Smart Speed Breaker

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Abstract

The Smart Speed Breaker project is an innovative approach to addressing the problem of speeding on roads. The project utilized a combination of hardware and software components, including a Raspberry Pi camera, a sound sensor, and a servo motor, to detect over-speeding vehicles and raise the speed breaker in real-time. The system was able to accurately detect vehicles and measure their speed, while the servo motor was able to smoothly and reliably raise and lower the speed breaker. Through the project, we gained valuable experience in working with various electronic components, programming languages, and software libraries, as well as problem-solving and troubleshooting skills. The project demonstrated the potential for technology to make our lives better and safer by addressing real-world problems such as road safety.

Keywords—*Raspberry Pi, python Idle, Image Processing, Audio Recon*

INTRODUCTION

The issue of road safety has become a significant concern in recent years due to the rising number of accidents caused by over-speeding. Despite efforts to enforce speed limits, many drivers continue to flout these rules, leading to a high incidence of accidents and fatalities on roads. This has led to an urgent need for innovative solutions to address the problem of over-speeding and improve road safety.

The Smart Speed Breaker project is an innovative approach to addressing the problem of speeding on roads. The project utilizes a combination of hardware and software components, including a Raspberry Pi camera, a sound sensor, and a servo motor, to detect over-speeding vehicles and raise the speed breaker in real-time. The system is able to accurately detect vehicles and measure their speed, while the servo motor is able to smoothly and reliably raise and lower the speed breaker. In this project report, we will provide a detailed description of the Smart Speed Breaker system, including the hardware and software components involved, the design and implementation of the system, and the testing and validation of the system's performance. We will also discuss the potential applications and future development of the system. Through the project, we gained valuable experience in working with various electronic components, programming languages, and software libraries, as well as problem-solving and troubleshooting skills. The project demonstrated the potential for technology to make our lives better and safer by addressing real-world problems such as road safety. The results of this project can contribute to ongoing efforts to improve road safety and reduce the incidence of accidents caused by over-speeding.

Literature Review

[1] The paper proposes a smart speed breaker system using image processing to control the speed of vehicles. The system consists of a camera and an image processing unit that detect the speed of the approaching vehicle and adjust the height of the speed breaker accordingly. The system effectively reduces the chances of accidents caused by speeding vehicles and outperforms the conventional speed breaker system. The authors have provided a detailed explanation of the system's design and implementation, which can be useful for researchers and practitioners interested in developing similar systems.

[2] The paper proposes an automatic intelligent speed breaker system that uses image processing techniques to detect the speed of approaching vehicles and adjust the height of the speed breaker accordingly. The proposed system aims to reduce the chances of accidents caused by speeding vehicles. The authors present the design and implementation of the system, which includes the selection of hardware components, image processing algorithms, and control logic. The experiments conducted to evaluate the

performance of the proposed system show that it effectively controls the speed of vehicles and has the potential to improve road safety.

[3] The paper proposes an intelligent speed breaker system for road safety that uses image processing. The system comprises a camera and an image processing unit that detect the speed of approaching vehicles and adjust the height of the speed breaker accordingly. The authors have presented the design and implementation of the proposed system and conducted experiments to evaluate its performance. The results show that the proposed system effectively controls the speed of vehicles and can improve road safety. The paper can be useful for researchers and practitioners interested in developing similar systems.

[4] The paper presents a real-time automatic number plate recognition system for vehicle tracking using image processing. The system can recognize number plates of moving vehicles in real-time and track their movement. The proposed system uses image processing algorithms and machine learning techniques to recognize the number plates. The authors have conducted experiments to evaluate the performance of the system under different lighting and weather conditions. The proposed system has the potential to improve traffic management and can be useful for law enforcement agencies.

[5] The paper provides an overview of sound-based classification of vehicles. The authors discuss the various techniques used for vehicle classification based on their sound signatures, such as the Fourier transform, wavelet transform, and machine learning algorithms. The paper presents the advantages and limitations of each technique and highlights their applications in real-world scenarios. The overview can be useful for researchers and practitioners interested in developing sound-based vehicle classification systems.

