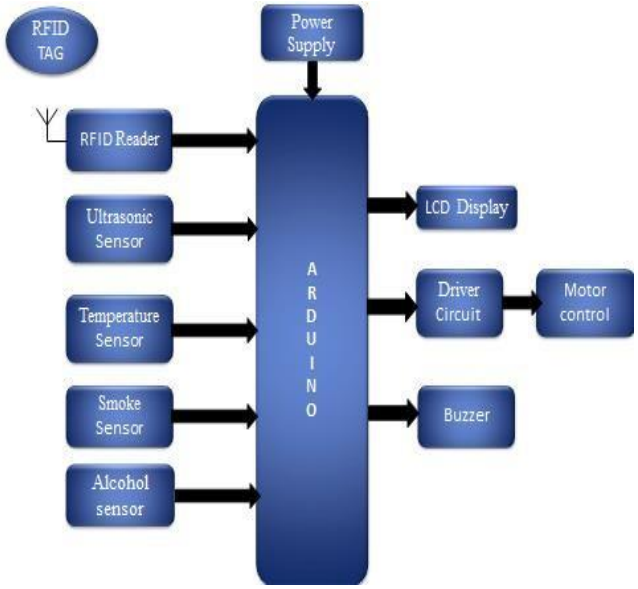

Fig.1. Diagram representation of ADAS

The RFID tag contains the tag ID which is read by the reader. Each ID is assumed with the particular speed limit in common. So when the car enters into that particular region the speed is reduced to the limit which is read from the tag. The ultrasonic sensor is used to find the obstacles nearer to the vehicle and to take particular actions like an application of brake when the vehicle is closer to other vehicles. So the sensors are placed on the left and right side of the door to prevent the vehicle from sideward collision. The smoke sensor is used to identify the smoke presence inside the car and to provide alertness to the driver with the help of a buzzer. The temperature sensor is used to measure the engine temperature as well as cabin and provide alertness which is used to save the vehicle from fire.

IV. HARDWARE DESCRIPTION

The section describes the hardware components used for this proposed work

A. Switches:

The switch is an electronic component that is used to turn a device on and off. Turn off occurs when the circuit is open and there is no current flowing through the conductor. Turn on occurs when the circuit is closed and there is a current flowing through the conductor.

Fig.2. Switch

The switches are used at the transmitting end of the prototype device to select the input mode to be given by the user. The user can be blind or deaf or dumb or any of the three disabilities combinations or a normal person. The switches can also be used at the receiver side to select only a needy output for reducing the power usage. Fig. 2 shows a picture of the DPDT push button switch.

B. Radio Frequency Identification:

The main idea provided in this paper is to use Radio Frequency Identification (RFID) technology to attach the warning signals where ever road safety is much needed. The tag consists of a copper wire that acts as an antenna and also provides the necessary power to the tag. This antenna is connected to the chip as shown in Fig. 3.

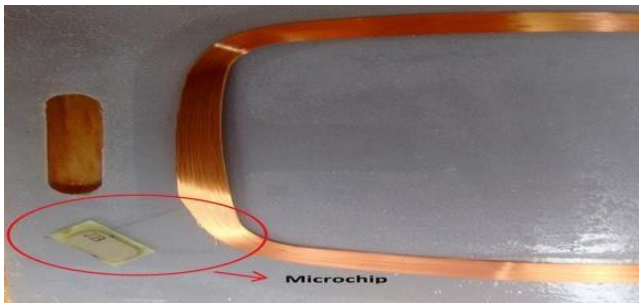

Fig.3. Interior design of RFID tag with a microchip

This chip is the key component of the RFID tag. The chip has an EEPROM that stores the unique identification number and other details like location if any and also has circuitry for the logical functioning of the chip.

The silicon microchip is attached to a small antenna and mounted on a substrate and placed in materials like plastics. The RFID tags get power from the reader through the inductive coupling method. The RFID reader consists of a coil connected to an AC supply so that around the coil magnetic field is produced. The tag coil is placed within the vicinity of the reader coil and then an electromotive force is induced in the coil. Then the tag will send the id to the reader through the antenna. This is how the identification number is read by the reader.

