CHENNAI INSTITUTE OF TECHNOLOGY

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ELECTRONICS AND COMMUNICATION DEPARTMENT

DRIVING ALERT SYSTEM

A Report on Core Course Project

ELECTRONICS AND COMMUNICATION DEPARTMENT

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Mission of the Institute:

IM1.To creates next generation leaders by effective teaching learning methodologiesand instill scientific spark in them to meet the global challenges.

IM2.To transform lives through deployment of emerging technology, novelty and sustainability.

IM3.To inculcate human values and ethical principles to cater the societal needs.

IM4.To contributes towards the research ecosystem by providing a suitable, effectiveplatform for interaction between industry, academia and R & D establishments.

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CERTIFICATE

This is to certify that the "**Core Course Project**" Submitted by **SARAVANAN A (Reg no: 210421106085), SARAN RAJ S (Reg no: 210421106084), SUJARITH J (Reg no: 210421106102), VASANTHA RUBAN N (Reg no: 210421106118)** is a work done by him and submitted during **2023-2024** academic year, in partial fulfilment of the requirements for the award of the degree of **BACHELOR OF ENGINEERING** in **DEPARTMENT OF ELECTRONICS AND COMMUNICATION**.

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ABSTRACT

In response to the critical need for enhanced driver attentiveness and public safety, this project presents an innovative driving alert system featuring an ultrasonic sensor embedded in the steering wheel and a voice recognition module, coupled with an external LED signaling mechanism. The integrated ultrasonic sensor continuously monitors the position of the driver's hands on the steering wheel, triggering a distinct beep sound in the event of hands-off detection, prompting the driver to regain control and ensure continuous vehicle operation. Moreover, the voice recognition module enables the driver to activate an exterior LED panel through voice commands, serving as a proactive visual signal to alert pedestrians and fellow motorists of potential dangers, thereby promoting a safer driving environment. This comprehensive system, by combining real-time driver alertness with public awareness measures, aims to significantly mitigate the risks associated with driver distraction and contribute to the overall improvement of road safety standards. This project proposes an advanced driving alert system, leveraging an integrated ultrasonic sensor within the steering wheel to monitor the driver's hand position. The system is designed to emit a distinctive beep sound when the sensor detects the driver's hands being removed from the steering wheel, effectively prompting immediate attention and corrective action. This feature aims to prevent potential accidents caused by driver inattentiveness or distraction. Furthermore, the system incorporates a voice recognition module, enabling the driver to activate an external LED panel through specific voice commands. This LED panel serves as an active visual alert to notify pedestrians and other drivers of the ongoing situation, especially in instances where the driver's attention might be compromised. By combining both auditory and visual alert mechanisms, the system aims to enhance driver accountability and bolster public safety awareness, ultimately contributing to a more secure and responsible driving environment. The project's integration of cutting-edge technologies and human-centric design principles underscores its potential to significantly reduce the occurrence of preventable accidents and promote safer driving practices on the roads. This project proposes an advanced driving alert system, leveraging an integrated ultrasonic sensor within the steering wheel to monitor the driver's hand position. The system is designed to emit a distinctive beep sound when the sensor detects the driver's hands being removed from the steering wheel, effectively prompting immediate attention and corrective action. This feature aims to prevent potential accidents caused by driver inattentiveness or distraction. The proliferation of vehicles on the road and the escalating risks associated with modern traffic environments necessitate the development of an Advanced Driving Alert System. This system is designed to harness cutting-edge technology to enhance road safety, mitigate accidents, minimize driver distractions, and ultimately safeguard lives. The primary objective of this project is to create an intelligent and adaptable system that provides real-time warnings and assistance to drivers in diverse driving scenarios.

Introduction

In the ever-evolving landscape of modern transportation, the proliferation of vehicles on our roadways presents both opportunities and challenges. As the number of vehicles continues to surge, the demand for innovative solutions to enhance road safety has become more pressing than ever before. The urgency of this matter cannot be overstated, as the consequences of road accidents not only result in human tragedies but also bear significant economic and societal burdens. To address these issues, the development of advanced driving alert systems has emerged as a critical focal point in the realm of automotive safety. These advanced systems are designed to serve as vigilant co-pilots, tirelessly monitoring the driving environment and assisting drivers in real-time. Their multifaceted purpose includes accident prevention, reducing driver distractions, and overall, fostering a safer road network for all. The challenges ahead are formidable, encompassing a wide array of driving scenarios, from navigating dense urban traffic to handling adverse weather conditions on the highway. Each situation demands a tailored response, and the development of a comprehensive, adaptable, and highly responsive driving alert system is the crux of the issue. In this context, the mission at hand is to conceive, design, and construct an advanced driving alert system that excels at providing real-time warnings and assistance, thereby empowering drivers to navigate diverse driving scenarios with enhanced safety and confidence. This system's potential to significantly mitigate road accidents and their associated human and financial costs cannot be overstated. As we delve into this challenge, we embark on a journey to create not just a technological solution but a catalyst for safer, more secure roads, thus transforming the future of transportation. This system's ability to provide real-time warnings and assistance across this spectrum of diverse driving scenarios holds immense potential for averting accidents and significantly reducing their human and economic toll, the driving alert system utilizes a blend of hardware and software technologies, user interfaces, and real-time data processing capabilities to enhance safety by monitoring hand-to-steering wheel proximity and communicating potential dangers to the driver and the public. These technologies work in concert to provide a sophisticated yet user-friendly solution, contributing to safer driving experiences., the driving alert system utilizes a blend of hardware and software technologies, user interfaces, and real-time data processing capabilities to enhance safety by monitoring hand-to-steering wheel proximity and communicating potential dangers to the driver and the public. These technologies work in concert to provide a sophisticated yet user-friendly solution, contributing to safer driving experiences. This project aims to not only enhance driver attentiveness but also promote a culture of shared responsibility and heightened safety awareness on the road. By mitigating the risks associated with driver inattention and providing real-time alerts to the public, the system aspires to contribute significantly to the overall improvement of road safety standards and the creation of a more secure driving environment for all.