Raspberry Pi

Fig.5 Raspberry Pi

The Raspberry Pi 4B is a small single-board computer developed by the Raspberry Pi Foundation. It is the latest addition to the Raspberry Pi family and was released in June 2019. Some of its key features include:

The Raspberry Pi 4B is a powerful and versatile computer that can be used for a variety of projects, including media centers, game consoles, servers, and IoT devices. It runs a variety of operating systems, including Linux distributions like Raspbian and Ubuntu, as well as specialized operating systems like RetroPie for gaming.

USB Cable

Fig.6 USB Cable

A USB-A to USB-C cable is a type of USB cable that has a USB-A connector on one end and a USB-C connector on the other. The USB-A connector is the standard rectangular connector that is commonly found on desktop computers, laptops, and USB chargers. The USB-C connector, on the other hand, is a newer and more versatile connector that can be found on many modern devices such as smartphones, tablets, laptops, and even some cameras. This can be useful for charging your device, transferring data between your device and your computer, or connecting your device to other USB-A peripherals such as printers, external hard drives, or keyboards. It's important to note that not all USB-A to USB-C cables are created equal. Some cables may not support fast charging or high-speed data transfer, and others may not be able to handle the power requirements of certain devices. When purchasing a USB-A to USB-C cable, it's important to choose one that is compatible with your device and meets your needs in terms of length, durability, and data transfer speeds.

Servo Motor

Fig.7 Servo Motor

A servo motor is a type of motor commonly used in robotics and other electromechanical applications. It is a rotary actuator that allows for precise control of angular position, velocity, and acceleration. The basic design of a servo motor consists of a motor, a position sensor (usually a potentiometer), and a control circuit. Servo motors are available in a variety of sizes and torque ratings, and can be used for a wide range of applications, from small hobby projects to industrial automation. Some common uses for servo motors include robotics, RC vehicles, camera gimbals, and industrial machinery. One advantage of servo motors is their ability to hold a position even when under external load. They are also able to move quickly and precisely to different positions, making them well-suited for applications that require precise control of movement.

Pi Camera

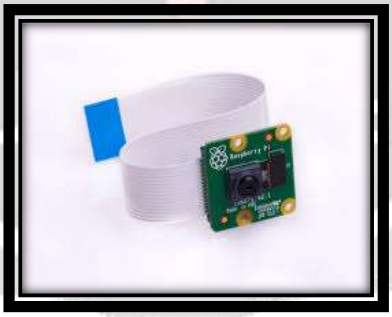

Fig.8 Pi Camera

A Pi camera, short for Raspberry Pi camera, is a camera module designed specifically for use with the Raspberry Pi single-board computer. The Pi camera module connects to the Raspberry Pi via a ribbon cable and provides a high-quality camera system that is easy to use and highly versatile.There are several different versions of the Pi camera available, including the original 5-megapixel camera, the 8-megapixel camera, and the high-quality 12.3-megapixel camera. The cameras offer a wide range of features and capabilities, including still image and video capture, low-light performance, and adjustable focus.

Pi cameras can be used for a variety of applications, including security monitoring, wildlife observation, time-lapse photography, and video streaming. They are also used in robotics projects and other applications that require image or video capture. One advantage of using a Pi camera with a Raspberry Pi is that it allows for easy integration of image and video capture into your projects. The Raspberry Pi provides a powerful platform for

image processing and analysis, and the Pi camera module provides a convenient and affordable way to capture high-quality images and video for use in your projects.

- Fully Compatible with Both the Model A and Model B Raspberry Pi
- 5MP Omnivision 5647 Camera Module
- Still Picture Resolution: 2592 x 1944
- Video: Supports 1080p @ 30fps, 720p @ 60fps and 640x480p 60/90 Recording
- 15-pin MIPI Camera Serial Interface - Plugs Directly into the Raspberry Pi Board
- Size: 20 x 25 x 9mm

Sound Sensor

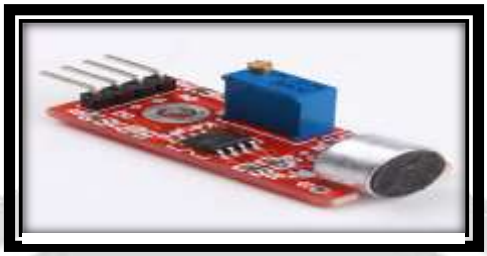

Fig.9 Sound sensor

A sound sensor, also known as a sound detector or sound level sensor, is an electronic device that detects sound waves and converts them into an electrical signal. Sound sensors can be used in a wide range of applications, from detecting noise pollution in urban environments to monitoring sound levels in industrial and manufacturing settings.

