



# International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

*(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)*



**Impact Factor: 8.699**

**Volume 14, Issue 7, July 2025**

# **Design and Implementation of Automatic Braking System & Pedestrian Detection using Artificial Neural Network Algorithm and Regenerative Power Generation**

**S.Srimathi<sup>1</sup>, Prof. M.Deepa<sup>2</sup>, Prof. A.Jothi<sup>3</sup>, Prof. S.Gayathri<sup>4</sup>**

PG Scholar, Embedded System Technologies, PSV College of Engineering and Technology (Autonomous), Krishnagiri,  
Tamil Nadu, India<sup>1</sup>

Assistant Professor, Department of ECE, PSV College of Engineering and Technology (Autonomous), Krishnagiri,  
Tamil Nadu, India<sup>2-4</sup>

**ABSTRACT:** Integrate several state technologies to promote vehicle security and optimize accident response. This system uses pulse width modulation (PWM) for the automatic braking system. Use loudspeakers to dynamically adapt braking forces based on actual detection of obstacles such as pedestrians, dogs, cars, bicycles, and more. This precise control minimizes the risk of a collision by ensuring good time and effective braking. Ultrasound sensors are used in a comprehensive sense of situations to recognize the periphery of the vehicle from left to right, recognize obstacles and avoid collisions. Once the object is recognized, this means that the photo will be recorded and sent to a certified person with the SMTP protocol E-Mail-AM alarm. Refilling this renewable power source to restore energy in the vehicle improves the efficiency and sustainability of the vehicle. This mechanism uses the kinetic energy of the vehicle and converts it into electrical energy during a braking event. This renewable energy can be stored and reused to improve energy efficiency and contribute to sustainable power sources for vehicle systems. This integrated approach combines adaptive braking, real-time monitoring, accurate location tracking and efficient energy recovery, making it a robust frame for improved safety and road performance. generation.

## **I. INTRODUCTION**

The integration of advanced technologies to improve vehicle security and optimize accident response is to revolutionize modern transportation systems. By including pulse width modulation (PWM) in the automatic braking, the system dynamically adapts based on real-time recognition of obstacles such as pedestrians, animals, vehicles, and motorcycles using artificial neural networks (ANN) algorithms. Once the object is recognized, the system records the image and sends an email alert to the certified employee using the SMTP protocol. To further improve the vehicle fabric, recycled power supplies are used to restore kinetic energy during braking events and convert it into electrical energy that can be stored and reused. This not only increases the overall energy efficiency of the vehicle, but also contributes to its sustainability. Together, these technologies integrate adaptive braking, real-time monitoring, accurate location tracking and efficient energy recovery to create a robust framework that improves both safety and performance on the road.

## **II. OBJECTIVES**

- The purpose of this integrated system for vehicle safety and efficiency is to use highly developed technologies to advance accident prevention, reaction and energy delivery. vehicle. Ultrasound sensors continuously scan areas around the vehicle to add a layer of situational awareness, recognize nearby objects, and prevent the possibility of an accident.
- In addition, the system uses image recording and email alerts via the SMTP protocol to notify certified staff when obstacles are recognized, improving fast response functions.
- To improve sustainability, the system contains renewable power technology, kinetic energy generated during braking, which is converted into electrical energy for reuse. Overall, these innovations create comprehensive solutions to maximize security, improve actual monitoring, and promote energy efficiency in modern vehicles.