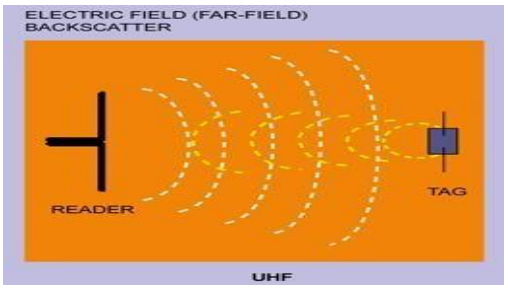

Fig.4. RFID tag and reader working

In RFID applications the tags are embedded into the objects that are to be identified or tracked. RF signals might still be transmitted reliably. When the speed information is received from those zones where the RFID tags are placed in the signboards, then the vehicle's embedded unit will automatically alert the driver to reduce the speed. If the particular actions are not taken by the driver after receiving the alertness the embedded unit will automatically reduce the speed as read by the reader.

Fig.5. RFID passive tags

Fig.6. RFID reader Module

C. Arduino Uno:

The Arduino is an open-source platform that is capable of easier implementation of the hardware and software. Many projects can be done easily with the help of Arduino.

Fig.7. Arduino Uno board

Arduino board is a microcontroller that can read the various types of sensor values or a message from the social media and actuate the actuators based on those values obtained. The Arduino board has an inbuilt Central processing unit along with the memory unit. The Arduino board can send the output signals to the actuators like changing the states of relays automatically, turning on and off the motors, switching on and off the LED, LCD and more. The Arduino is a free platform for the beginners. The Arduino can be used in various hardware and software domains like IoT, Embedded systems, Image processing and more.

Fig. 7 shows the diagram for the Arduino Uno board. There are many Arduino boards available in the markets which are manufactured by Atmel. Some of them are Uno, Mega, Diecimila, Duemilanove, Leonardo, LilyPad, Nano, Robot, Yun, Due and more. Among them, Arduino Uno is the cheapest and very compatible board. So in this project, the Arduino Uno Microcontroller board is used. The Microcontroller used in the Arduino board is AT mega 328P which is inbuilt. It is an 8-bit microcontroller. The technical specifications of the Arduino Uno are given in Table-I.

The poly fuse present in the Arduino Uno board is resettable type and it helps in giving protection to the USB port of the computer from short circuit and over current. Most of the boards have an inner layer of protection to stop the overflow of the current and the fuse present will protect from the outside. If the current through the USB port of the computer exceeds above 500milliamperes the fuse comes into action and breaks the circuit until shorting is cleared.

Table-I: Arduino Uno specifications

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Inout Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
LED_BUILTIN	13
Length	68.6 mm
Width	58.4 mm
Weight	25 g

D. Gas Sensor:

A Gas detector is a device that senses smoke, which is an indicator of fire. The MQ-2 smoke sensor used to detect the concentration of combustible gas in the air and produce analog output. The sensor can measure the concentration of flammable gas of 300 to 10,000 ppm. They are used in gas leakage detecting equipment in family and industry and portable gas detectors. This sensor reports smoke by the voltage level that it outputs. The more the smoke there will be greater voltage output from the sensor whereas when there is less smoke that it is exposed to, then there will be less voltage level. Here we wired MQ-2 with Arduino so that the Arduino can read the output voltage from the gas sensor and ON the buzzer if the sensor outputs a voltage above the threshold. In this way, we know that the sensor is detecting the smoke and the buzzer alerts the person when there is a presence of smoke.

MQ-2 is a gas sensor made up of metal oxide semiconductors. The Concentration of the gases is measured using a voltage divider network present in the sensor. MQ-2 gas sensor has four leads which include an analog output pin, digital output pin, VCC, GND. This sensor needs about 5 volts of power to operate. The output is the voltage depending on the concentration of smoke. When it comes in contact with the gas resistance of the sensing material changes. This change in the value of the resistor is used for the detection of the gas or smoke. The sensing element is mainly an aluminum oxide enclosed in a stainless steel mesh. The sensing element has six connecting legs. Two leads are used for heating the sensing element, the other four are used for output signals. Oxygen gets adsorbed on the surface of the sensing material when it is heated in air at high temperature. Then donor electrons present in tin oxide are attracted to oxygen and prevent the current flow. When reducing gases are present, the oxygen reacts with the reducing gases thereby reducing the surface density of the adsorbed oxygen. Now current can flow through the sensor, which generates analog voltage values. These voltages are used to measure the concentration of the gas. When the concentration of gas is high voltage value is also high.