Sound sensors can be used to measure the intensity or frequency of sound waves, and can be used to trigger alarms or other actions based on the sound level. They are commonly used in noise monitoring systems, smart home automation systems, and in industrial applications to monitor noise levels and ensure compliance with regulatory standards.

Methodology

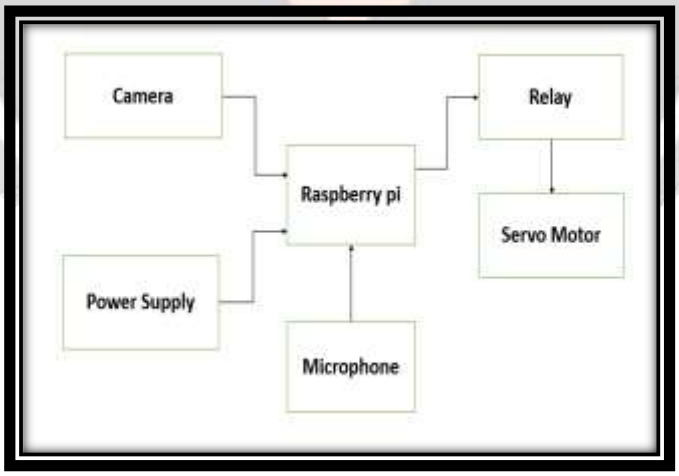

Fig.10 Block Diagram

The block diagram shown in fig 3.2 explains the design methodology that is the flow or plan of working of the project. Here the raspberry pi is the main hardware processor. The camera, microphone and servo motor are integrated with the Raspberry pi. The image processing is used to detect the speed of the vehicle and the microphone is used to intake and measure the sound. Either if the speed or the sound is high then the speed breaker will elevate. So that the driver will reduce the speed of the vehicle in the speed restricted area, where each area has its own speed limit and the sound limit.

Vehicle Speed Detection

The flow chart of the vehicle speed detection is fig 1. The methodology of vehicle speed detection using image processing involves several steps:

The first step is to capture images of the approaching vehicle using cameras installed near the speed breaker. These images are typically captured at regular intervals, such as once per second.

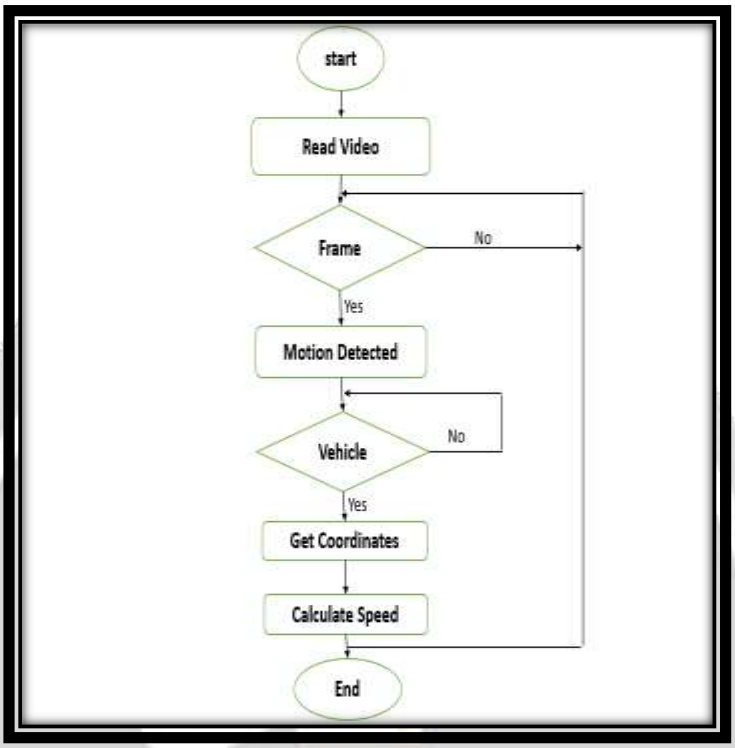

Fig.11 Methodology of Vehicle Speed Detection

Traffic monitoring systems use image processing techniques to capture images of vehicles and monitor their movement on roads. The first step in this process is to capture images using cameras that are strategically placed on the roads. The images captured by the cameras are then pre-processed to remove any noise and enhance their quality. The pre-processing stage may involve techniques such as image filtering, contrast enhancement, and colour correction.