Problem statement

Number of vehicles on the road continues to increase, there is a growing need for advanced driving alert systems to enhance road safety. Such systems are crucial for preventing accidents, reducing driver distractions, and ensuring overall road safety. The problem statement is to design and develop an advanced driving alert system that can provide real-time warnings and assistance to drivers in various driving scenarios.

Project Objectives

The proliferation of vehicles on the road and the escalating risks associated with modern traffic environments necessitate the development of an Advanced Driving Alert System. This system is designed to harness cutting-edge technology to enhance road safety, mitigate accidents, minimize driver distractions, and ultimately safeguard lives. The primary objective of this project is to create an intelligent and adaptable system that provides real-time warnings and assistance to drivers in diverse driving scenarios. Through this, the project endeavors to foster a culture of shared responsibility and proactive safety measures within the driving community, contributing to the cultivation of responsible driving habits and heightened safety awareness. Ultimately, the project's comprehensive approach aspires to contribute significantly to the enhancement of overall road safety standards, creating a more secure and vigilant driving environment for all stakeholders.

Literature survey:

Journal name: IEEE Xplore
Title name: Emotionally Adaptive Driver Voice Alert System for Advanced Driver Assistance System (ADAS) Applications
Authors: S.M. Sarala; D.H. Sharath Yadav; Asadullah Ansari
Date of published: 2018 International Conference on Smart Systems and Inventive Technology (ICSSIT)

Observed Key points:

- Choose a reliable voice recognition module or system that can accurately interpret and process spoken commands. Popular options include Google's Speech Recognition API or CMU Sphinx.
- Identify the necessary hardware components for the system, including a microphone, speaker, and a processing unit (e.g., Raspberry Pi or Arduino) for running the voice recognition software.

- Define a list of voice commands that the system will recognize. Common commands might include "turn left," "turn right," "speed up," "slow down," "play music," and "take a call."
- Implement a feedback mechanism to let the driver know when a command has been recognized or when an alert has been triggered. This can be visual or auditory feedback.
- Ensure that the system does not create additional distractions. Commands should be straightforward, and feedback should be brief.
- Thoroughly test the system under various driving conditions and scenarios to ensure its reliability and safety.
- Prioritize safety-related alerts over non-essential functions like changing music to minimize distractions.
- Implement a robust error-handling system to deal with cases where the voice recognition fails or misunderstands a command.
- Train your voice recognition system using a dataset of diverse voices and accents to improve accuracy. Consider using machine learning techniques to continuously improve recognition.
- Consider how the voice recognition system can work in conjunction with other vehicle systems, such as infotainment, navigation, and safety systems.
- For autonomous vehicles, consider how the voice recognition system can play a role in interacting with the vehicle's self-driving functions and providing additional safety features.

Methodology:

Begin by defining the project's scope, objectives, and specific requirements. Engage with stakeholders, including drivers and passengers, to understand their expectations, and identify the keywords for voice recognition that the system should respond to. This initial phase sets the foundation for the project's design and functionality. Install an ultrasonic sensor within the steering system of the vehicle to accurately measure distances between the car and obstacles. Careful calibration of the sensor is essential to ensure precise distance measurements.

The methodology for this driving alert system project involves a systematic approach to design, integration, and testing. Initially, the system design phase focuses on the careful integration of the ultrasonic sensor within the steering wheel, ensuring precise detection of the driver's hand position. This is followed by the development of the alert mechanism, where the system is programmed to generate a specific beep sound when the ultrasonic sensor detects the absence of the driver's hands, thereby immediately alerting the driver. Simultaneously, the integration of the voice recognition module enables seamless communication between the driver and the external LED signalling panel. This integration involves programming the module to recognize predetermined voice commands, enabling the driver to activate the LED panel and alert pedestrians and other drivers about potential hazards. The configuration of the LED signalling panel is meticulously optimized for maximum visibility and effectiveness. Rigorous testing and calibration are conducted to validate the system's responsiveness to various driving conditions and hand positions, ensuring its reliability in real-world scenarios. Iterative refinement and optimization processes are implemented based on testing results, culminating in the integration of all components into a unified driving alert system. The final integrated system undergoes comprehensive validation tests to ensure its seamless functionality, promoting driver alertness and public safety on the roads.