### **III. LITERATURE SURVEY**

[1] I.S. Gladushevsky, S.S. Evtyukov. 2020 Improvement of the research methodology of vehicle deceleration during operation of summer tires with different tread heights World of transport and technological machines . The primary cause is that the driver is unable to appropriately gauge road conditions in real time and take appropriate emergency measures. As a result, autonomous driving systems have emerged in order to reduce the occurrence of traffic accidents[2] I.S. Gladushevsky, S.S. Evtyukov. 2020 Identification of the factors most significantly influencing the assessment of the deceleration of vehicles of category M1 Information technology and innovation in transport (VI International Scientific and Practical Conference) ed. A.N. Novikov. 2020 Oryol State University named after I.S. Turgeneva (Oryol). It is necessary to detect not only the number and distance of pedestrians in front of the vehicle, but also their precise location, and to provide reliable data to the driving system's central processor so that measures can be taken to ensure the safe passage of vehicles and the safety of pedestrians.[3] I.S. Gladushevsky, S.S. Evtyukov. 2021 Methodology for calculating the braking distance on a dry asphalt surface when driving on studded tires Bulletin of Civil Engineers 2 (73). Pedestrian detection is most commonly employed in autonomous driving circumstances that necessitate rapid detection. It is also very useful for the purpose of video surveillance and other similar purpose. The primary goal of this project is to create a system that recognises pedestrians from video, or a stream of video sent to the system in the form of previously recorded video or real-time camera input[4] A. Ivanov, S. Shadrin, N. Popov, V. Gaevskiy, S. Kristalniy, "Virtual and physical testing of advanced driver assistance systems with soft targets", 2022 . Bounding boxes will be drawn around the things that the system has spotted along with the confidence score of prediction. This project employs Python programming and the YOLO machine learning technology.

### **IV. EXISTING & PROPOSED SYSTEM**

#### **1. EXISTING SYSTEM**

The existing method focuses on testing the effectiveness of modern electronic driver assistance systems, specifically the Automatic Emergency Braking System (AEBS) with pedestrian collision prevention functionality. This experimental study involves a controlled traffic scenario in which a movable model of an adult pedestrian crosses the road in front of an oncoming vehicle equipped with AEBS. The system's vision is enabled by radar and a video camera, which detect the pedestrian's presence and trigger braking to prevent a collision. Tests are conducted under varying conditions, including daytime and nighttime scenarios, with a moistened asphalt road surface to reflect real-world challenges. The study closely examines the system's performance during collision events, including the impact on the pedestrian model and the response parameters of AEBS activation. Detailed parametric records from each test run are collected, providing insights into the reliability and functionality of AEBS in mitigating pedestrian collisions.

#### **1.1 DISADVANTAGES**

- System tests are performed in a controlled environment. This may not be possible to completely replicate real scenarios that are completely unpredictable, such as irregular pedestrian movements, different weather conditions, and heavy traffic.
- These sensors can be affected by fog, rain, or poor lighting. This can reduce the effectiveness of AEBs, especially during nighttime and undesirable weather.

#### **2. PROPOSED SYSTEM**

The proposed method focuses on the integration of advanced control, detection and energy recovery technologies to improve vehicle safety and sustainability. An automatic braking system is determined by pulse width modulation (PWM), which dynamically adjusts the braking force based on real-time obstacle detection. Algorithm Algorithms - Input from algorithmic sensors in artificial neural network processes to recognize a variety of obstacles, such as pedestrians, animals, and other vehicles, ensuring accurate braking responses that minimize the risk of collisions. To achieve comprehensive situational awareness, ultrasonic sensors are used in vehicles around the vehicle to continuously monitor the periphery from several angles. Once a failure is determined, the system records the image and sends an email alert to the certified staff via the SMTP protocol. The vehicle uses regeneration performance technology. Monitoring and energy efficiency.

#### **2.1 ADVANTAGES**

- Pulse width modulation (PWM) is used to dynamically place the braking force.
- This creates smooth, responsive and efficient brakes based on obstacle type, distance and speed.