Once the images have been pre-processed, the next step is to detect the presence of vehicles in the captured images. This can be achieved using techniques such as object detection or background subtraction. Object detection involves using machine learning algorithms to identify vehicles in the images based on their features, such as shape and size. Background subtraction involves comparing each frame of the video to a reference frame and detecting any differences that may indicate the presence of a vehicle. Once a vehicle has been detected, its location in the image needs to be identified. This is achieved using techniques such as bounding box detection, which involves drawing a box around the vehicle in the image. After the location of the vehicle has been identified, it needs to be tracked across multiple frames to calculate its speed. This is achieved using techniques such as optical flow or Kalman filtering. Optical flow involves tracking the movement of pixels in the image between frames, while Kalman filtering involves using a mathematical model to predict the position of the vehicle in each frame.

After tracking the vehicle across multiple frames, its speed can be calculated using the change in its position over time. The speed can be calculated in units such as kilometres per hour (km/h). The information on the speed of the vehicles can be used to detect traffic congestion, accidents, or violations of speed limits. The data can also be used to optimize traffic flow and improve road safety. In summary, the use of image processing techniques is essential for traffic monitoring systems to accurately detect and track vehicles on roads.

Smart Speed Breaker Elevation

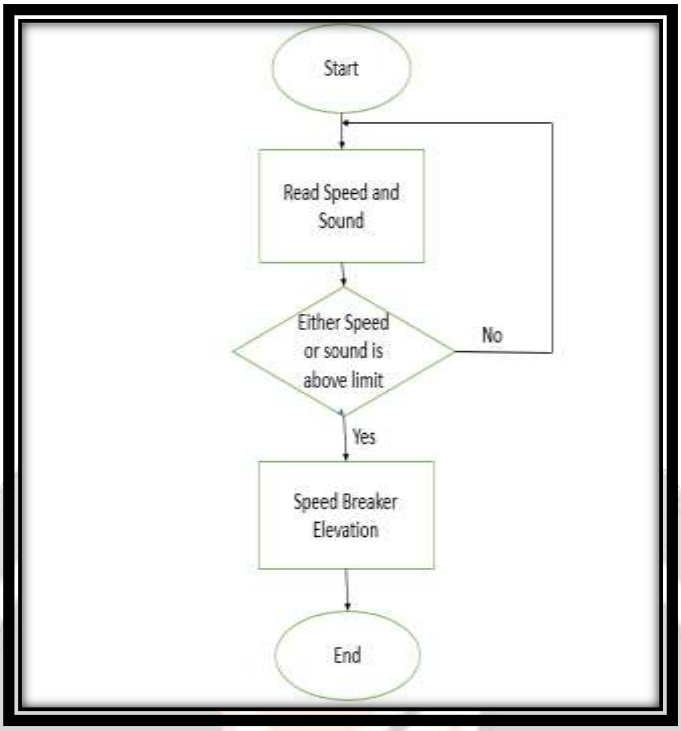

Fig.12 Methodology Breaker Elevation

The flowchart of the smart Speed Breaker Elevation is Fig 3.3.2. The methodology of a smart speed breaker elevation taking speed and sound into consideration involves several steps: The first step is to detect the speed of the approaching vehicle using sensors such as cameras. The speed detection system should be accurate and reliable to ensure that the speed of the vehicle is detected correctly.

The next step is to measure the sound generated by the vehicle as it passes over the speed breaker. This can be achieved using sound detection devices. The sound measurement system should be sensitive enough to detect the sound generated by the vehicle passing before the speed breaker. The speed and sound measurements should be processed in real-time to adjust the the speed breaker quickly and accurately. The control system should be designed to respond to changes in vehicle speed and sound levels quickly to ensure that the speed breaker is always adjusted to the correct level.