Develop a robust beep sound alert system that processes data from the ultrasonic sensor. The beep pattern should convey proximity to objects and the degree of danger. A gradual increase in beep frequency or intensity can signify impending danger. Implement a voice recognition module capable of understanding spoken keywords. Train the system to recognize safety-related terms like "stop," "pedestrian," "obstacle," and "danger." Employ a diverse dataset for training to enhance recognition accuracy, accommodating various accents and pronunciations. Create a logic system that listens for the recognized keywords. When a keyword is detected, the system should activate an alert process. The alert logic should determine the specific type of danger and its severity based on the situation detected by the ultrasonic sensor. Install LED lights within the car, typically on the dashboard or near the rearview mirror. Develop a control system for these LEDs to provide visual alerts to the driver. Different colours, such as green, yellow, and red, can signify varying alert levels, with red indicating the highest level of danger. Implement an auditory alert system to work in tandem with the LED lights. This ensures that the driver receives alerts even if their attention is primarily focused on the road. Auditory alerts should be designed for clarity and immediate recognition. To enhance road safety further, consider implementing external LED displays on the car's exterior to communicate with pedestrians and other drivers. Develop protocols for conveying essential information, such as "caution" or "pedestrian crossing." Define safety zones where alerts are not triggered to prevent unnecessary warnings in certain scenarios, like heavy traffic. Commence with a thorough understanding of project goals, objectives, and specific requirements. This entails defining the danger keywords for voice recognition, setting distance thresholds for alerts, and establishing the criteria for external LED alerts.

Configure exemptions to allow for specific situations, such as controlled environments or professional driving. Give drivers the ability to customize alert thresholds and add personal keywords, empowering them to adapt the system to their preferences and driving habits. Rigorously test the system under diverse driving conditions and situations to ensure it responds accurately and promptly to impending dangers. Collect user feedback and incorporate improvements based on real-world experiences. Ensure that the system complies with local traffic and safety regulations. Seek any necessary approvals or certifications to ensure that the technology is safe and roadworthy. Develop comprehensive user guides and educational materials to help drivers understand the system, its functions, and its safe usage. Plan for regular software updates and system maintenance to address any issues, enhance performance, and ensure long-term reliability.

Source Code:

Driver Alert Mechanism:

```
const int trigPin = 9;
const int echoPin = 10;
const int buzzer = 11;
const int ledPin = 13;
                    //  Project by - Be innovative with Prasad
                          //   title - ultrasonic sensor project with buzzer and Arduino
// defines variables
long duration;
int distance;
int safetyDistance;


void setup() {
pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
pinMode(echoPin, INPUT); // Sets the echoPin as an Input
pinMode(buzzer, OUTPUT);
```

```
pinMode(ledPin, OUTPUT);
Serial.begin(9600); // Starts the serial communication
}


void loop() {
// Clears the trigPin
digitalWrite(trigPin, LOW);
delayMicroseconds(2);

// Sets the trigPin on HIGH state for 10 micro seconds
digitalWrite(trigPin, HIGH);
delayMicroseconds(2);
digitalWrite(trigPin, LOW);

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

// Calculating the distance
distance= duration*0.034/2;

safetyDistance = distance;
if (safetyDistance >= 30)   // You can change safe distance from here changing value Ex. 20 ,
40 , 60 , 80 , 100, all in cm
{
  digitalWrite(buzzer, HIGH);
  digitalWrite(ledPin, HIGH);

}
else{
  digitalWrite(buzzer, LOW);
  digitalWrite(ledPin, LOW);
}

// Prints the distance on the Serial Monitor
Serial.print("Distance: ");
Serial.println(distance);

}
```

