# SMART SPEED BREAKER AND ZEBRA CROSSING

**A MINI-PROJECT REPORT**

***Submitted by***


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**An Autonomous Institute**

**CHENNAI**

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## BONAFIDE CERTIFICATE

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**INTERNAL EXAMINER** **EXTERNAL EXAMINER**

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# TABLE OF CONTENTS

**CHAPTER NO. PAGE**

**TITLE**

# LIST OF FIGURES

# LIST OF MATERIALS

| TABLE NO. | TITLE | QUANTITY |
|---|---|---|
| 1 | ULTRASONIC SENSOR | 1 |
| 2 | SERVO MOTOR | 1 |
| 3 | ARDUINO UNO | 1 |
| 4 | SOUND SENSOR | 1 |
| 5 | JUMPER WIRE | REQUIRED AMOUNT |
| 6 | NORMAL WIRES | REQUIRED AMOUNT |
| 7 | LED LIGHTS | 12 |
| 8 | LCD DISPLAY | 1 |
| 9 | USB CABLE | 1 |
| 10 | POWER SUPPLY | 1 |
| | | |

# LIST OF ABBREVIATION

| ABBREVIATION | ACRONYM |
|---|---|
| **IR** | Infrared |
| **RF** | Radiofrequency |
| **UNO** | Arduino UNO (Microcontroller) |

# ABSTRACT

This project introduces a novel approach to road safety by integrating intelligent technologies into speed breakers and zebra crossings. The Smart Breaker system utilizes speed sensing technology to dynamically adjust the speed breaker based on the approaching vehicle's speed. When vehicles exceed a predefined speed threshold, the speed breaker automatically elevates to effectively slow down the traffic. Furthermore, the system incorporates an advanced zebra crossing with embedded LED lights that illuminate when pedestrians stand on the crossing, enhancing their visibility to approaching vehicles. This feature significantly improves pedestrian safety, especially during low light conditions or high traffic volumes. The Smart Breaker system is designed to promote responsible driving behaviour by providing real-time feedback to motorists and encouraging compliance with speed limits. Additionally, it prioritizes pedestrian safety by ensuring that they are easily discernible to drivers, thereby reducing the risk of accidents at zebra crossings. Key features of the system include speed sensing technology, variable height adjustment mechanisms, LED-equipped zebra crossings, and integration with pedestrian detection systems. These elements work synergistically to create a safer and more efficient road environment for both motorists and pedestrians.

# CHAPTER 1

# INTRODUCTION

## 1.1 INTRODUCTION

In today's fast-paced world, road safety remains a critical concern as traffic congestion and pedestrian-related accidents continue to pose significant challenges in urban environments. To address these issues, innovative solutions are imperative, and one promising approach is the integration of smart technologies into road infrastructure. The Smart Breaker system represents a groundbreaking advancement in this regard, combining dynamic speed management with enhanced pedestrian safety features.

At the heart of the Smart Breaker system lies its ability to adapt in real-time to changing traffic conditions. Through the utilization of speed sensors embedded in the road surface, the system continuously monitors the speed of approaching vehicles. When vehicles exceed a predefined speed threshold, the Smart Breaker's height adjustment mechanism is activated, effectively slowing down traffic and reducing the risk of accidents caused by speeding.

At the heart of the Smart Breaker system lies its ability to adapt in real-time to changing traffic conditions. Through the utilization of speed sensors embedded in the road surface, the system continuously monitors the speed of approaching vehicles. When vehicles exceed a predefined speed threshold, the Smart Breaker's height adjustment mechanism is activated, effectively slowing down traffic and reducing the risk of accidents caused by speeding.

In summary, the Smart Breaker system represents a comprehensive solution to the complex challenges of urban road safety. As cities continue to evolve and grow, investments in smart infrastructure like the Smart Breaker will be essential in building safer and more sustainable transportation networks for the future.

## 1.2 SCOPE OF THE WORK

The scope of work for implementing the Smart Breaker system encompasses several key phases, including design, installation, integration, and testing. Initially, thorough planning and design are essential to ensure that the system meets the specific requirements and challenges of the targeted road environment. This involves conducting site surveys, selecting appropriate components, and developing detailed technical specifications.

Following the design phase, the installation process involves the physical implementation of the speed sensors, height adjustment mechanism, LED lights, and other system components. Careful attention must be paid to factors such as road surface conditions, traffic patterns, and pedestrian behaviour to ensure optimal placement and functionality.