## V. BLOCK DIAGRAM

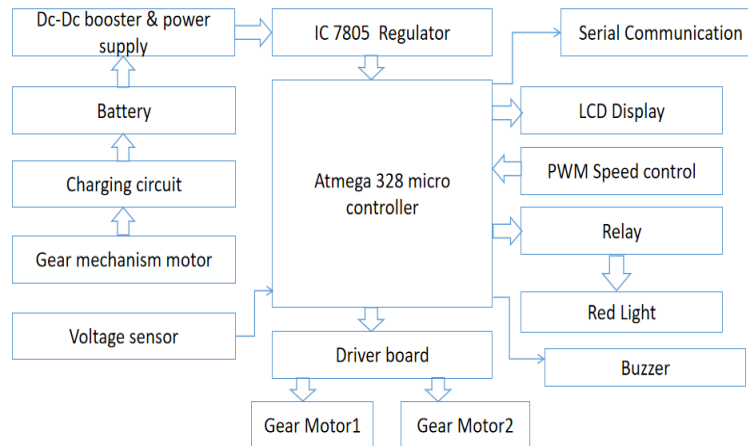


Fig No: 1 Hardware Block diagram

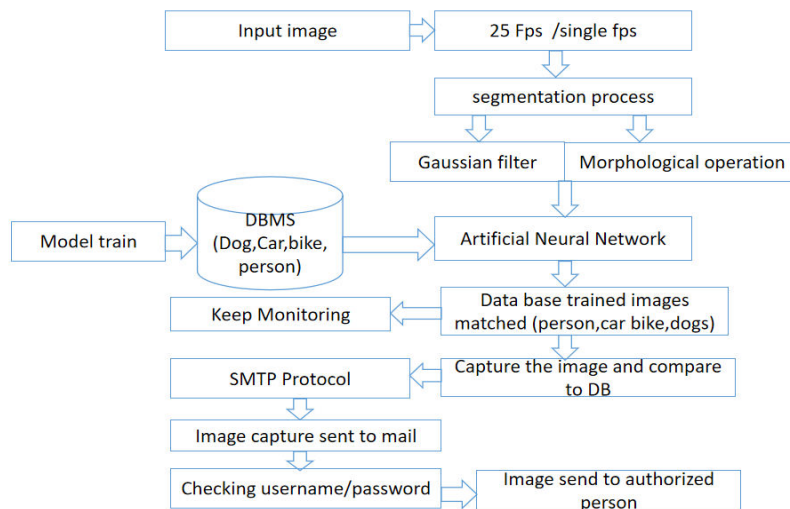


Fig No: 2 Software block diagram

## VI. HARDWARE REQUIREMENTS

### 1. BATTERY

The battery system stores excess solar power for later use. The battery extends the use of PV system-generated energy, providing free and sustainable performance even when the sun doesn't shine and the table isn't shine



Fig No: 3 12 V, 4.5 Ah BATTERY

## 2. GEAR MOTOR

Geared DC engines can be defined as extensions to DC engines. The details of the findings have already deteriorated with this engine. A geared DC engine has a gear assembly on the engine. Engine speed is counted in relation to the rotation of the shaft per minute and is called speed.



Fig No: 4 gear motor

## 3. VOLTAGE SENSOR

A voltage sensor is a sensor used to calculate and monitor the amount of voltage on an object. The tension sensor can determine alternating current or DC voltage levels. The input of this sensor is tension, but the output is a switch, an analog voltage signal, a current signal, or an acoustic signal.

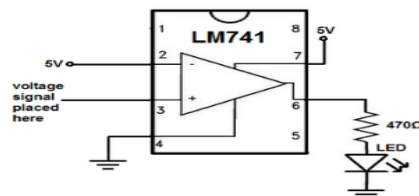


Fig No: 5 LM741 IC

## 4. LCD Display

The models described here are due to their affordability and their great potential to be used most often. Based on the HD44780 microcontroller (Hitachi), the message can be displayed on two lines, each with 16 characters. It indicates all alphabets, Greek letters, symbols, mathematical symbols, and more.

## 5. RELAY

Relays can be considered an electrical amplifier format because they can control output groups with better performance than input groups.