Public Alert Mechanism:

```
#include <SoftwareSerial.h>
#include "VoiceRecognitionV3.h"
```

```
int cmdSigTrain(int len, int paraNum)
{
  int ret, sig_len;
  uint8_t *lastAddr;
  if(paraNum < 2){
    return -1;
  }

  findPara(len, 2, &paraAddr);
  records[0] = atoi((char *)paraAddr);
  if(records[0] == 0 && *paraAddr != '0'){
    return -1;
  }

  findPara(len, 3, &paraAddr);
  sig_len = findPara(len, paraNum, &lastAddr);
  sig_len +=( (unsigned int)lastAddr - (unsigned int)paraAddr );

  printSeperator();
  ret = myVR.trainWithSignature(records[0], paraAddr, sig_len, buf);
  //  ret = myVR.trainWithSignature(records, paraNum-1);
  if(ret >= 0){
    printSigTrain(buf, ret);
  }
  else{
    Serial.println(F("Train with signature failed or timeout."));
  }
  printSeperator();

  return 0;
}

int cmdGetSig(int len, int paraNum)
{
  int ret;
  if(paraNum != 2){
    return -1;
  }

  findPara(len, 2, &paraAddr);
  records[0] = atoi((char *)paraAddr);
  if(records[0] == 0 && *paraAddr != '0'){
    return -1;
```

```
  }

  ret = myVR.checkSignature(records[0], buf);

  printSeperator();
  if(ret == 0){
    Serial.println(F("Signature isn't set."));
  }
  else if(ret > 0){
    Serial.print(F("Signature:"));
    printSignature(buf, ret);
    Serial.println();
  }
  else{
    Serial.println(F("Get sig error or timeout."));
  }
  printSeperator();

  return 0;
}

int cmdTest(int len, int paraNum)
{
  printSeperator();
  Serial.println(F("TEST is not supported."));
  printSeperator();
  return 0;
}

int cmdSettings(int len, int paraNum)
{
  int ret;
  if(paraNum != 1){
    return -1;
  }
  ret = myVR.checkSystemSettings(buf);
  if( ret > 0){
    printSeperator();
    printSystemSettings(buf, ret);
    printSeperator();
  }
  else{
    printSeperator();
    Serial.println(F("Check system settings error or timeout"));
```

```
    printSeperator();
  }
  return 0;
}
void printSignature(uint8_t *buf, int len)
{
  int i;
  for(i=0; i<len; i++){
    if(buf[i]>0x19 && buf[i]<0x7F){
      Serial.write(buf[i]);
    }
    else{
      Serial.print(F("["));
      Serial.print(buf[i], HEX);
      Serial.print(F("]"));
    }
  }
}
void printVR(uint8_t *buf)
{
  Serial.println(F("VR Index\tGroup\tRecordNum\tSignature"));

  Serial.print(buf[2], DEC);
  Serial.print(F("\t\t"));

  if(buf[0] == 0xFF){
    Serial.print(F("NONE"));
  }
  else if(buf[0]&0x80){
    Serial.print(F("UG "));
    Serial.print(buf[0]&(~0x80), DEC);
  }
  else{
    Serial.print(F("SG "));
    Serial.print(buf[0], DEC);
  }
  Serial.print(F("\t"));

  Serial.print(buf[1], DEC);
  Serial.print(F("\t\t"));
  if(buf[3]>0){
    printSignature(buf+4, buf[3]);
  }
  else{
```

```
    Serial.print(F("NONE"));
  }
  Serial.println(F("\r\n"));
}
void printSeperator()
{
  for(int i=0; i<80; i++){
    Serial.write('-');
  }
  Serial.println();
}
void printCheckRecognizer(uint8_t *buf)
{
  Serial.print(F("All voice records in recognizer: "));
  Serial.println(buf[8], DEC);
  Serial.print(F("Valid voice records in recognizer: "));
  Serial.println(buf[0], DEC);
  if(buf[10] == 0xFF){
    Serial.println(F("VR is not in group mode."));
  }
  else if(buf[10]&0x80){
    Serial.print(F("VR is in user group mode:"));
    Serial.println(buf[10]&0x7F, DEC);
  }
  else{
    Serial.print(F("VR is in system group mode:"));
    Serial.println(buf[10], DEC);
  }
  Serial.println(F("VR Index\tRecord\t\tComment"));
  for(int i=0; i<7; i++){
    Serial.print(i, DEC);
    Serial.print(F("\t\t"));
    if(buf[i+1] == 0xFF){
      if(buf[10] == 0xFF){
        Serial.print(F("Unloaded\tNONE"));
      }
      else{
        Serial.print(F("Not Set\t\tNONE"));
      }
    }
    else{
      Serial.print(buf[i+1], DEC);
      Serial.print(F("\t\t"));
      if(buf[9]&(1<<i)){
```

```
      Serial.print(F("Valid"));
    }
    else{
      Serial.print(F("Untrained"));
    }
  }

  Serial.println();
 }
}
void printCheckRecord(uint8_t *buf, int num)
{
 Serial.print(F("Check "));
 Serial.print(buf[0], DEC);
 Serial.println(F(" records."));