## 1.3 PROBLEM STATEMENT

The existing infrastructure for road safety, particularly speed breakers and zebra crossings, faces significant challenges in effectively managing vehicle speeds and ensuring pedestrian safety. Traditional speed breakers lack adaptability, often causing discomfort to drivers and inadequate traffic flow regulation, while conventional zebra crossings may fail to provide sufficient visibility to pedestrians, leading to increased risks of accidents, especially in low light or high traffic conditions. Addressing these challenges requires the development of a comprehensive system that integrates smart technologies to create a more responsive and efficient road environment, ultimately reducing accidents and enhancing overall safety for both motorists and pedestrians.

## 1.4 AIM AND OBJECTIVES OF THE PROJECT

The aim of this project is to design and implement a Smart Breaker system that integrates advanced technologies to effectively manage vehicle speeds and enhance pedestrian safety at zebra crossings. The objectives include developing a dynamic speed management mechanism for the speed breaker, integrating LED lighting for improved pedestrian visibility, implementing a responsive control system, and conducting comprehensive testing to ensure the system's effectiveness in reducing accidents and promoting safer road interactions between vehicles and pedestrians

# CHAPTER 2

## LITERATURE SURVEY

In [1] paper explains about poor visibility conditions during foggy winters or nighttime driving as leading causes of road accidents in India. The primary contributor to such accidents is often attributed to drivers' unintentional oversight of speed breakers, either due to their inability to detect them promptly or due to vehicles traveling at excessive speeds. In response to this pressing issue, this paper proposes the concept of an intelligent speed breaker system aimed at preventing such accidents

[2] This paper introduces a novel approach to enhancing public safety through the implementation of a flexible speed breaker system. The primary objective of this project is to mitigate road accidents by regulating vehicle speeds, particularly when vehicles surpass their speed limits. This innovative technology employs an Arduino UNO microcontroller interfaced with a servo motor and an IR (Infrared Ray) sensor to monitor vehicle speeds. The key feature of this system is its adaptability, with the speed breaker dynamically adjusting its size based on vehicle speed.

[3] This paper explains the development of an innovative speedbreaker system aimed at improving public safety on roadways. In alignment with this objective, various studies have emphasized the pressing need for proactive measures to mitigate road accidents, particularly those caused by speeding vehicles and inadequate road infrastructure. Research indicates that traditional static speed breakers often fail to effectively regulate vehicle speeds, leading to a heightened risk of accidents. Furthermore, studies have underscored the importance of flexible road infrastructure in adapting to dynamic traffic conditions and enhancing overall road safety.

[4] This paper talks about the role of adaptable road infrastructure in promoting safer road environments. By incorporating technologies like servo motors, IR sensors, and microcontrollers, the proposed flexible speed breaker system represents a proactive step towards enhancing road safety. Its ability to dynamically adjust in response to changing traffic conditions not only addresses the limitations of traditional static speed breakers but also aligns with the broader goal of creating more responsive and efficient transportation networks and innovative solutions.

[5] This paper emphasizes the pressing need for more adaptive and responsive solutions to address road safety concerns. Traditional static speed breakers have been found to be inadequate in effectively regulating vehicle speeds and can lead to discomfort for drivers and congestion on roads. In response, recent research has focused on developing dynamic speed breaker systems that utilize advanced technologies such as hydraulic actuators and pneumatic systems to adjust their height and position in real-time.

[6] Recent studies in the field of road safety have underscored the significance of innovative solutions to address the challenges posed by traditional static speed breakers. Static speed breakers, while serving as important traffic calming measures, often present limitations in adaptability and effectiveness. Research has shown that these conventional speed breakers can lead to discomfort for drivers and contribute to traffic congestion, particularly in urban areas with heavy traffic.

# CHAPTER 3

## SYSTEM SPECIFICATIONS

### 3.1 HARDWARE SPECIFICATIONS

| | | |
|---|---|---|
| Processor | : | 12th Generation Intel® Core™ i7 processor |
| Memory Size | : | 256 GB (Minimum) |
| HDD | : | 40 GB (Minimum) |
| BOARD | : | Arduino Uno |
| SENSOR | : | Ultrasonic sensor<br>IR sensor |
| LED Lights | : | Required amount |
| Jumper Wire | : | Required amount |
| LCD | : | 16*2 Board |

### 3.2 SOFTWARE SPECIFICATIONS

| | | |
|---|---|---|
| Operating System | : | WINDOWS 10 AND PLUS |
| Open-source Platform | : | Arduino IDE |
| Library | : | IRremote Library |

# CHAPTER 4

## MODULES DESCRIPTION

**Arduino Uno**

This serves as the central control unit for the project. It receives input from sensors, processes data, and controls the operation of the speed breaker system.