Fig.8. Gas Sensor

E. Temperature Sensor:

The LM35 is a temperature-sensing device produced output voltage proportional to the temperature. It provides output voltage in centigrade (Celsius). The sensitivity of LM35 is 10mV/degree Celsius. Thermocouple, a temperature-sensing device consisting of 2 dissimilar metal wires. The wires are joined together at one end to form a hot junction. The other end known as the reference (cold) junction is connected across an electronic measurement device (collector or digital indicator). A thermocouple will generate a signal in response to a difference in temperature between the measuring and reference junctions.

Fig.9. LM35 Temperature Sensor

Only two wires are necessary to connect the thermocouple to an electrical circuit however, these connecting wires must be made from the same metals as the thermocouple itself. Adding wire from other materials may create new measuring junctions that will result in incorrect readings. Similarly, RTD is also a temperature-sensing device whose resistance changes with temperature. It is typically built in the form of platinum. RTDs can take many different shapes like a thin film. To measure the resistance across the RTD, a constant current Has to be provided and measure the resulting voltage and determine the RTD resistance.

The Thermistor is also a temperature-sensing device whose resistance changes with temperature. Thus in very small temperature change, we can see a large resistance. This makes for highly sensitive device, ideal for set-point applications.

F. Motors:

Fig.10. Thermistor

For the machine-driven action like gyration, motors are used. Here we have cast-off 12 volt DC motor. The voltage variation gives the change in requisite speed. Fig. 11 shows the motor used in our projected work.

Fig.11. Motor

G. LCD Display:

The liquid crystal display cast-off to display the outcomes of all the sensors interfaced to upsurge the safety while driving. It is better than LED and other display devices in several ways. LEDs have a variable set of use cases for customers, they'll be usually found in smart phones, televisions, pc monitors and instrument panels. It also depletes much less power than LED and gas display. Fig. 12 is the display we Used.

Fig.12. LCD Display

H. Alcohol sensor:

An alcohol sensor used for the vigilance of the presence of alcohol gas in the air and produces an analog voltage as the output reading. Here we come up with this sensor to recognize whether the driver is drunk or not. If the driver's consumption of alcohol over a particular limit then the system will not power on, so through this we can prevent the accidents. MQ3 alcohol sensors can be easily interfaced with Arduino Boards, Microcontroller, Raspberry Pi, etc.

Fig.13. Alcohol Sensor

I. Ultrasonic Sensor:

Ultrasonic sensors are typically used in industrial applications to found hidden tracks, discontinues in metals, plastics, ceramics, and water level detection. It operates by emanating sound waves at a frequency which is too high for human beings to hear. It is a four-pin module, with pins Vcc, Trigger, Echo, and ground respectively. This sensor will transmit an ultrasonic wave and this wave then travel in the air when it gets objected by any material it is then reflected toward the sensor, the reflected wave is then observed by the ultrasonic receiver module as shown in Fig. 14.

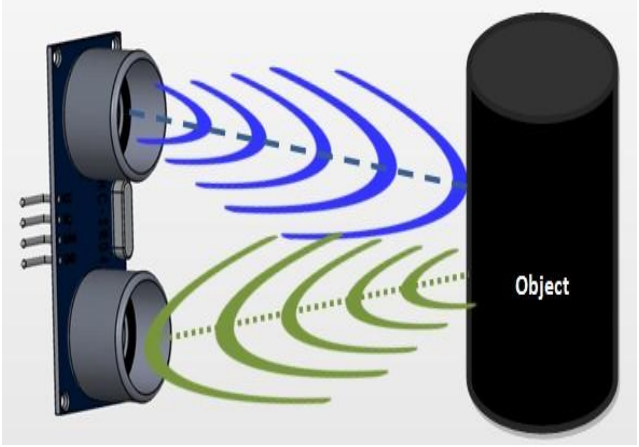

Fig.14. Ultrasonic sensor working

HC-SR04 is most commonly used with microcontroller and processor platforms like Arduino, ARM, Raspberry Pi, etc. These gadgets frequently transmit a short burst of ultrasonic sound towards the target, which reflects the sound of the sensor. The system governs the distance stuck between the entities by computing the time when the echo waves to reach the sensor.