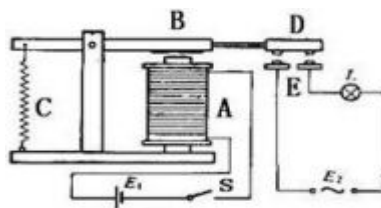


FIG: 6 DIAGRAM FOR RELAY

## VII. RESULT

The results of Phase 1 of software development for vehicle security and optimization systems have been successfully completed. This phase implemented the integration of pulse width modulation (PWM) for automatic braking systems. This allows for dynamic and actual adjustment of braking forces based on obstacle detection. The software processes entries from artificial neural network (ANN) algorithms, allowing you to accurately identify a variety of obstacles, such as pedestrians, animals, vehicles, and bicycles. The obstacle recognition system was integrated into ultrasound sensors that scan the vehicle's periphery and provide a comprehensive sense of situation. If a recognized failure occurs, the system triggers the absorption of the image and sends a warning via e-mail to certified staff via SMTP protocol.

Additionally, the software successfully integrates renewable power technology, allowing kinetic energy to be converted into electrical energy during braking events. This energy recovery mechanism now works and improves the fabric across the vehicle. Basic components of the system have been established, including adaptive braking, real-time monitoring, and energy recovery, providing the foundation for future improvements in safety, performance and sustainability.