**IR Sensor Module**

The IR (Infrared) sensor module is used for detecting the speed of approaching vehicles.

**RF Module**

The RF (Radio Frequency) module enables wireless communication between the speed breaker system and vehicles. It is used to transmit warnings to drivers about the presence of the speed breaker in proximity.

**Servo Motor**

The servo motor is responsible for adjusting the height of the speed breaker based on the detected vehicle speed.

# CHAPTER 5

## SYSTEM DESIGN

### 5.1 FLOW CHAT

A flowchart is a graphical representation of a process, workflow, or algorithm. It uses standardized symbols and shapes to depict the various steps, decisions, and actions involved in completing a task or achieving a goal.

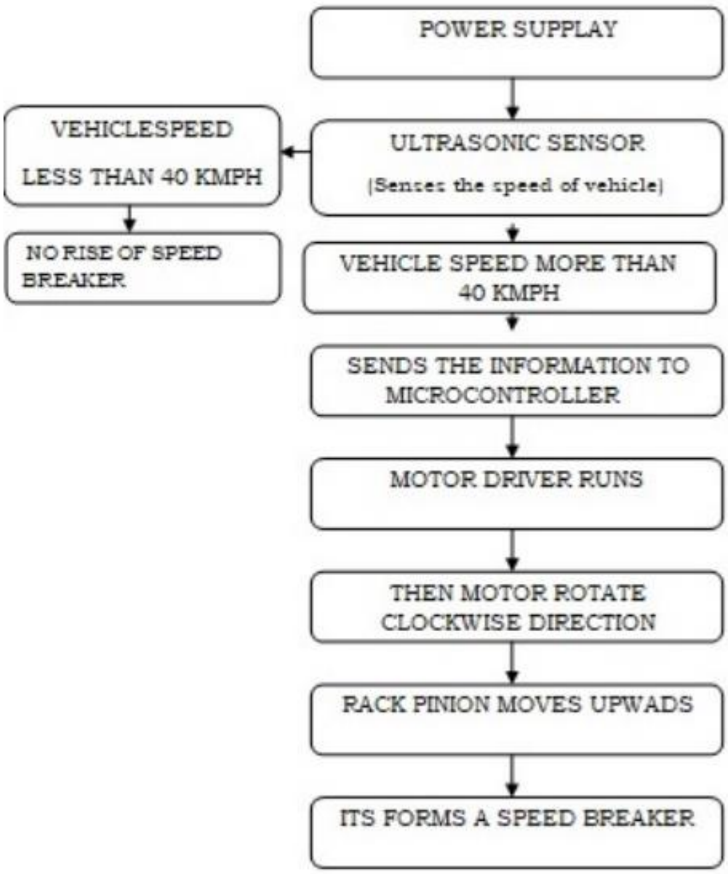


Figure 4.1 Flowchart

## 5.2 ARCHITECTURE DIAGRAM

An architecture diagram is a visual representation of the structure, components, and relationships within a system or application. It provides a high-level overview of how different parts of the system interact with each other and how data flows between them.

