iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** VI **Month of publication:** June 2021

DOI: https://doi.org/10.22214/ijraset.2021.35506

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VI Jun 2021- Available at www.ijraset.com

Minimum Distance Warning and Braking System for Vehicles

Battula Pranay Kumar[1], Makthala Krishna Chaitanya Goud[2], Elukapally Raj Kumar[3], Mrs. K. Vineetha[4]
[1, 2, 3]*U.G.Student,* [4]*Assistant Professor Dept. of ECE, Sreenidhi Institute of Science and Technology, Hyderabad, Telangana-501301 India*

Abstract: ***A vehicle distance measuring safety warning and braking system is disclosed having one or more distance measurement sensors measuring the distance from the driver's vehicle to a second vehicle immediately in front, the minimum distance between the vehicle and any object depends on the speed of the vehicle and here the speed of the vehicle is measured by calculating RPM(revolutions per minute) of wheels, based on the calculated minimum distance the speed of the vehicle is regulated by auto-lever mechanism. A vehicle distance alarm alerts the driver when the distance between the driver's vehicle and the second vehicle is less than a configured minimum distance, indicating an unsafe driving condition. An event record display device displays the time/date or the last twenty occurrences of the distance warning alarm. When an alarm is generated, a throttle set-back actuator operates to gently and automatically slow the car and increase vehicle to vehicle distance. Vehicle brakes may be automatically applied by the system to further slow the vehicle. The vehicle distance measuring safety warning system provides an additional margin of safety for a driver who may be distracted while driving.***

Keywords: ***Distance, RPM, Auto-Braking.***

I. INTRODUCTION

Ultrasonic sensors make it easy to measure distances. Perfect sensor for distance measurements between moving or stationary objects. Ultrasonic sensors measure the distance of objects in the air using a non-contact technique. They measure distances without damage and are easy to use and reliable. These rangefinders connect to all common types of automation and telemetry equipment. Machines and processes in many industries use proximity sensors when size or position information is needed. Distance sensors are used to control or indicate the position of objects and materials. Distance sensors can determine the dimensions of objects such as height, width and diameter, using one or more sensors. The echo temporal response of ultrasonic sensor detectors based on the travel time after the trigger pulse to surrounding objects is non-linear and depends on the reflective properties of the object's surface. Ultra-Sonic sensors are widely used for distance measurement purposes. They offer low cost and accuracy of less than 1cm for distance measurements up to 6m. However, the most common method used in these measurements is based on time-of-flight (ToF) measurements. This ToF is the time elapsed between emission and the arrival after reflection of a supersonic pulse train traveling at the speed of sound. This results in a long response time for a measurement. Driving is a compulsory activity for most people. People use their cars to get from one place to another. The number of cars is increasing day by day. It is made in a sealed manner and there is a risk of accident. Today, the number of accidents is too high and uncertain. Accidents will happen anytime, anywhere and cause the most damage, serious injury, and death. The accidents are mainly caused by slow braking. Preventing accidents and mitigating their consequences are integrated techniques we follow. In the unique term of "Perceptual Navigator", we've always pursued this approach with new assist systems, vastly improved lenses, and nasty defences. Percept Drive turns the car into a "perceptual partner". This identifies a range of specific hazards and provides assistance through audible, visual and tactile warnings, which can also increase driver response. Many systems are capable of performing the necessary actions in an emergency situation. The driver is finally happy and the comfort level is increased. This insight and innovative combination of sensors and systems set a benchmark on the path to autonomous driving and accident prevention.

II. LITERATURE SURVEY

The U.S. Department of Transportation is increasingly showing an interest in developing and implementing an effective traffic control system. This has led to an increase in studies focusing on and defined as vehicle-to-vehicle communication, vehicle-to-road communication, and road-to-road communication. V2v can be classified into 3 types depending on the technology used:

A. Radar based
B. Camera based
C. Radio systems.

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Radar and camera-based technology is used to avoid collisions in the same lane due to visibility limitations. Radio technology is more widely used for collisions regardless of line of sight or lane passing. V2r applications mainly focus on the intersection warning system, whether mounted inside or outside the vehicle. Most v2rs use DGPS technology to support a base station installed at an intersection, facilitating the vehicle information needed for prediction. An alternative implementation is possible. For example, in a single RFID built into each vehicle for separate purposes.