Result

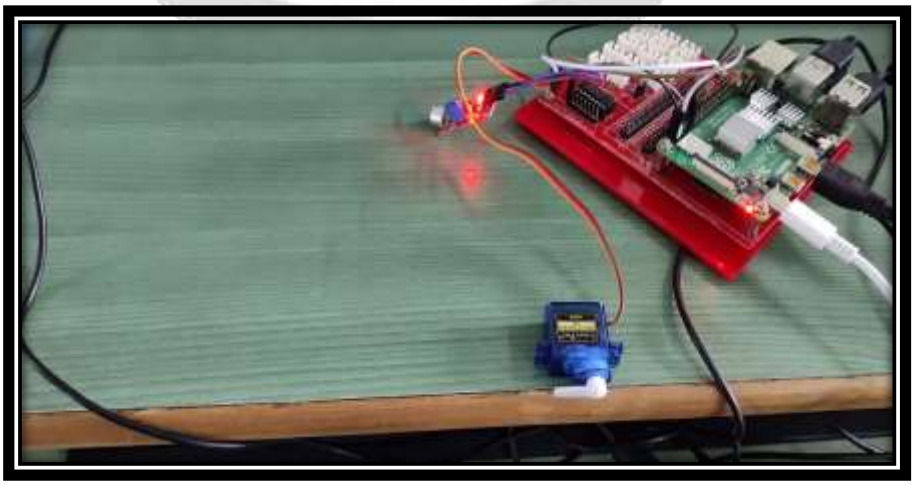

Fig.1 Servo motor alignment when the sound is less

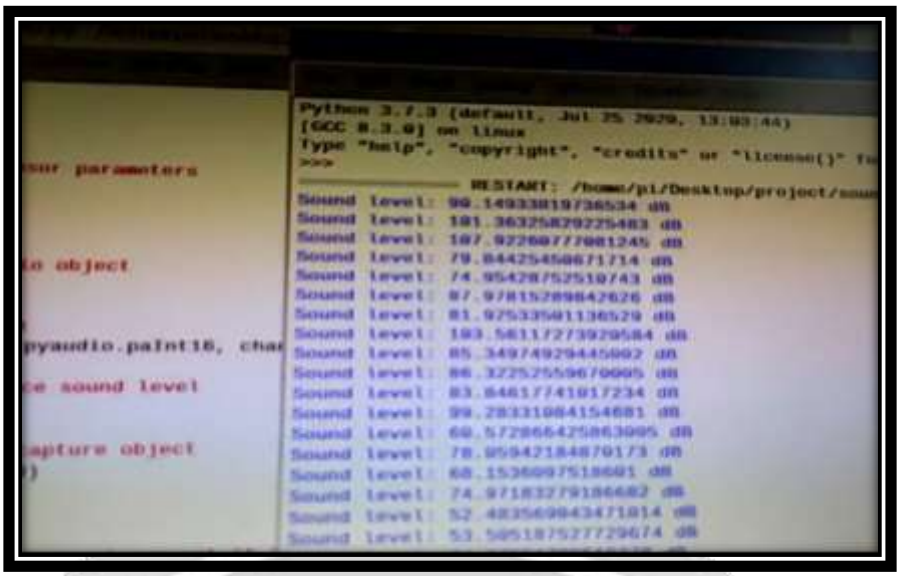

Fig.2 Sound sensor value greater than the limit

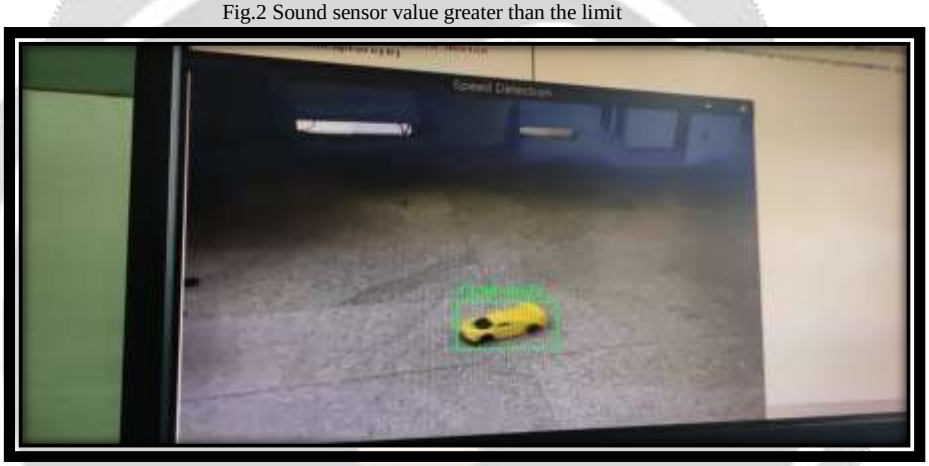

Fig.3 Speed detection

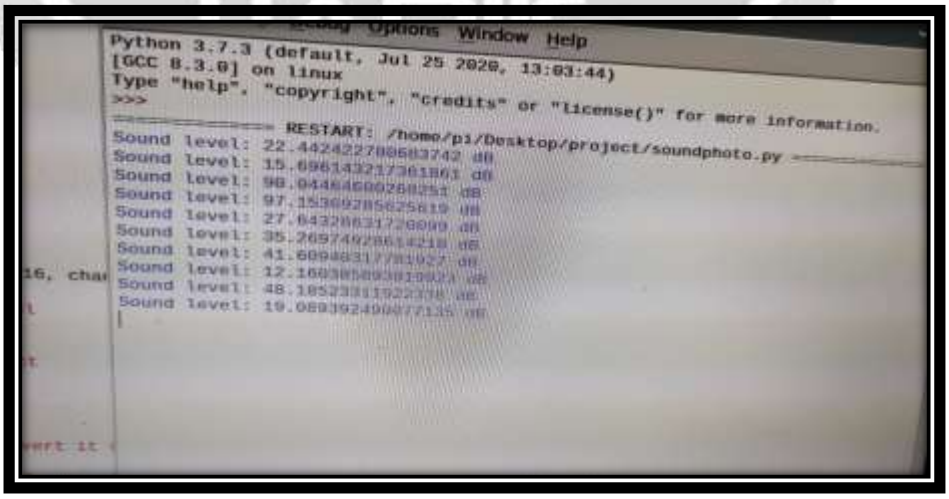

Fig.4 Sound sensor value when less than 100

Summary

The Smart Speed Breaker mainly Requires Raspberry pi, camera, sound sensor and servo motor. It mainly involves Speed Detection, Sound detection and the elevation of the speed breaker. The methodology of vehicle speed detection using image processing involves capturing images, pre-processing them, detecting and tracking vehicles, calculating their speed, adjusting the speed breaker, and analysing the data collected. By using these techniques, smart speed breakers can effectively regulate and monitor vehicle speed, helping to prevent accidents and promote safer roadways. The methodology of a smart speed breaker elevation taking speed and sound into consideration involves detecting the speed and measuring the sound generated by the approaching vehicle, adjusting the shape of the speed breaker accordingly, and processing the data in real-time to ensure that the speed breaker is always adjusted to the correct shape. By using these techniques, a smart speed breaker system can effectively regulate and monitor vehicle speed while minimizing noise levels, helping to prevent accidents and promote safer roadways.

CONCLUSION

In conclusion, the Smart Speed Breaker project is an innovative approach to addressing the problem of speeding on roads. By utilizing a combination of image processing, audio recognition, and servo motor control, the system can detect over-speeding vehicles and raise the speed breaker in real-time, thereby forcing drivers to slow down. The project has the potential to significantly reduce accidents caused by over-speeding and make roads safer for everyone.