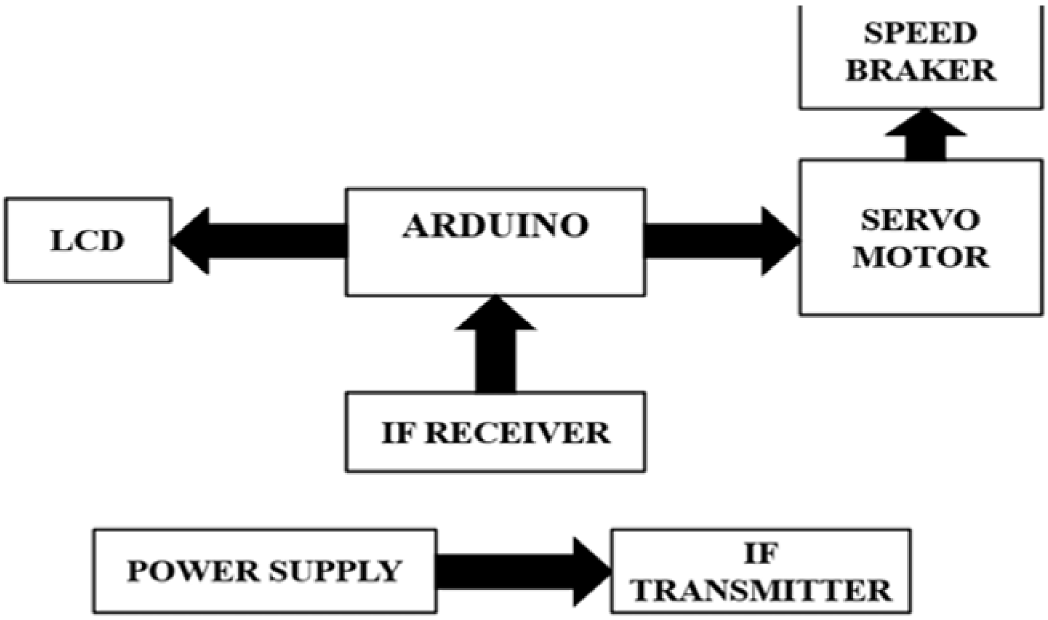


Figure 4.2 Architecture diagram

# CHAPTER 6

## CODING

### 1. ARDUINO IDE- C++

```
#include <LiquidCrystal_I2C.h>
#include <Servo.h>
const int trigPin = 32;
const int echoPin = 33;
const int echoPin1 = 35;
const int led1  = 23;
const int led2 = 18;
const int led3 = 19;
#include <WiFi.h>
#include "ThingSpeak.h"
const char* ssid = "joejoe";   // your network SSID (name)
const char* password = "joejoe123";
//define sound velocity in distanceCm/uS
#define SOUND_VELOCITY 0.034
#define CM_TO_INCH 0.393701
WiFiClient  client;
unsigned long myChannelNumber = 3;
const char * myWriteAPIKey = "906MHNTU7F9DV0SF";
long duration;
float distanceCm;
float distanceInch;
// set the LCD number of columns and rows
int lcdColumns = 16;
int lcdRows = 2;
```

```
Servo servo;

// set LCD address, number of columns and rows

// if you don't know your display address, run an I2C scanner sketch

LiquidCrystal_I2C lcd(0x27, lcdColumns, lcdRows);                         double
startTime = 0; // Initialize the start time

double endTime = 0;   // Initialize the end time

double timeTakenInSeconds = 0; // Difference between start and end time

float speedOfObject = 0;      // Holds the value distance divided by time taken

const double distance = 1;  // Distance between the two sensors in meters


int executed = 0;              // Flag to run the code in the loop only once. When set to 1, code
in the loop is not executed.

const int sensor1 = 13;        // First sensor is connected to pin 13

const int sensor2 = 27;        // Second sensor is connected to pin 27

void setup() {

  Serial.begin(9600);

  servo.attach(26);

  lcd.init();

   lcd.backlight();

   lcd.print("IOT enabled");

   lcd.setCursor(0,1);

   lcd.print("Speed Monitor");

   delay(3000);

   lcd.clear();

   WiFi.mode(WIFI_STA);

  ThingSpeak.begin(client);

  int count = 0;

 if((WiFi.status() != WL_CONNECTED)){

  Serial.print("Attempting to connect");
```

```
 lcd.print("Connecting");

 while(WiFi.status() != WL_CONNECTED && count<5){
   WiFi.begin(ssid, password);
   delay(5000);
   count ++;
 }
 lcd.clear();
 Serial.println("\nConnected.");
 lcd.print("Cloud Enabled");
 delay(3000);
 lcd.clear();
}
else {
 lcd.print("Cloud Disabled");
 delay(3000);
 lcd.clear();
}
 // turn on LCD backlight

 // Sets the pin modes of sensors
 pinMode(sensor1, INPUT);
 pinMode(sensor2, INPUT);
 servo.write(0);
 pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
 pinMode(echoPin, INPUT);
  pinMode(echoPin1, INPUT);
   pinMode(led1, OUTPUT); // Sets the trigPin as an Output
 pinMode(led2, OUTPUT);
```

```
  pinMode(led3, OUTPUT); // Sets the trigPin as an Output
 ThingSpeak.begin(client);
}
void loop() {
 digitalWrite(trigPin, LOW);
 delayMicroseconds(2);
 // Sets the trigPin on HIGH state for 10 micro seconds
 digitalWrite(trigPin, HIGH);
 delayMicroseconds(10);
 digitalWrite(trigPin, LOW);

 // Reads the echoPin, returns the sound wave travel time in microseconds
 duration = pulseIn(echoPin, HIGH);

 // Calculate the distance
 distanceCm = duration * SOUND_VELOCITY/2;

 // Convert to inches
 distanceInch = distanceCm * CM_TO_INCH;
 lcd.setCursor(0, 0);
 lcd.print("Speed= 0.00");
 lcd.setCursor(12,0);
 lcd.print("m/s");
 if(distanceCm > 10){
   digitalWrite(led3,HIGH);
    digitalWrite(led1,LOW);
   lcd.clear();
   lcd.setCursor(0, 0);
 lcd.print("Speed= 0.00");
```

```
 lcd.setCursor(12,0);

 lcd.print("m/s");

  servo.write(0);