1) Many automobile makers have introduced such systems to their high-end models since 2003.however the systems are not perfect and need further enhancement to be more effective.

2) There are two main causes leading to car accidents:

a) Careless or fatigued drivers.

b) Sudden change in road direction.

c) Weather Conditions.

3) *Existing System:* Emergency Auto Braking System

a) It is an active safety system that activates the car brakes, when a potential collision is detected.

b) It can also increase braking force if the driver is applying the brakes.

c) But it is not enough to prevent a collision.

III. PROPOSED SYSTEM

The system is based on Arduino and some sensors. Here, the ultrasonic sensor (HC SR-04) and PIR sensor detects the input. And led, buzzer and servo motor for output. As soon as the Arduino is powered up, the ultrasonic sensor emits ultrasonic waves and PIR sensor senses the RPM of the vehicle. When these waves detect or hit an obstacle, they are reflected back to the receiver as an echo. It then detects the presence of an obstacle in front of this sensor at a certain distance from the sensor. The data is processed and transmitted to the Arduino through the receiver of the ultrasonic sensor and PIR sensor. Based on the data, the Arduino gives commands to the LEDs, buzzer and servo motor. When the obstacle is more than 50 distance units, no commands are transmitted to the output devices. When an obstacle or vehicle is less than 50 units away and more than 20 units away, an alert will be generated with a buzzer and alert the driver that there is a vehicle ahead. If the distance is less than 20 units, the red LED will illuminate and the brake will be applied. This process continues as long as the Arduino is in the active state.

IV. WORKING

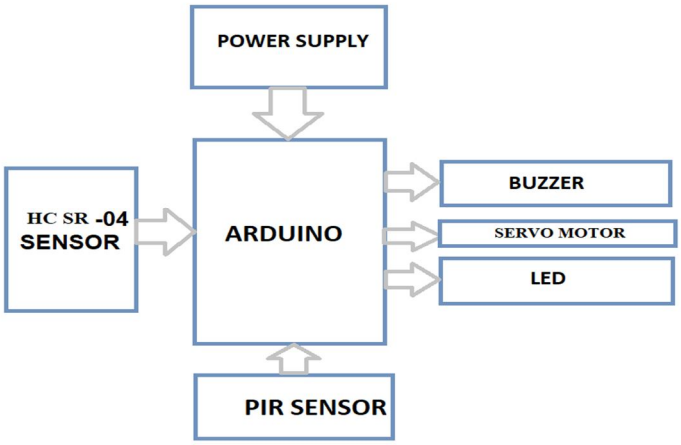


Fig.1 Block diagram

This system is based on Arduino and couple of sensors. Here, the ultra-sonic sensor (HC SR-04) and PIR sensor senses the input. And the led, buzzer and micro servo (SG 90) gives the output. As soon as the Arduino is powered the ultrasonic sensor emits the ultrasonic waves through the transmitter and IR sensor starts measuring the RPM of the vehicle. When ultra-sonic waves detect or hit any obstacle, then it will reflect back to the receiver as an echo.

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Then, it detects there is an obstacle present Infront of this sensor at a particular distance from the sensor. The data is processed and it is transmitted to the Arduino through receiver end of the ultra-sonic sensor and IR sensor. Based on the data Arduino gives commands to the Led's, buzzer and micro servo. When the speed is more than 1000 RPM functionality of the system enters into highway mode. In highway mode, when the obstacle is in the range of more than 50 units of distance, then no command is passed to the output devices (Led and Buzzer). When an obstacle or vehicle is in the range of less than 50 units and more than 20 units of distance an alert is generated by a buzzer to notify the driver that there is a vehicle in front. If the distance is less than 20 units, then red Led will glow and auto-braking system is activated. This process continues as along as Arduino is in active state. When the speed is less than 1000 RPM functionality of the system enters into traffic mode. In traffic mode, when the obstacle is in the range of more than 20 units of distance, then no command is passed to the output devices (Led and Buzzer). When an obstacle or vehicle is in the range of less than 20 units and more than 5 units of distance an alert is generated by a buzzer. If the distance is less than 5 units, then red Led will glow and auto-braking system is activated. In this system auto-braking is implemented by a micro servo, when auto-braking mechanism is activated the servo hand is shifted by 90 degrees and when it comes to real-time application servo hand is made to move piston of the master cylinder in the braking system of vehicle.