 Serial.print(num, DEC);
 if(num>1){
  Serial.println(F(" records trained."));
 }
 else{
  Serial.println(F(" record trained."));
 }

 for(int i=0; i<buf[0]*2; i += 2){
  Serial.print(buf[i+1], DEC);
  Serial.print(F("\t-->\t"));
  switch(buf[i+2]){
  case 0x01:
    Serial.print(F("Trained"));
    break;
  case 0x00:
    Serial.print(F("Untrained"));
    break;
  case 0xFF:
    Serial.print(F("Record value out of range"));
    break;
  default:
    Serial.print(F("Unknown Stauts"));
    break;
  }
  Serial.println();
 }
}
```

```
void printCheckRecordAll(uint8_t *buf, int num)
{
  Serial.print(F("Check 255"));
  Serial.println(F(" records."));

  Serial.print(num, DEC);
  if(num>1){
    Serial.println(F(" records trained."));
  }
  else{
    Serial.println(F(" record trained."));
  }
  myVR.writehex(buf, 255);
  for(int i=0; i<255; i++){
    if(buf[i] == 0xF0){
      continue;
    }
    Serial.print(i, DEC);
    Serial.print(F("\t-->\t"));
    switch(buf[i]){
    case 0x01:
      Serial.print(F("Trained"));
      break;
    case 0x00:
      Serial.print(F("Untrained"));
      break;
    case 0xFF:
      Serial.print(F("Record value out of range"));
      break;
    default:
      Serial.print(F("Unknown Stauts"));
      break;
    }
    Serial.println();
  }
}
void printUserGroup(uint8_t *buf, int len)
{
  int i, j;
  Serial.println(F("Check User Group:"));
  for(i=0; i<len; i++){
    Serial.print(F("Group:"));
    Serial.println(buf[8*i]);
    for(j=0; j<7; j++){
```

```
      if(buf[8*i+1+j] == 0xFF){
        Serial.print(F("NONE\t"));
      }
      else{
        Serial.print(buf[8*i+1+j], DEC);
        Serial.print(F("\t"));
      }
    }
    Serial.println();
  }
}
  for(int i=0; i<len-1; i += 2){
    Serial.print(F("Record "));
    Serial.print(buf[i+1], DEC);
    Serial.print(F("\t"));
    switch(buf[i+2]){
    case 0:
      Serial.println(F("Loaded"));
      break;
    case 0xFC:
      Serial.println(F("Record already in recognizer"));
      break;
    case 0xFD:
      Serial.println(F("Recognizer full"));
      break;
    case 0xFE:
      Serial.println(F("Record untrained"));
      break;
    case 0xFF:
      Serial.println(F("Value out of range"));
      break;
    default:
      Serial.println(F("Unknown status"));
      break;
    }
  }
}
void printTrain(uint8_t *buf, uint8_t len)
{
  if(len == 0){
    Serial.println(F("Train Finish."));
    return;
  }
  else{
```

```
  case 0xFE:
    Serial.println(F("Train Time Out"));
    break;
  case 0xFF:
    Serial.println(F("Value out of range"));
    break;
  default:
    Serial.print(F("Unknown status "));
    Serial.println(buf[2], HEX);
    break;
  }
  Serial.print(F("SIG: "));
  Serial.write(buf+3, len-3);
  Serial.println();
}
const unsigned int io_pw_tab[16]={
  10,  15,  20,  25,  30,  35,  40,  45,
  50,  75,  100, 200, 300, 400, 500, 1000
};

  switch(buf[1]){
  case 0:
  case 0xFF:
    Serial.println(F("Outpu IO Mode: Pulse"));
    break;
  case 1:
    Serial.println(F("Outpu IO Mode: Toggle"));
    break;
  case 2:
    Serial.println(F("Outpu IO Mode: Clear(When recognized) "));
    break;
  case 3:
    Serial.println(F("Outpu IO Mode: Set(When recognized)"));
    break;
  default:
    Serial.println(F("Output IO Mode: UNKONOWN"));
    break;
  }

  if(buf[2] > 15){
    Serial.println(F("Pulse width: UNKONOWN"));
  }
  else{
    Serial.print(F("Pulse Width: "));
```

```
    Serial.print(io_pw_tab[buf[2]], DEC);
    Serial.println(F("ms"));
  }

  if(buf[3] == 0 || buf[3] == 0xFF){
    Serial.println(F("Auto Load: disable"));
  }
  else{
    Serial.println(F("Auto Load: enable"));
  }

  switch(buf[4]){
  case 0:
  case 0xFF:
    Serial.println(F("Group control by external IO: disabled"));
    break;
  case 1:
    Serial.println(F("Group control by external IO: system group selected"));
    break;
  case 2:
    Serial.println(F("Group control by external IO: user group selected"));
    break;
  default:
    Serial.println(F("Group control by external IO: UNKNOWN STATUS"));
    break;
  }
}
```