 if (executed == 0) { // Flag is initialized to 0 to ensure that the loop runs only once

  if (digitalRead(sensor1) == LOW) { // If movement is detected by the first sensor

   if (startTime == 0) { // If startTime is 0 and no time has been logged yet

    startTime = millis(); // Assign Arduino time to startTime

   }

  }


  if (digitalRead(sensor2) == LOW) { // If movement is detected by the second sensor

   if (endTime == 0) {  // If endTime is 0 and no time has been logged yet

    endTime = millis();   // Assign Arduino time to endTime

   }

  }


  if ((startTime != 0) && (endTime != 0)) { // Now calculate the speed of the object if both times have been registered

   if (startTime < endTime) { // If the object moves from sensor1 to sensor2

    timeTakenInSeconds = (endTime - startTime) / 1000.0; // Convert milliseconds to seconds

    speedOfObject = distance / timeTakenInSeconds; // Calculate speed in meters per second

    // Print the values to the serial monitor

    Serial.print("Start Time: ");

    Serial.print(startTime);

    Serial.println(" milliseconds");

    Serial.print("End Time: ");

    Serial.print(endTime);

    Serial.println(" milliseconds");
```

```
        Serial.print("Speed of Object = ");
        Serial.print(speedOfObject);
        Serial.println(" m/s");
        Serial.println();
        lcd.setCursor(7,0);


        lcd.print(speedOfObject);
        executed = 1; // Set the value to 1 to stop the loop from running again
        if(speedOfObject>1){
         servo.write(180);
         digitalWrite(led3,LOW);
        digitalWrite(led1,HIGH);
        }
        ThingSpeak.setField(1, speedOfObject);
         int x = ThingSpeak.writeFields(myChannelNumber, myWriteAPIKey);
  if(x == 200){
    Serial.println("Channel update successful.");
  }
  else{
    Serial.println("Problem updating channel. HTTP error code " + String(x));
  }

        reset();
      } else { // If the object moves from sensor2 to sensor1

        timeTakenInSeconds = (startTime - endTime) / 1000.0; // The value of startTime is
greater than endTime
```

```
    speedOfObject = distance / timeTakenInSeconds; // Calculate speed in meters per
second
    // Print the values to the serial monitor
    Serial.print("Start Time: ");
    Serial.print(endTime);
    Serial.println(" milliseconds");
    Serial.print("End Time: ");
    Serial.print(startTime);
    Serial.println(" milliseconds");
    Serial.print("Speed of Object = ");
    Serial.print(speedOfObject);


    Serial.println(" m/s");
    Serial.println();
    lcd.setCursor(7,0);
    lcd.print(speedOfObject);


  if(speedOfObject>1){
     servo.write(180);
     digitalWrite(led3,LOW);
    digitalWrite(led1,HIGH);
    }


    executed = 1;
    ThingSpeak.setField(1, speedOfObject);
    int x = ThingSpeak.writeFields(myChannelNumber, myWriteAPIKey);
 if(x == 200){
   Serial.println("Channel update successful.");
 }
 else{
```

```
    Serial.println("Problem updating channel. HTTP error code " + String(x));
  }

        reset(); // A function to start the loop from running again
      }
    }
  }
 }
 else{
  digitalWrite(led3,LOW);
  digitalWrite(led1,HIGH);
  lcd.setCursor(0,1);

  lcd.print("People Crossing!");
  servo.write(180);
  delay(3000);
 }
}
void reset() {

  delay(3000); // Wait for 5 seconds
  executed = 0; // Reset the executed flag
  startTime = 0; // Reset start time
  endTime = 0; // Reset end time
  speedOfObject = 0; // Reset speed
  digitalWrite(led1,LOW);
  digitalWrite(led3,HIGH);
  lcd.clear();
  servo.write(0);
}
```