V. CIRCUIT DIAGRAM

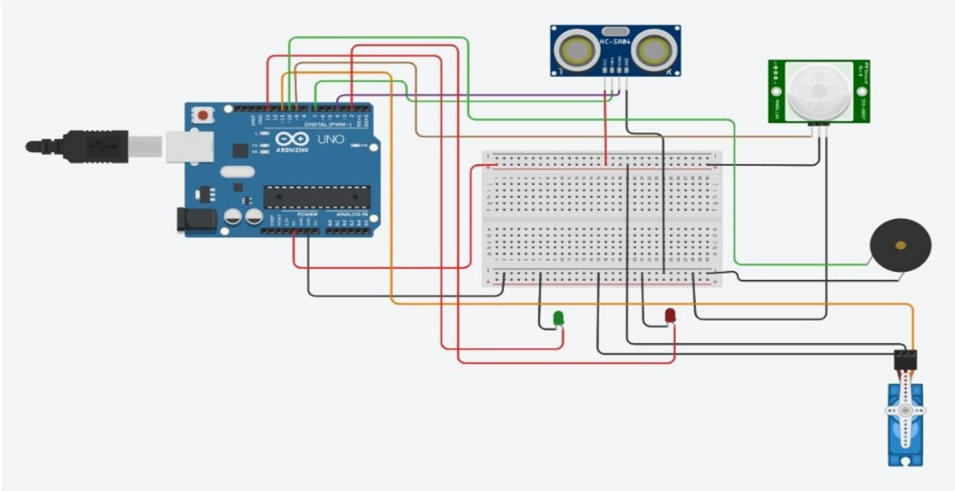


Fig.2 Circuit diagram

1) The above figure gives the description about the hardware connections and input and output devices connected to Arduino.
2) Arduino board is a microcontroller, which process the two types of data i.e., Analog and Digital.by the use of two set of pins analog pins, digital pins.
3) Arduino can be powered by three ways.
a) Through data cable
b) 12v DC Power supply
c) Power supply through Battery
4) Ultra-sonic sensor (HC SR - 04) has 4 pins.
a) *Vcc:* It is connected to +5v of Arduino.
b) *Trig:* It is connected to the digital pin 7 of Arduino
c) *Echo:* It is connected to the digital pin 4 of Arduino
d) *Gnd:* It is connected to the common ground of the Arduino to close the circuit.
5) Ultra-sonic sensor has two blocks, one is Transmitter and another one is Receiver. It senses the obstacle by sending ultra-sonic waves through transmitter and the receives the echo, which is reflected or when it hits the obstacle.
6) A Blue Led is connected to the pin -13 and the other terminal is connected to the ground via 1K resistor.
7) And a Red Led is connected to the digital pin -2.
8) Piezo – electric buzzer is connected to the digital pin 10.
9) PIR sensor is connected to the digital pin -9 (d0).
10) Servo motor is connected to the digital pin -11.

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ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VI Jun 2021- Available at www.ijraset.com

VI. RESULTS

The connections that are made by the sensors and rest of the components with Arduino UNO. We give power supply to the Arduino through the laptop by using USB cable, which of 5v and we generally use that GSB cable to dump the code from laptop into the Arduino. The sensors and components get the power supply from Arduino itself.

A. Traffic Mode

1) *Zone 1:* Here the driver is in safe zone (>20 units) and driving the vehicle perfectly.so, there will be no indication or warning to the driver.
2) *Zone 2:* Here the driver is in intermediate or warning zone (<20 units and >5 units). The driver will get a warning by the green led indication and buzzer sound.
3) *Zone 3:* Here the driver is in action zone (<5 units). In this case, the driver will geta warning by the RED led indication and brakes are applied.