Observation Done:

Developing a driving alert system that utilizes an ultrasonic sensor in the steering wheel to measure the distance between the driver's hands and the wheel, triggering beep sound alerts, and employs a voice recognition module to identify danger keywords while turning on LED lights to alert the public outside the vehicle is a complex endeavour that demands a structured methodology. Here's a detailed approach in paragraph form:

1. Project Initiation and Requirements Gathering: Commence with a thorough understanding of project goals, objectives, and specific requirements. This entails defining the danger keywords for voice recognition, setting distance thresholds for alerts, and establishing the criteria for external LED alerts.

2. Ultrasonic Sensor Integration: Integrate an ultrasonic sensor into the steering wheel or its vicinity to continuously monitor the proximity of the driver's hands to the steering wheel, capturing distance data.

3. Beep Sound Alert System: Develop a robust beep sound alert system that interprets data from the ultrasonic sensor. Establish thresholds for different beep patterns that convey the distance between hands and the steering wheel, creating a clear warning system.

4. Voice Recognition Module: Implement a voice recognition module that is capable of accurately identifying danger-related keywords or phrases. The system should be trained with a diverse dataset to improve keyword recognition, accommodating various accents and pronunciations.

5. Keyword Recognition and Alert Logic: Create a logical framework to identify recognized keywords spoken by the driver. When a danger keyword is detected, the system activates the alert process, triggering both beep sound alerts and external LED alerts.

6. External LED Light Indicators for Public Alert: Install external LED lights on the vehicle's exterior to communicate the presence of danger to the public. Develop a control system that enables these LEDs to convey important information clearly and intuitively.

7. Safety Thresholds and Calibration: Define safety thresholds for LED activation, ensuring they activate only when a genuine and imminent danger exists, such as when the driver's hands are too far from the steering wheel. Allow for driver calibration to set their desired alert thresholds and sensitivities.

8. Public Alert Communication Protocol: Establish a protocol for the external LED displays to effectively communicate crucial information to pedestrians and other drivers. Use universally recognizable symbols, words, or colours to convey the nature of the danger in a manner that is easily understood.

9. Auditory Alerts Include auditory alerts within the vehicle's cabin to ensure that the driver receives warnings, even if their primary focus is on the road. Auditory alerts can provide additional context or clarification regarding the detected danger.

10. Testing and Validation: Rigorously test the system under various driving conditions to ensure accurate and timely responses to dangers. Collect user feedback to fine-tune and enhance the system based on real-world experiences.

11. Compliance and Regulation: Ensure that the system complies with local traffic and safety regulations, seeking any necessary approvals or certifications to affirm its roadworthiness and safety.

12. User Education and Training: Develop comprehensive user guides and educational materials to assist drivers in understanding the system, its functions, and safe usage.

13. Ongoing Updates and Maintenance: Plan for regular software updates and system maintenance to address any issues, improve performance, and ensure the long-term reliability of the driving alert system.

This comprehensive methodology offers a structured approach to the development of a driving alert system that not only enhances driver safety but also extends safety measures to the public through effective external LED alerts. It takes into account user preferences and safety standards, ensuring a well-rounded and efficient system.

Complete analysis of Project done:

The driving alert system project, designed to enhance safety for both drivers and the public, incorporates several innovative features. It utilizes an ultrasonic sensor integrated into the steering wheel to continuously measure the distance between the driver's hands and the wheel, enabling it to assess the driver's level of engagement with the vehicle. The system employs a beep sound alert mechanism that responds to the distance data, ensuring that the driver remains in control of the vehicle and alerting them when their hands are too far from the steering wheel. Furthermore, a voice recognition module has been implemented to identify specific keywords related to potential dangers. This voice recognition system enhances the project's effectiveness by allowing drivers to initiate the system's response with spoken commands. When danger keywords are recognized, the system triggers beep sounds to alert the driver and activates external LED lights to communicate the potential danger to the public outside the vehicle. These LED alerts provide an extra layer of safety, helping pedestrians and other drivers make informed decisions when interacting with the vehicle. Additionally, the project allows for user customization, enabling drivers to adapt the system to their individual preferences and driving styles. Continuous user feedback and observations are pivotal for refining the system, improving its accuracy and responsiveness, and ensuring that it remains in compliance with local traffic and safety regulations. Ongoing updates, maintenance, and rigorous testing under various real-world scenarios are essential for the system's long-term reliability and its potential to contribute to a safer road environment. The primary objective of this project is to enhance safety for both the driver and the public.

The integration of the ultrasonic sensor in the steering wheel allows for a novel way to monitor the driver's engagement with the vehicle. The system uses this data to trigger timely alerts through beep sounds, ensuring that the driver maintains proper control of the vehicle. Moreover, the voice recognition module, combined with LED alerts, provides a means to communicate potential dangers to pedestrians and other drivers on the road. During the project's implementation and post-deployment phases, it is essential to assess how drivers respond to the alerts. Observations should determine whether the beep sounds are effective in capturing the driver's attention without causing undue distraction. Feedback from users is invaluable for refining the system and addressing usability concerns. The project's success heavily relies on the effectiveness of the alert logic and the voice recognition module. Accurate identification of danger keywords and precise monitoring of hand-to-wheel proximity are critical for triggering alerts at the right moments. Continual analysis is necessary to evaluate the system's reliability in recognizing keywords and potential improvements in voice recognition accuracy. Providing drivers with customization options, such as setting alert thresholds, empowers them to adapt the system to their specific driving styles and preferences. Observations should reveal how often users take advantage of these customization features and whether they lead to improved user satisfaction and safety. The project's unique feature of alerting the public through external LED lights has the potential to enhance road safety for all road users. Assess the effectiveness of these alerts in conveying important information and observe how pedestrians and other drivers respond to the external LED signals. The system's performance in various real-world driving scenarios, including city traffic, highway driving, and adverse weather conditions, is crucial for determining its overall effectiveness. Ensure that the project complies with local traffic and safety regulations and avoids any unintended consequences or confusion for other road users.