# CHAPTER 7

## SCREENSHOTS

### CONNECTION

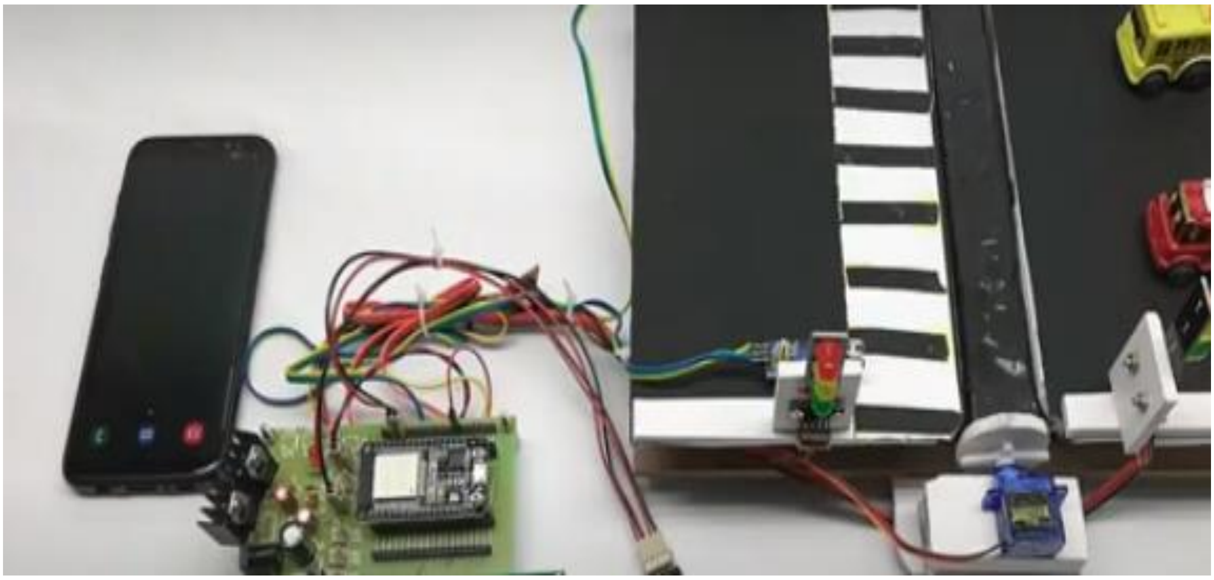

Figure 7.1 Connection Setup

# CHAPTER 8

## CONCLUSION AND FUTURE ENHANCEMENT

The smart speed breaker system presents a promising solution to address road safety concerns, particularly in mitigating accidents caused by speeding vehicles and inadequate visibility conditions. By leveraging advanced technologies such as IR sensors, RF modules, and servo motors, the system effectively detects speeding vehicles and adjusts the height of the speed breaker accordingly to regulate vehicle speeds. The integration of LED lights and wireless communication further enhances the system's effectiveness by providing timely warnings to drivers and improving visibility at night or in adverse weather conditions. Through the implementation of this system, significant strides can be made towards creating safer road environments and reducing the risk of accidents for both motorists and pedestrians.

In conclusion, the smart speed breaker system presents a significant advancement in road safety technology by effectively addressing the challenges posed by speeding vehicles and poor visibility conditions. While the current implementation demonstrates promising results in regulating vehicle speeds and enhancing driver awareness, further enhancements can be explored to maximize its effectiveness. These include integrating machine learning algorithms for predictive analysis, enhancing communication capabilities, adapting to environmental factors, implementing data analytics for informed decision-making, and integrating with existing smart city infrastructure. Through continuous innovation and collaboration, the smart speed breaker system has the potential to significantly reduce road accidents and contribute to the development of safer and smarter transportation networks.

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