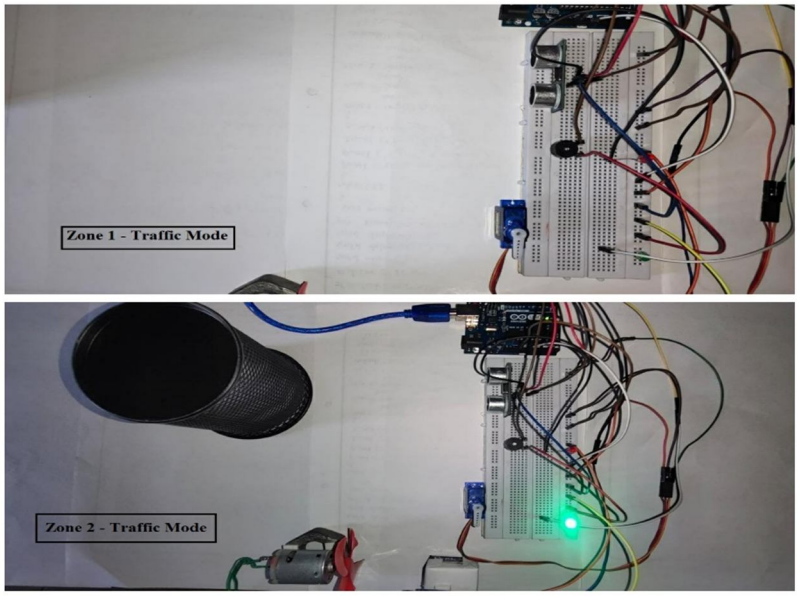


Fig.3 Zone 1 and Zone 2

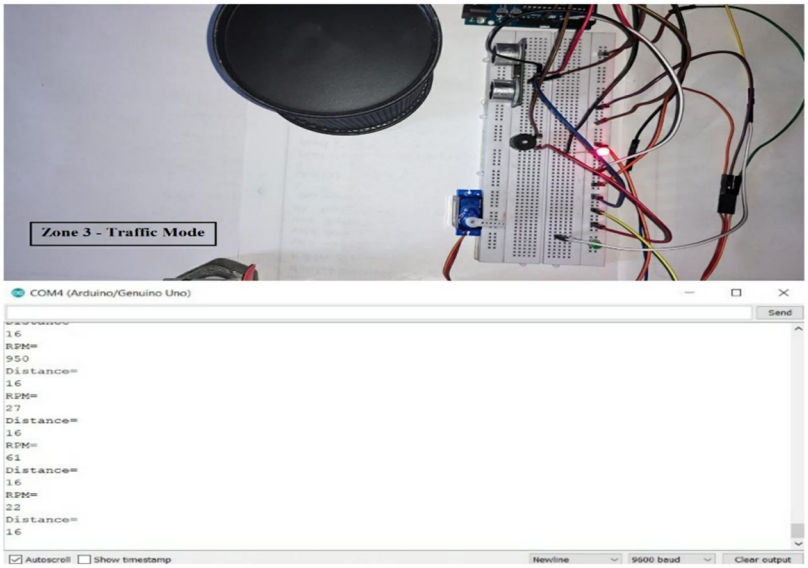


Fig.4 Zone 3 and Serial Monitor Output – Traffic Mode

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B. Highway Mode

1) *Zone 1:* Here the driver is in safe zone (>50 units) and driving the vehicle perfectly.so, there will be no indication or warning to the driver.
2) *Zone 2:* Here the driver is in intermediate or warning zone (<50 units and >20 units). The driver will get a warning by the green led indication and buzzer sound.
3) *Zone 3:* Here the driver is in action zone (<20 units). In this case, the driver will geta warning by the RED led indication and brakes are applied.