The project also highlights the versatility and power of the Raspberry Pi platform for building complex systems that combine hardware and software components. Through this project, we have gained valuable experience in working with various electronic components, programming languages, and software libraries, as well as problem-solving and troubleshooting skills..

FUTURE SCOPE

In the future, the Smart Speed Breaker project can be further improved by incorporating machine learning algorithms to better detect over-speeding vehicles and minimize false positives. The system can also be integrated with traffic lights and other traffic management systems to optimize traffic flow and enhance road safety. Overall, the Smart Speed Breaker project is an exciting and promising example of the potential for technology to make our lives better and safer.

- Explore the use of machine learning algorithms to improve the accuracy of the vehicle detection and speed measurement.
- Implement a real-time traffic monitoring and analysis system to detect traffic congestion and adjust the speed limit dynamically.
- Develop a low-cost, scalable version of the system that can be deployed in low-income areas and rural roads to improve road safety.
- Explore the possibility of using the system as a data collection tool to gather information about traffic patterns, speed violations, and road conditions.
- Integrate the system with a centralized traffic management system to enable remote monitoring and control of the speed breakers.
- Develop a mechanism to monitor the health of the system components and alert maintenance personnel in case of any issues.
- Investigate the use of renewable energy sources, such as solar panels or wind turbines, to power the system and reduce its environmental impact.
- Expand the project to include other safety features, such as pedestrian detection and automatic emergency braking, to create a comprehensive road safety system.