The transmitter can distribute 40 kHz ultrasonic sound while the receiver is designed to accept only a maximum of 40 kHz sound waves.

Fig.15. Ultrasonic Sensor

V. RESULTS AND DISCUSSIONS

The prototype device for accident prevention in roads and to assist the driver with the speed control mechanism in particular zones have been designed and implemented. It consists of an RFID reader, RFID tags, sensors, switches, motors, Arduino Uno and LCD. The overall setup of the system is shown in Fig. 16.

Fig.16. Overall Hardware Setup

All sensors and other components are interfaced with Arduino as shown in the above hardware setup. The outputs of the Ultrasonic sensor, Temperature sensor, Smoke sensor, Alcohol sensor after powering the setup are shown below in the screenshot.

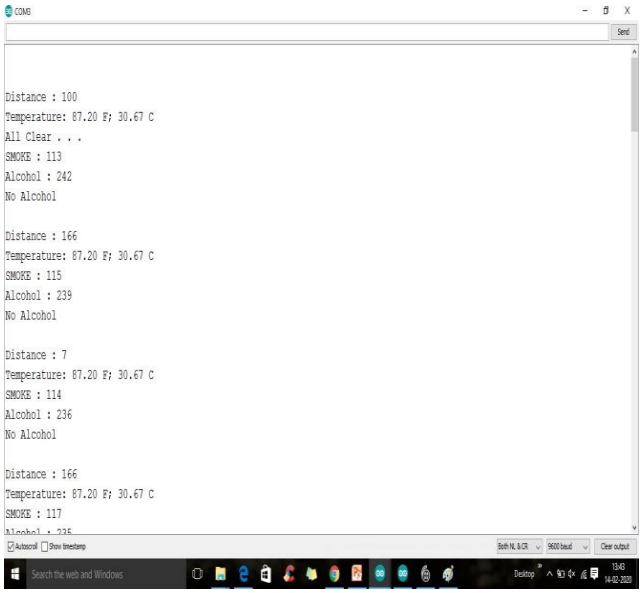

Fig.17. Output of all sensors displayed in the serial monitor

The RFID tags are placed in the signboards and when the vehicle with RFID reader reaches the region where tags are placed, then identification number present in the tags are read by the reader and displayed in Liquid Crystal Display which is shown below in fig. 18 and each identification number are assigned to specific speed limits.

Fig.18. Tag output in LCD

The received identification number is processed by the Arduino and for each speed limits, the motor speed is controlled by using the Pulse Width Modulation technique. Then ultrasonic sensor is used to avoid vehicle to vehicle crashes and pedestrian collisions. The setup of the placement of RFID tags and the reader is designed as shown in Fig. 19, then the control actions are performed after reading the speed limits and sensor working is also done simultaneously. Ultrasonic sensor is used to avoid collisions between two vehicles by measuring the distance. So it is useful to avoid crashes among vehicles and pedestrian accidents. If the measured distance is too small then the car will automatically stop and also if the distance measured is not within the dangerous limit it continuously the same speed. The speed of the car reduces while entering skeptical distance from the obstacle.

If any unwelcoming smoke or fire is caused inside the vehicle it will be sensed by the smoke or gas sensor and the driver is notified immediately. The engine will not start if the alcohol consumption level of the driving party exceeds beyond limit sensed by the alcohol sensor. Continuous heating of the engine resulting in increased temperature conditions will be appraised instantly with the help of the temperature sensor.