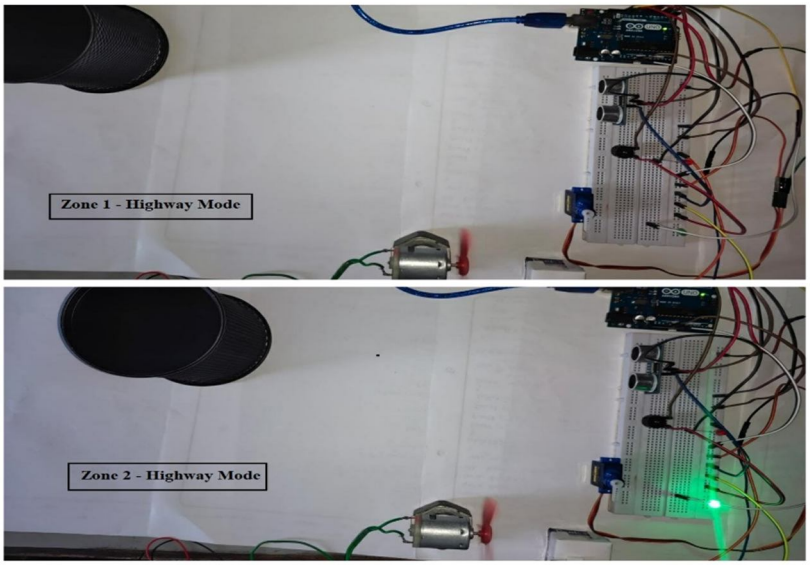


Fig.5 Zone 1 and Zone 2

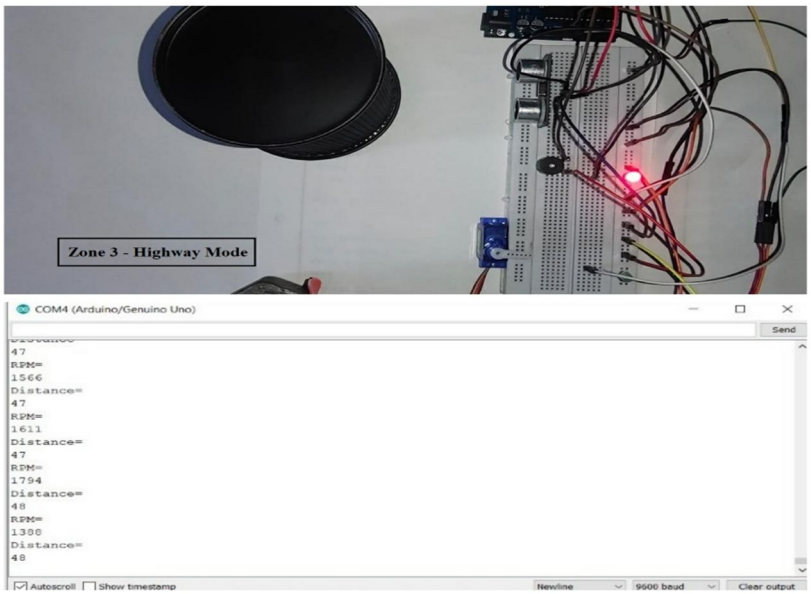


Fig.6 Zone 3 and Serial Monitor Output -Highway Mode

VII. FUTURE SCOPE

Future vehicle minimum distance warning and braking system will become a safety feature in all auto-mobiles. In the future, the system development should take advantage of new technologies to increase its robustness. This project gives a basic idea to design automatic cars with great safety features in future.

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Volume 9 Issue VI Jun 2021- Available at www.ijraset.com

VIII. CONCLUSION

With the help of this project, we can provide warning to the vehicle driver and when the vehicle comes even closer auto-braking system mechanism comes to work. This system can help driver to react in faster way. And can be avoid collision between the vehicles. This can help driver and passengers who are in the vehicle. This method can also be helpful parking. The results demonstrated during this project have been broad, varied, significant, and very encouraging. Minimum distance warning and braking system if carefully designed would increase the situation awareness of drivers by eliminating or decreasing the human errors. These systems would bring about a major change in solving traffic safety related problems and reducing the number of accidents. Consideration of human factors in the design of this warning and braking system plays a very important role. It will be a great tool regarding the safety of the people in vehicles. Human centered design would make them more acceptable and useful to mankind.

IX. ACKNOWLEDGEMENT

Firstly, we are grateful to the Sreenidhi Institute of Science and Technology for allowing us to work on this project. We are fortunate to have worked under the supervision of our guide Mrs. k. Vineetha, Assistant Professor ECE Dept. SNIST. Her guidance and ideas have made this project work.