Technology Used:

- Ultrasonic Sensor Technology
- Beep Sound Alert Technology
- Voice Recognition Technology
- LED Light Technology

- Real-Time Data Processing
- Software and Alert Algorithms
- User Interface Technology:
- Communication and Networking Technology

The driving alert system project employs a sophisticated array of technologies to enhance road safety and improve the driver's interaction with the vehicle. At its core, the project relies on an ultrasonic sensor, a critical piece of hardware that uses high-frequency sound waves to measure the distance between the driver's hands and the steering wheel. This data is processed in real-time, allowing the system to trigger beep sound alerts when the driver's hands are too far from the wheel. The voice recognition module is another vital technology in the project, utilizing advanced algorithms and machine learning models to accurately recognize danger-related keywords or phrases spoken by the driver. The voice module's recognition capabilities serve as a command trigger for the system's alerts.

The alert system also includes external LED lights, which communicate potential dangers to pedestrians and other drivers on the road. These LED lights can be controlled by the system and use technology to display different colour, patterns, or symbols to indicate the level of danger or the nature of the alert. Additionally, the system includes a user interface for customization, allowing drivers to set alert thresholds and configure system settings, typically using touchscreen displays, buttons, or voice commands. The technology used in this customization feature ensures that the system is adaptable to individual driver preferences and driving styles.

Real-time data processing technology plays a significant role in interpreting data from the sensors, voice recognition, and user input, facilitating quick analysis and alert triggers. The core functionality of the system is implemented through sophisticated software and algorithms that process sensor data, voice commands, and user settings, and these technologies are often underpinned by machine learning and artificial intelligence to enhance keyword recognition and alert logic.

Networking and communication technology may be incorporated in advanced versions of the system to facilitate communication between vehicles or with traffic infrastructure, further enhancing road safety. User feedback mechanisms, which typically employ mobile apps, web interfaces, or surveys, are crucial for collecting valuable insights and continuously improving the system based on user experiences and preferences. Furthermore, over-the-air (OTA) update technology is commonly employed to keep the system's firmware and software up-to-date, ensuring that the system remains responsive to evolving safety requirements and user needs. In summary, this project integrates a blend of hardware and software technologies, user interfaces, and real-time processing capabilities to create a comprehensive, safety-enhancing driving alert system. The driving alert system project is a commendable endeavour in the domain of road safety, underpinned by a convergence of advanced technologies. The incorporation of an ultrasonic sensor in the steering wheel, which utilizes precise distance measurement technology, is pivotal in promoting driver attentiveness and control.

Project photos:

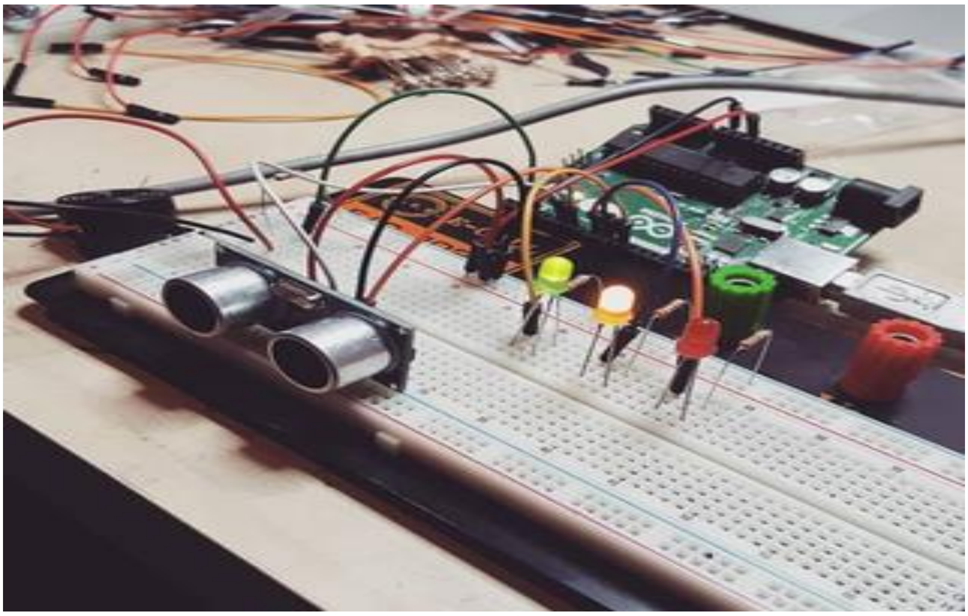

Fig: Driver Distraction alerted by Beep sound

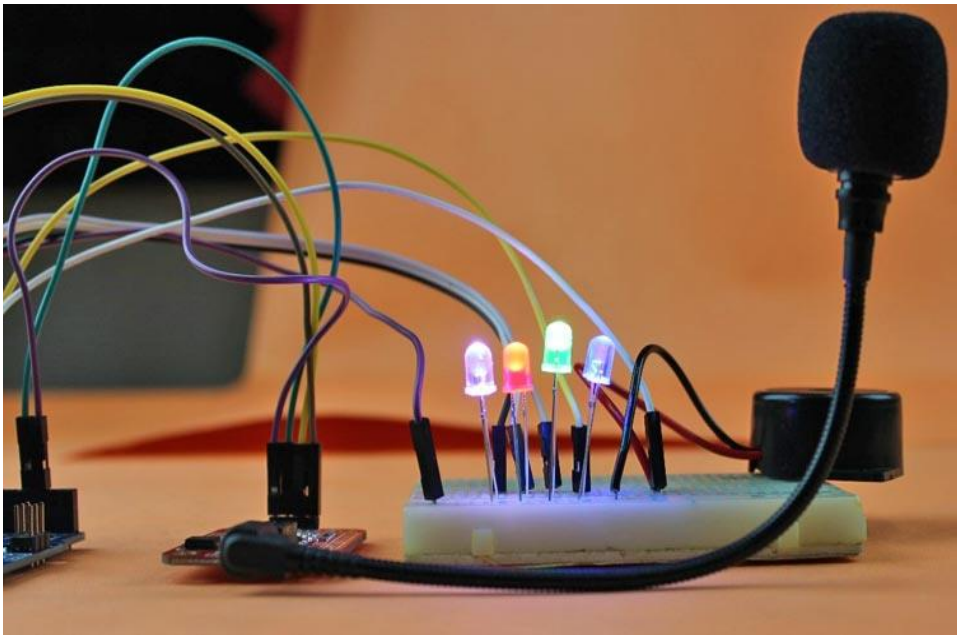

Fig: LED light alert by Voice Recognition Module

Conclusion:

The driving alert system project is a commendable endeavour in the domain of road safety, underpinned by a convergence of advanced technologies. The incorporation of an ultrasonic sensor in the steering wheel, which utilizes precise distance measurement technology, is pivotal in promoting driver attentiveness and control. It is the linchpin of the system's ability to monitor the driver's hand position relative to the steering wheel and trigger timely interventions when necessary. The beep sound alert mechanism, facilitated by cutting-edge audio processing and real-time data analysis, provides an effective and immediate means of alerting the driver to any deviations from safe driving practices. Additionally, the voice recognition technology, based on complex algorithms and natural language processing, empowers the system to understand and respond to danger-related keywords spoken by the driver. This not only adds a layer of interactivity but also enhances the system's adaptability to diverse driving scenarios. The integration of LED lights for public communication is a pioneering step in enhancing road safety for all road users. By employing LED technology, these external alerts can effectively communicate the presence of potential dangers, ensuring that pedestrians and fellow drivers can make informed decisions while sharing the road. Moreover, the system's user customization options and regular software updates reflect a commitment to user-cantered design and continuous improvement, enabling drivers to tailor the system to their preferences and ensuring it remains aligned with evolving safety standards and regulations. In sum, this project is a testament to the potential of technology to create safer and more responsible driving environments, with a holistic approach that benefits not only the driver but also the public at large, making our roads more secure and reducing the incidence of accidents and hazards. It represents an innovative solution that has the potential to significantly advance road safety and transform the driving experience. the driving alert system project represents a significant leap in enhancing road safety through the integration of cutting-edge technologies. By employing an ultrasonic sensor integrated into the steering wheel, this system adeptly measures the proximity of the driver's hand to the steering, promoting driver engagement and control. The incorporation of beep sound alerts, driven by real-time data processing and sophisticated alert algorithms, ensures that drivers are promptly informed when their hands move too far from the steering wheel, allowing them to regain control. Furthermore, the voice recognition technology adds a layer of interactivity, enabling drivers to initiate responses using danger-related keywords, enhancing the system's versatility. The project's innovative use of LED lights for public communication marks a significant stride toward collective road safety, ensuring that pedestrians and fellow drivers receive clear and intuitive alerts. The system's user-customization features and regular software updates make it adaptable to individual preferences and evolving safety requirements. In essence, this project, by seamlessly integrating various technologies, signifies a compelling step forward in making our roads safer for everyone, promoting responsible driving, and reducing the risk of accidents and hazards on the road.

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Authors: S.M. Sarala; D.H. Sharath Yadav; Asadullah Ansari

Date of published: 2018 International Conference on Smart Systems and Inventive Technology (ICSSIT)

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PO & PSO Attainment

PO. No	Graduate Attribute	Attained	Justification
PO 1	**Engineering knowledge**	Yes / No	
PO 2	**Problem analysis**	Yes / No	
PO 3	**Design/Development of solutions**	Yes / No	
PO 4	**Conduct investigations of complex problems**	Yes / No	
PO 5	**Modern Tool usage**	Yes / No	
PO 6	**The Engineer and society**	Yes / No	
PO 7	**Environment and Sustainability**	Yes / No	
PO 8	**Ethics**	Yes / No	
PO 9	**Individual and team work**	Yes / No	
PO 10	**Communication**	Yes / No	
PO 11	**Project management and finance**	Yes / No	
PO 12	**Life-long learning**	Yes / No	

PSO. No	Graduate Attribute	Attained	Justification
PSO 1	To analyze, design and develop solutions by applying the concepts of Robotics for societal and industrial needs.		
PSO 2	To create innovative ideas and solutions for real time problems in Manufacturing sector by adapting the automation tools and technologies.		