REFERENCES

[1] S. S. Gawande and S. M. Kazi, "Intelligent speed breaker system using image processing," 2017 International Conference on Nascent Technologies in Engineering (ICNTE), Coimbatore, India, 2017, pp. 1-5. doi: 10.1109/ICNTE.2017.8294583

[2] R. S. Suresh Kumar and R. C. Thangavelu, "Automatic image processing based intelligent speed breaker for reducing accidents," 2014 International Conference on Control, Instrumentation, Communication and Computational Technologies (ICCICCT), Kanyakumari, India, 2014, pp. 233-238. doi: 10.1109/ICCICCT.2014.6993038

[3] H. K. Singh, A. K. Kori, and K. K. Choudhary, "Intelligent speed breaker for road safety using image processing," 2016 IEEE Uttar Pradesh Section International Conference on Electrical, Computer and Electronics Engineering (UPCON), Varanasi, India, 2016, pp. 307-312. doi: 10.1109/UPCON.2016.7953519

[4] S. S. Patel, P. B. Patel, and N. K. Patel, "Real-time automatic number plate recognition system for vehicle tracking using image processing," 2017 International Conference on Inventive Computing and Informatics (ICICI), Coimbatore, India, 2017, pp. 414-419. doi: 10.1109/ICICI.2017.8363287

[5] D. B. Joshi, R. V. Dubey, and V. K. Patle, "An overview on sound based classification of vehicles," 2017 International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India, 2017, pp. 1066-1070. doi: 10.1109/ICCONS.2017.8250754

[6] B. T. Upadhyay, R. K. Singh, and N. Kumar, "An intelligent speed control system using image processing," 2016 IEEE 1st International Conference on Power Electronics, Intelligent Control and Energy Systems (ICPEICES), Delhi, India, 2016, pp. 1-5. doi: 10.1109/ICPEICES.2016.7853313

[7] S. S. Gawande and S. M. Kazi, "Smart speed breaker system for speed control of vehicle," 2016 IEEE 7th Power India International Conference (PIICON), Bikaner, India, 2016, pp. 1-5. doi: 10.1109/POWERI.2016.8077338

[8] V. Singh, R. Singh, and P. Singh, "Smart speed breaker with intelligent control and warning system," 2016 IEEE 1st International Conference on Power Electronics, Intelligent Control and Energy Systems (ICPEICES), Delhi, India, 2016, pp. 1-6. doi: 10.1109/ICPEICES.2016.7853301

[9] P. R. Devi, S. M. Bagewadi, and S. M. Sakhare, "Smart speed breaker for vehicle speed control and power generation," 2017 IEEE International Conference on Computational Intelligence and Computing Research (ICCIC), Chennai, India, 2017, pp. 1-5. doi: 10.1109/ICCIC.2017.8280609

[10] A. Kumar, A. Kumar, and P. Kumar, "A smart speed breaker for speed control and safety of vehicles," 2017 2nd International Conference on Computing and Communications Technologies (ICCCT), Chennai, India, 2017, pp. 158-161. doi: 10.1109/ICCCT2.2017.8284302

[11] S. B. Wagh, S. S. Bagal, and S. B. Patil, "Smart speed breaker system with automatic number plate recognition," 2018 3rd International Conference on Communication and Electronics Systems (ICCES), Coimbatore, India, 2018, pp. 1465-1468. doi: 10.1109/ICCES.2018.8723897

[12] A. R. Jadhav, V. S. Patil, and S. S. Gawande, "Smart speed breaker with accident detection and reporting system," 2019 6th International Conference on Signal Processing and Integrated Networks (SPIN), Noida, India, 2019, pp. 219-223. doi: 10.1109/SPIN.2019.8711685

[13] D. P. Sharma, P. Verma, and V. K. Sharma, "Intelligent speed breaker for vehicle speed control," 2017 2nd IEEE Uttar Pradesh Section International Conference on Electrical, Computer and Electronics Engineering (UPCON), Varanasi, India, 2017, pp. 520-524. doi: 10.1109/UPCON.2017.8252595