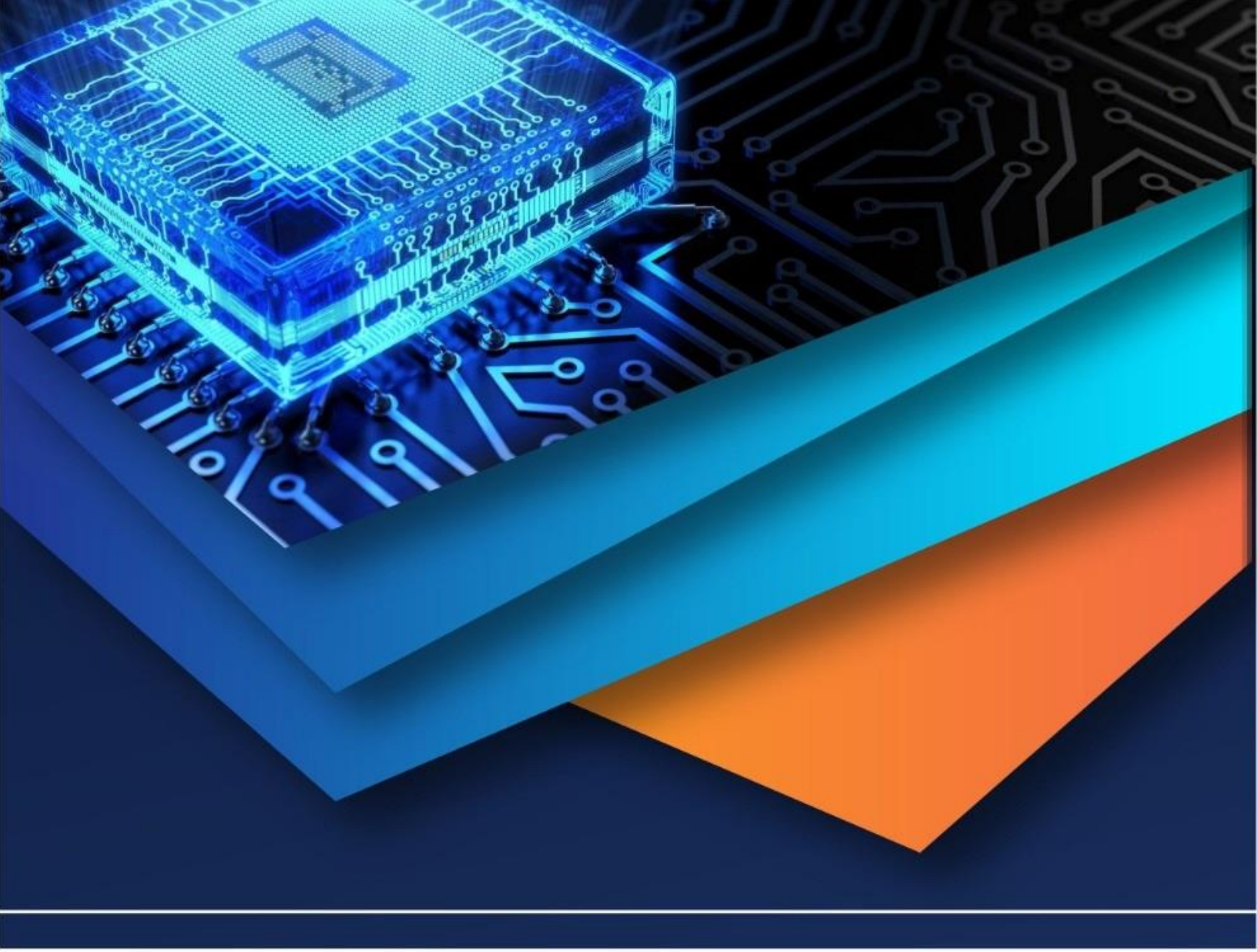
We are thankful to Dr. K. Sateesh Kumar, Assistant Professor ECE Dept. SNIST and Dr. Chattopadhyay, Professor ECE Dept. SNIST for being in charge of this project and conducting reviews.

We are also thankful to the HOD of Electronics and Communication Engineering [ECE], Dr. S.P.V. Subba Rao for giving us access to all the resources that went into building this project.

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