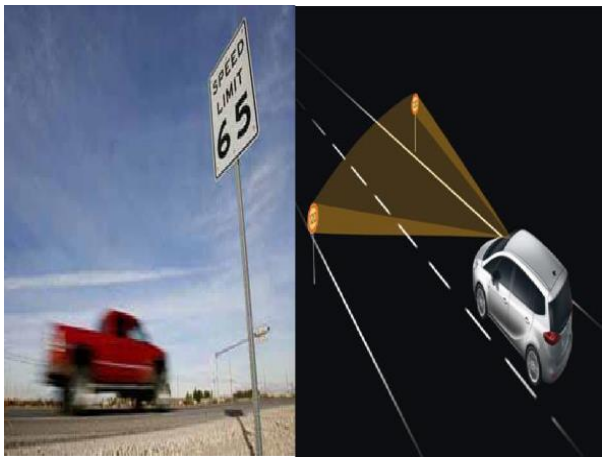

Fig.19. Speed Limit Sign Boards

VI. FUTURE SCOPE

In the future, Radio Frequency Identification tags will find their own space in our environment. Nowadays the vehicle traffic and usage becomes very high.

The future scope of our system is to avoid accidents, fire accidents and crashes among vehicles. In the real world entity, we have planned to use pneumatic cylinders interfaced with embedded parts to reduce the speed of the vehicle. The driver will be assisted more than today's trend in their comfortable journey. In this, we can use voice alarm to get the driver's attention to make the drive faster and safer. The system can also get enhanced with active type Radio Frequency Identification tags to increase the coverage area of the communication range. A narrow range of sensors can be replaced by a wide range of sensors with low frequency.

VII. CONCLUSION

In this paper, the drawbacks obtained by conventional methods are recognized and modified. This methodology can be embedded in all types of vehicles at an affordable cost. This system is durable and ensures maximum safety to the passengers as well as the public. The average performance of the system considering certain drawbacks with proper making is 90%. This system doesn't require any GPS or smart phones using the mobile battery for operation. A vehicle with a high degree of comfort can be designed using this method. In the future, it can be interfaced and customized with modern technology for better performance.

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REFERENCES

1. Li Li, Ding Wen, Nan-Ning Zheng, Lin-Cheng Shen, *Cognitive Cars: A New Frontier of ADAS Research*, IEEE Transaction on Intelligent Transportation System, March 2012, Volume 13, Issue 1.
2. Ameer Rasouli, John K.Tsotos, *A Survey of Theory and Practice Autonomous Vehicle that Interact with Pedestrians*, IEEE Transaction on Intelligent Transportation Systems, 2020, Volume 21, Issue 3
3. Paolo Bosetti, Mauro Da Lio, Andrea, Saroldi, *On Curve Negotiation from Driver Support to Automation*, IEEE Transaction on Intelligent Transportation Systems, 2015, Volume 16, Issue 4.
4. Chaudhari Priyanka Ramnath, *Advanced Driver Assistance System*, International Journal of Advanced Research in Electronics and Communication Engineering, 2015, Volume 4, Issue 10.
5. Nayana H.C, Basavaraj Neelgar, Rahul Hiware, *Object Detection and Classification for Vehicle Advanced Driver Assistance System*, International Journal of Engineering Science and Computing, 2017, Volume 7, Issue 6.
6. Ashok Kumar, Kavitha.V, Jegan R.R, Satish.S, *A Beacon Automatic Vehicle Speed Control System for Restricted Zone*, International Journal of Research, October 2018, Volume 7, 2236-6124.
7. Ashok Kumar.K, Karunakar Reddy Vanga, *IoT Based Zone Vehicle Speed Control*, International Journal of Recent Technology and Engineering, May 2019, Volume 8, Issue 1, 2277-3878.
8. Rajeev Thakur, *Scanning LIDAR in Advanced Driver Assistance System*, IEEE Consumer Electronics Maganize, July 2016.
9. Luciano Alonso, Vicente Milan, Jorge Godoy, Juan.P, *Ultrasonic Sensors in Urban Traffic Driving-Aid Systems*, Sensors 2011, Volume 11, pp, 661-673.
10. Arun Tigadi, Rudrappa Gujanatti, Anil Gonchi, *Advanced Driver Assistance System*, International Journal of Engineering Research and General Science, May-June 2016, Volume 4, Issue 3, 2019-2730.
11. Sawant Supriya.C, Bombale U.L, Patil T.B, *An intelligent Vehicle Control and Monitoring using Arm*, International Journal of Engineering and Innovative Technology, October 2012, Volume 2, Issue 4.

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