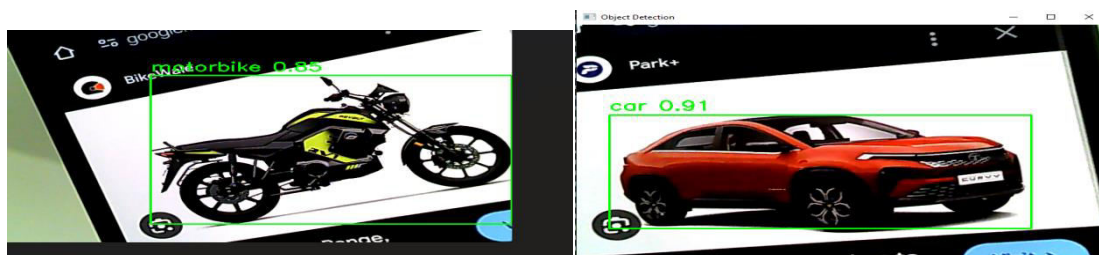


Fig No: 7 Bike Detection and Car Detection

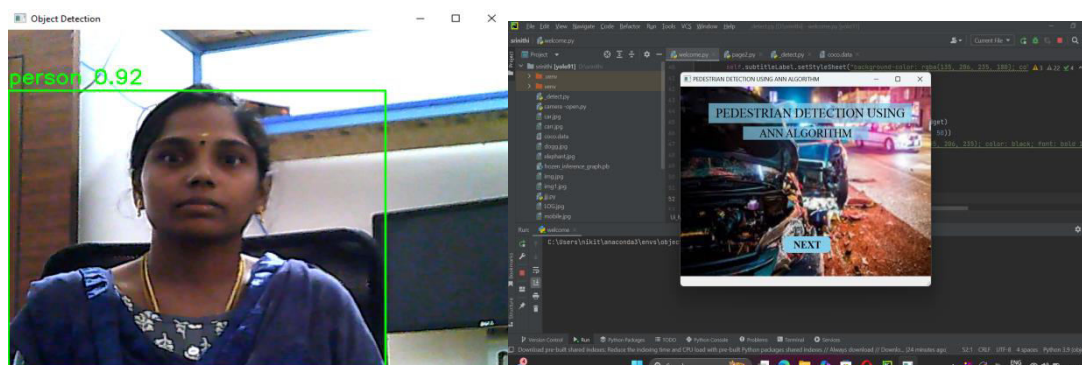


Fig No: 8 Person Detection and Welcome Page

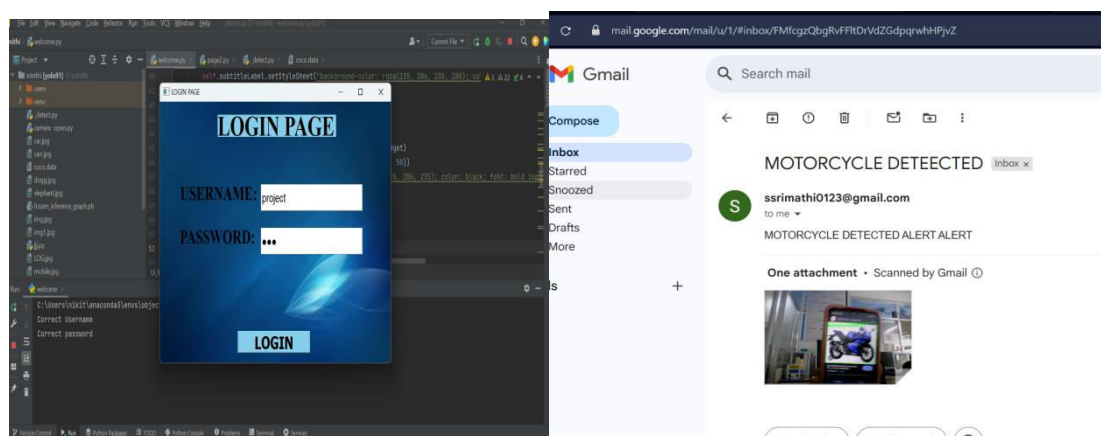
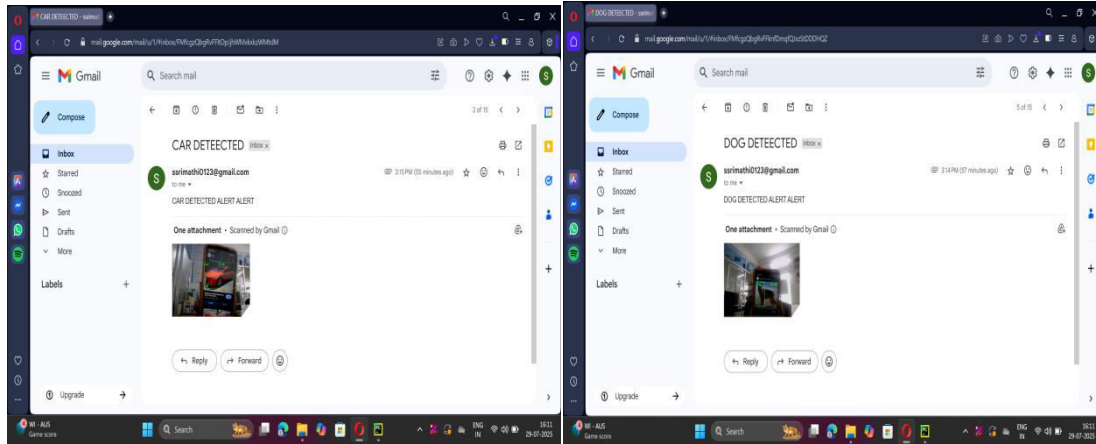
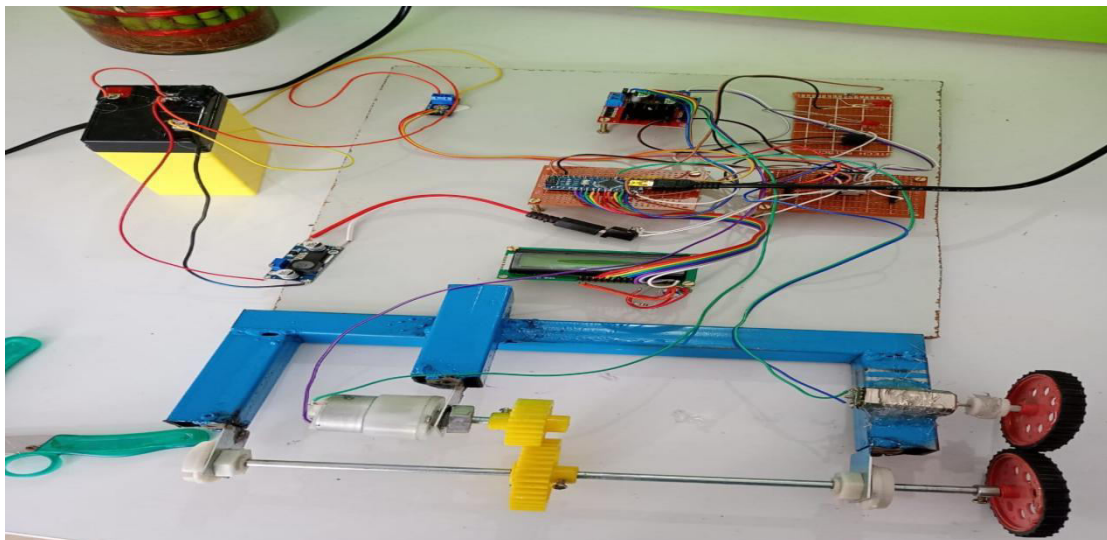


Fig No: 9 Login Page and Motorcycle detected-mail sent





**Fig No: 10 Car detected-mail sent and Dog detected-mail sent**



**Fig no: 11 Hardware Kit setup**

## **VIII. CONCLUSION**

In conclusion, the integration of cutting-edge technologies within modern vehicular systems offers a significant leap forward in enhancing both safety and efficiency. The combination of adaptive braking using PWM, obstacle detection powered by ANN, ultrasonic sensors for real-time situational awareness, and regenerative energy recovery creates a highly effective and sustainable framework for accident prevention and vehicle optimization. This system not only ensures timely response to potential hazards but also improves overall vehicle efficiency by harnessing energy during braking. With these innovations working in harmony, the approach promises to contribute to safer roads, reduced environmental impact, and a more intelligent driving experience, paving the way for the future of smart transportation.

## **REFERENCES**

- [1] I.S. Gladushevsky, S.S. Evtyukov. 2020 Improvement of the research methodology of vehicle deceleration during operation of summer tires with different tread heights World of transport and technological machines 1 (68). P. 24.
- [2] I.S. Gladushevsky, S.S. Evtyukov. 2020 Identification of the factors most significantly influencing the assessment of the deceleration of vehicles of category M1 Information technology and innovation in transport (VI International

Scientific and Practical Conference) ed. A.N. Novikov. 2020 Oryol State University named after I.S. Turgeneva (Oryol).

[3] I.S. Gladushevsky, S.S. Evtyukov. 2021 Methodology for calculating the braking distance on a dry asphalt surface when driving on studded tires Bulletin of Civil Engineers 2 (73). P. 142.

[4] A. Ivanov, S. Shadrin, N. Popov, V. Gaevskiy, S. Kristalnyi, "Virtual and physical testing of advanced driver assistance systems with soft targets", 2022 International Conference on Engineering and Telecommunication, EnT 2019 9030527.

[5] A. M. Ivanov, S. S. Shadrin, S. R. Kristalnyi, N. V. Popov. 2021 IOP Conference Series: Materials Science and Engineering 4-12.

[6] Redmon, J., Divvala, S., Girshick, R., & Farhadi, A. (2021). You only look once: Unified, real-time object detection. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (pp. 779-788).

[7] Ren S Q, He K M, Girshick R, et al. Faster R-CNN: towards real-time object detection with region proposal networks[J]. IEEE Transactions on Pattern Analysis and Machine Intelligence, 2020, 39(6): 1137-1149.

[8] Pavan Kalyan Pandranki (2023). Design Analysis of Regenerative Braking System. International Journal for Multidisciplinary Research (IJFMR), 05(04).

[9] Siva Maran Venkatesan (2022). Regenerative braking power system. Manufacturing Technology Today, Vol. 20(11-12).

[10] Hamada, A.T. and Orhan, M.F., (2022). An overview of regenerative braking systems. Journal of Energy Storage, 52, p.105033. [11] Yadav, D., Kumar, R., Kulshrestha, U., Jain, A. and Rani, S., 2022. Enhancement of fuel efficiency in heavy duty vehicles through integrated module of TEG, piezoelectric and regenerative braking solutions. Materials Today: Proceedings, 63, pp.1-





INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  [ijirset@gmail.com](mailto:ijirset@gmail.com)



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details